

360iResearch

Thermally Conductive Spherical Alumina Powder Market

Global Forecast 2026-2032

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1. Preface

1.1. Objectives of the Study

- Assess how the defined global spherical alumina powder market changes across its historical, base, estimated, and forecast periods.
- Identify which grade attributes and thermal applications matter when comparing product positioning and customer requirements.
- Compare geographic and end-use patterns without mixing regional, country, and independent segmentation denominators.
- Evaluate supplier and sales-channel positions within the powder market rather than the broader value of finished thermal products.

1.2. Market Definition

Thermally Conductive Spherical Alumina Powder is the global market for spherical alumina powder supplied for heat-transfer filler applications. The commercial boundary follows eligible powder supplied to materials buyers, directly or through an intermediary, rather than the value of finished thermal-management products.

Included uses encompass thermal interface materials, encapsulation and potting compounds, thermally conductive plastics, heat-dissipating substrates, and heat-dissipating coatings. Manufacturer descriptions identify thermal interfaces and other electronic thermal-management uses. Non-spherical alumina, alternative filler materials, and nonthermal uses of spherical alumina fall outside this defined market.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka describes its spherical alumina as a thermally conductive filler for thermal interface materials and lists other thermal-material applications alongside nonthermal uses.
2. Spherical Alumina | Momentive Technologies
   · Momentive identifies spherical alumina powder applications in thermal interface materials and thermally conductive plastics used for thermal management.

1.3. Market Segmentation & Coverage

Particle size, particle size distribution, surface treatment, and ionic purity distinguish powder characteristics. Application and end-use industry locate the powder's commercial use, while sales channel distinguishes manufacturer-direct from intermediary-mediated supply. Each top-level axis is an independent view of the same global market.

Supplier descriptions show that spherical alumina can differ by size, surface treatment, and impurity-related grade. Those descriptions inform category interpretation but do not establish a universal cross-supplier specification. Child-category shares belong to their parent segment; shares from different axes should not be added together.

Table 1. Global Thermally Conductive Spherical Alumina Powder Market Segmentation & Coverage

Segmentation	Coverage
Application	• Thermal Interface Materials • Encapsulation & Potting Compounds • Thermally Conductive Plastics • Heat-Dissipating Substrates • Heat-Dissipating Coatings
End-Use Industry	• Transportation Equipment • Consumer Electronics & Appliances • Industrial & Energy Equipment • Data Center & Telecommunications Equipment • Medical Equipment
Ionic Purity Grade	• Standard Ionic-Purity Grades • Low-Ionic-Impurity Grades
Particle Size Distribution	• Individual Size Grades • Multimodal Blend Grades
Particle Size	• Medium Powder • Fine Powder • Coarse Powder • Submicron Powder
Sales Channel	• Manufacturer-Direct Sales • Intermediary-Mediated Sales
Surface Treatment	• Standard Surface Powder • Surface-Treated Powder

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka distinguishes particle-size distributions, surface-treatment options, and a low-ionic-impurity spherical alumina type.
   - Taxonomy evidence: Published spherical-alumina grade tables show submicron D50 values, including xx.xx micrometers.
   - Taxonomy evidence: Its listed super-fine spherical-alumina grades have D50 values below xx.xx micrometer.
   - Taxonomy evidence: The standard and low-sodium grade tables include D50 values below xx.xx micrometers and above xx.xx micrometer.
   - Taxonomy evidence: Its listed spherical-alumina grades include D50 values between xx.xx and xx.xx micrometers.
   - Taxonomy evidence: The grade tables include D50 values between xx.xx and xx.xx micrometers.
   - Taxonomy evidence: The grade tables include D50 values above xx.xx micrometers.
   - Taxonomy evidence: Its listed spherical-alumina grades include D50 values above xx.xx micrometers.
   - Taxonomy evidence: The supplier describes possible particle-surface treatments but does not establish treatment status for every listed standard grade.
   - Taxonomy evidence: The supplier identifies a standard grade type and says various surface treatments are possible for its spherical alumina.
   - Taxonomy evidence: A standard type is identified, without establishing that every such grade is physically untreated.
   - Taxonomy evidence: The catalog labels a spherical-alumina grade family as a standard type; the page does not establish that every standard grade is physically untreated.
   - Taxonomy evidence: The supplier states that its spherical alumina can receive various surface treatments.
   - Taxonomy evidence: The supplier states that its spherical alumina can be supplied with various surface treatments.
   - Taxonomy evidence: The supplier separately labels standard and low-sodium spherical-alumina types; the distinction does not supply a cross-supplier ionic threshold.
   - Taxonomy evidence: A spherical-alumina grade family is explicitly designated standard type.
   - Taxonomy evidence: Denka expressly labels a spherical-alumina product family as its standard type.
   - Taxonomy evidence: A separate low-sodium type is identified for electronic-material reliability needs.
   - Taxonomy evidence: Denka separately offers a low-sodium spherical-alumina type and identifies low ionic impurities as relevant to electronic-material reliability.
   - Taxonomy evidence: The stated powder uses span interface materials, semiconductor molding compounds, thermal plastics, and heat-dissipating paint; nonthermal uses are also listed and require exclusion from thermal-use sales.
   - Taxonomy evidence: The supplier identifies thermal pads, sheets, and pastes as uses for its spherical-alumina filler.
   - Taxonomy evidence: The spherical-alumina product page identifies thermal-interface pads, sheets, and pastes as filler uses.
   - Taxonomy evidence: The powder is listed as a filler for semiconductor-package epoxy molding compounds.
   - Taxonomy evidence: The page lists epoxy molding compounds for semiconductor packages among the powder's uses.
   - Taxonomy evidence: Thermal plastic is listed as a powder-filler use.
   - Taxonomy evidence: The page identifies thermal plastics as a powder-filler use.
   - Taxonomy evidence: Heat-dissipating paint is listed separately from heat-shielding paint; the latter is not automatically an eligible use.
   - Taxonomy evidence: The page identifies heat-dissipating paint as a spherical-alumina filler use; it separately lists heat-shielding paint, which is not automatically an eligible thermal-management use.
   - Taxonomy evidence: Identified uses include battery heat-dissipation pads for electric and hybrid vehicles and thermal paste for onboard electrical equipment.
   - Taxonomy evidence: Examples include heat-dissipation pads for electric-vehicle batteries and thermal paste for onboard electrical equipment.
   - Taxonomy evidence: The product's stated thermal-paste uses include 5G communication base stations.
   - Taxonomy evidence: The listed thermal-paste uses include 5G communication base stations.
   - Taxonomy evidence: The manufacturer's own product page supplies a company sales contact; it demonstrates a manufacturer-operated route, not a Global channel share.
   - Taxonomy evidence: Denka lists its own spherical-alumina powder for thermally conductive fillers and

2. Spherical Alumina | Momentive Technologies
   - Momentive presents spherical alumina grades with differing particle-size and impurity-related characteristics, supporting grade distinctions without establishing a universal classification.
   - Taxonomy evidence: The spherical-alumina thermal-filler listing separately presents regular-soda and low-soda grades.
   - Taxonomy evidence: The supplier labels one spherical-alumina product group Regular Soda Grades.
   - Taxonomy evidence: Momentive lists regular-soda spherical-alumina grades among its thermal-management filler powders.
   - Taxonomy evidence: The supplier separately labels a group Low Soda Grades, without defining a universal low-ion threshold.
   - Taxonomy evidence: Momentive separately lists low-soda spherical-alumina grades; the designation supports a reduced-sodium category without establishing a universal ionic-purity threshold.
   - Taxonomy evidence: The powder description identifies pads, tapes, and epoxies inserted between components as thermal-interface materials.
   - Taxonomy evidence: The spherical-alumina powder page identifies pads, tapes, and epoxies used between components as thermal-interface applications.
   - Taxonomy evidence: The powder description identifies thermally conductive plastics used in hardware.
   - Taxonomy evidence: The page describes thermally conductive plastics made for hardware components using conductive powder fillers.
   - Taxonomy evidence: The supplier identifies printed-circuit-board base materials among heat-dissipation applications.
   - Taxonomy evidence: The page identifies printed circuit boards among base-material applications for thermal dissipation.
   - Taxonomy evidence: Automotive and aerospace parts are listed as destinations for the powder-containing thermal plastics.
   - Taxonomy evidence: The thermally conductive plastics applications explicitly include automotive and aerospace parts.
   - Taxonomy evidence: Healthcare equipment is listed as a possible destination for the powder-containing thermal plastics; realized destination-specific sales are not stated.
   - Taxonomy evidence: The thermally conductive plastics applications explicitly include healthcare equipment; this establishes an identified application, not sales volume.
3. Resonac Thermal Filler Brochure
   - Taxonomy evidence: The spherical-alumina CB grade tables distinguish individually listed grades from a separately designated blended series.
   - Taxonomy evidence: Individual spherical-alumina CB grades have both sharp and broad distributions; broad distribution alone does not designate a supplier-sold blend.
   - Taxonomy evidence: Resonac lists individual spherical-alumina CB grades with both sharp and broad particle-size distributions.
   - Taxonomy evidence: The spherical-alumina CB Blend Series is expressly described as bimodal grades for resin fillers.
   - Taxonomy evidence: Resonac separately lists CB Blend Series spherical-alumina grades as bimodal grades offered for resin fillers.
   - Taxonomy evidence: The manufacturer directs prospective buyers of its thermal-filler products to its sales offices.
   - Taxonomy evidence: Resonac identifies its spherical-alumina filler products and directs prospective customers to its own sales offices, supporting a manufacturer-operated sales route.

4. Products | Product List / Alumina | Admatechs
   - Taxonomy evidence: The alumina product listing identifies a regular spherical grade with median particle diameter of approximately xx.xx-xx.xx micrometers and lists thermal conductive compounds as an application.
   - Taxonomy evidence: Its listed regular spherical-alumina grade includes an average particle size of approximately xx.xx micrometers.
   - Taxonomy evidence: The supplier lists high-purity spherical alumina and identifies thermally conductive resin filler as an application.
5. Hi-Cool Alumina-based Thermally Conductive Fillers | Spaeter
   - Taxonomy evidence: The supplier's thermal-filler page distinguishes interface materials, formed thermal plastics, circuit boards, and sealing materials as commercial applications; these are material functions, not an observed Global powder-sales split.
   - Taxonomy evidence: The listed applications include heat-sink sheets and heat-dissipation greases.
   - Taxonomy evidence: The supplier identifies semiconductor sealing resins and sealant materials among its thermal-alumina applications.
   - Taxonomy evidence: Its thermal-alumina applications include formed engineering-plastic components such as heat sinks and housings.
   - Taxonomy evidence: High-thermal-conductivity circuit boards and copper-clad laminates are identified as thermal-alumina applications; the page covers multiple alumina morphologies, so spherical-grade attribution requires care.
6. FY2022 Results Presentation | Denka Company Limited
   - Taxonomy evidence: The dated producer presentation discusses electric-vehicle demand in its spherical-alumina product discussion; it does not give a Global destination split.
   - Taxonomy evidence: In its FY2022 product discussion, Denka separately discusses electric-vehicle demand for spherical alumina. This is a dated producer observation, not a Global share estimate.
   - Taxonomy evidence: The dated spherical-alumina product discussion specifically identifies consumer-electronics demand, including smartphones, personal computers, and home appliances.
   - Taxonomy evidence: The FY2022 spherical-alumina product discussion explicitly identifies consumer-electronics demand, including smartphones, personal computers, and home appliances.
7. Spherical Oxide Powders | Momentive Technologies
   - Taxonomy evidence: The supplier names electric vehicles among markets for its spherical-oxide thermal fillers; it discusses spherical alumina and spherical silica together, without attributing market quantities to either.
   - Taxonomy evidence: The company's spherical-oxide powder page identifies its spherical alumina among thermal fillers for interface materials serving electric-vehicle applications.
   - Taxonomy evidence: Artificial-intelligence and telecommunications systems are named markets for the supplier's spherical-oxide thermal fillers; the page does not separate alumina from silica sales.
   - Taxonomy evidence: The stated markets for spherical-oxide thermal fillers include artificial-intelligence and telecommunications systems.
   - Taxonomy evidence: Consumer electronics is a named market for the supplier's spherical-oxide thermal fillers, without a separate alumina allocation.
   - Taxonomy evidence: Consumer electronics is an explicitly named market for the company's spherical-oxide thermal fillers.
   - Taxonomy evidence: Renewable energy is a named destination for the supplier's spherical-oxide thermal fillers; alumina-specific sales are not identified.
   - Taxonomy evidence: Renewable energy is an explicitly named market for the company's spherical-oxide thermal fillers; the page discusses spherical alumina and spherical silica together and does not allocate sales between them.

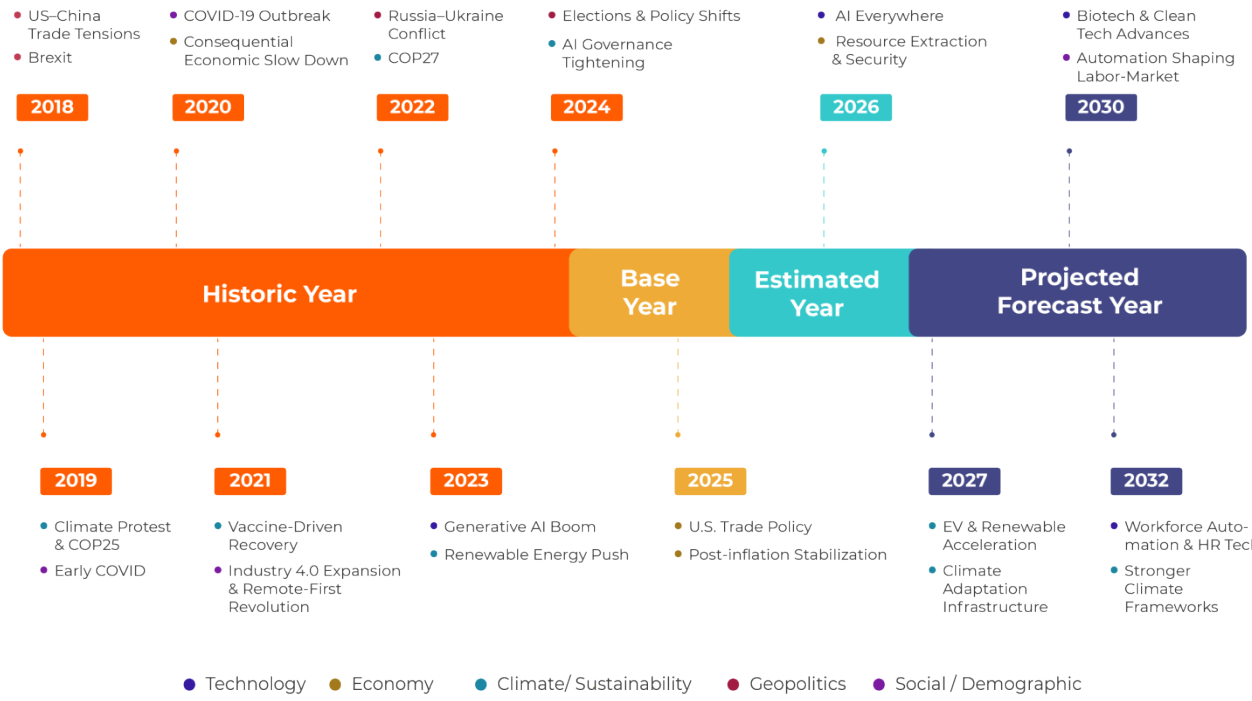
8. A View From Henkel North America: Chanhassen | Henkel
   - Taxonomy evidence: A downstream thermal-material formulator describes interface materials as filling voids between a heat-generating device and heat sink or housing. This supports the functional boundary, not a powder-specific sales allocation.
   - Taxonomy evidence: A thermal-interface-material formulator describes the interface function as filling voids to transfer heat between a device and a heat sink or housing; this clarifies the boundary against sealing compounds and formed plastics.
   - Taxonomy evidence: The formulator identifies electric-vehicle battery modules among destinations for its thermal-management materials.
   - Taxonomy evidence: Its thermal-management examples include electric-vehicle battery modules.
   - Taxonomy evidence: Its stated thermal-management destinations include data-center transceivers and 5G base stations.
   - Taxonomy evidence: Its thermal-management examples separately identify data-center transceivers and 5G base stations.
   - Taxonomy evidence: The formulator identifies factory equipment and power-generation or conversion technologies as destinations; this is downstream corroboration, not evidence of spherical-alumina sales into them.
   - Taxonomy evidence: Its thermal-management examples include industrial factory equipment and power generation and conversion technologies. This corroborates a downstream destination, not powder-specific sales.
9. Aluminium Oxide | Sibelco
   - Taxonomy evidence: The supplier describes a European distributorship for another manufacturer's spherical-alumina thermal-interface products, establishing an intermediary route distinct from powder manufacture.
   - Taxonomy evidence: The stated agreement covers distribution of Momentive spherical alumina for thermal-interface applications in Europe; resale does not constitute additional powder production.
   - Taxonomy evidence: Sibelco states that it markets Momentive spherical-alumina products for thermal-interface applications in Europe under a distributorship agreement, establishing an intermediary route rather than separate powder manufacture.
10. Silica/Alumina Spherical Particles | NIPPON STEEL Chemical & Material
    - Taxonomy evidence: Spherical alumina presented for heat-dissipation fillers is listed in D50-specified grade series.
    - Taxonomy evidence: The alumina grade tables include D50 values of xx.xx and xx.xx micrometers.
    - Taxonomy evidence: The alumina grade tables include a D50 value of xx.xx micrometers.
11. Spherical Alumina Powders | AdValue Technology
    - Taxonomy evidence: The supplier lists spherical-alumina grades for thermally conductive fillers with D50 values ranging from approximately xx.xx to xx.xx micrometers.
    - Taxonomy evidence: Its listed thermal-filler powder grades include D50 values of approximately xx.xx and xx.xx micrometers.
    - Taxonomy evidence: Its listed thermal-filler powder grades include D50 values of approximately xx.xx xx.xx and xx.xx micrometers.
    - Taxonomy evidence: Its listed thermal-filler powder grades include a D50 value of approximately xx.xx micrometers.
12. Products | What Is ADMAFINE? | Admatechs
    - Taxonomy evidence: The supplier distinguishes its base spherical-oxide products from secondary products with modified particle surfaces; its line includes alumina.
    - Taxonomy evidence: The described base product provides a commercial counterpart to separately described surface-modified products, without verifying the surface status of every individual sale.
    - Taxonomy evidence: The supplier describes spherical-oxide products whose particle surfaces are modified and states that the product line includes alumina.

13. Spherical Alumina | ASPP Co., Ltd.
    - Taxonomy evidence: The seller distinguishes spherical-alumina surface-treatment types and says powder can be shipped with a specified treatment.
    - Taxonomy evidence: The seller explicitly offers shipment of spherical alumina with a specified particle-surface treatment.
14. Electronics and Electric Appliance Applications | NOVORAY
    - Taxonomy evidence: The application page names spherical aluminum oxide powder as a heat-conducting filler for thermal-interface gaskets and greases.
    - Taxonomy evidence: The page identifies spherical aluminum oxide in heat-conducting molding compounds and in material used to fix and seal power devices.
    - Taxonomy evidence: The page identifies spherical aluminum oxide products as fillers for high-thermal-conductivity copper-clad laminates.
15. Henkel Opens Electronics Application Center in Bengaluru | Henkel
    - Taxonomy evidence: A thermal-management application center identifies medical electronics as a distinct target sector. This supports the end-use distinction but does not establish spherical-alumina powder purchases.
16. North American Industry Classification System: Manufacturing Industry Descriptions | U.S. Census Bureau
    - Taxonomy evidence: The official industry description distinguishes intermediate printed circuit assemblies from finished products and classifies finished products by their final manufacturing activity. The proposed end-use axis adapts that final-equipment distinction; it is not an official powder-market classification.

1.4. Years Considered for the Study

Historical year: 2024; base year: 2025; estimated year: 2026; forecast year: 2032.

Figure 1. Global Thermally Conductive Spherical Alumina Powder Market, Years Considered for the Study



1.5. Currency Considered for the Study

Market values are stated in absolute USD.

1.6. Language Considered for the Study

U.S. English.

1.7. Key Stakeholders

- Powder manufacturers: assess grade positioning, customer qualification priorities, and routes to the defined thermal-filler market.
- Formulators and materials buyers: compare eligible powder attributes against the requirements of thermal materials and applications.
- Equipment manufacturers and downstream integrators: interpret how thermal-material choices affect supplier selection without equating component value with powder value.
- Distributors and other intermediaries: evaluate their market access role while distinguishing resale activity from original powder supply.
- Investors and strategists: compare market composition and identified suppliers using the stated scope, years, and share denominators.

2. Research Methodology

2.1. Introduction

This study examines the global market for spherical alumina powder used as a thermally conductive filler. Its approach combines a defined powder-level boundary, accepted quantitative observations, product and application context, and analyst-led qualitative interpretation.

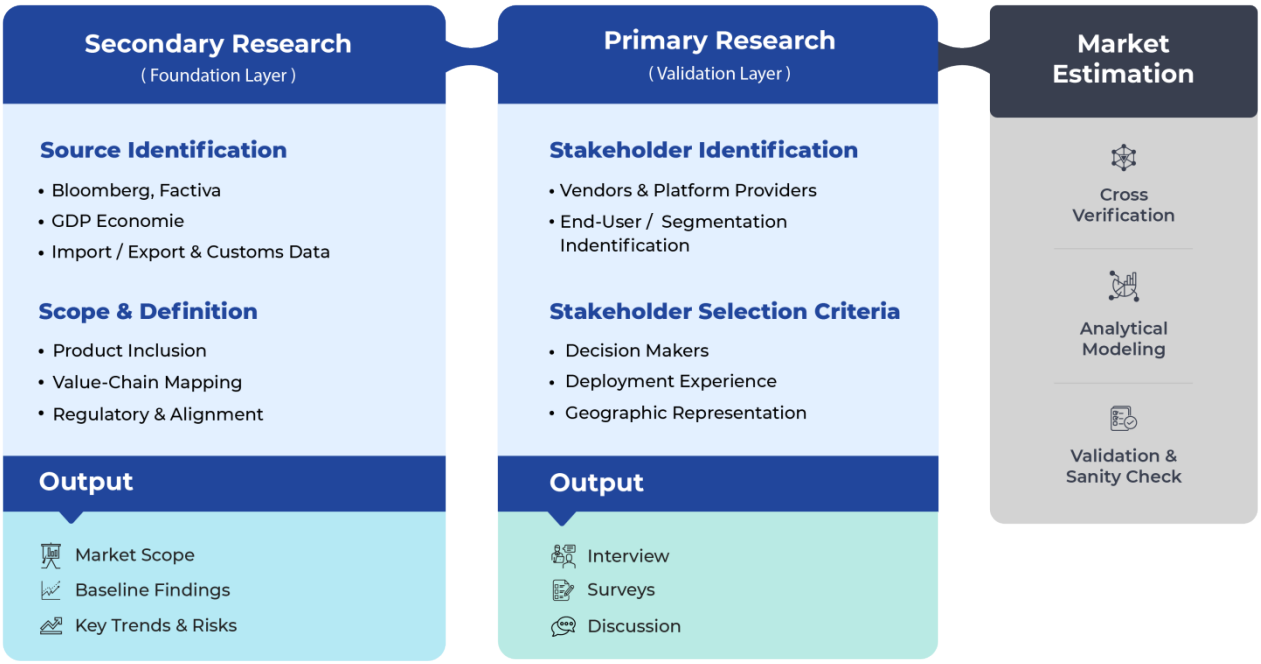
The methodology is intended to make comparisons across years, grades, geographies, and suppliers meaningful without conflating distinct measures. Numerical conclusions retain the accepted measurement record; qualitative research challenges assumptions and helps explain the commercial significance of the classifications.

2.2. Research Design

The research design starts with a global powder-market boundary and applies the accepted product, application, industry, channel, and geographic classifications consistently. This separates the value of eligible powder from the value of downstream formulations and finished thermal-management products.

Accepted quantitative observations establish the measurement record, while secondary material provides context for interpreting products and uses. The qualitative challenge layer tests whether the resulting explanations remain plausible within the defined market; neither contextual description nor interview participation substitutes for the quantitative record.

Figure 2. Global Thermally Conductive Spherical Alumina Powder Market, Research Design



2.2.1. Primary Research

The analyst team conducted primary research as a qualitative challenge layer for market definition, segmentation, demand conditions, adoption barriers, and competitive interpretation. This work tested analytical assumptions and sharpened explanations of market mechanisms without serving as standalone support for numerical estimates.

The qualitative challenge layer was integrated with secondary evidence and quantitative analysis during synthesis. Conclusions were retained only when they remained consistent with the accepted market scope and supporting evidence, so primary research informs interpretation while numerical estimates remain grounded in the approved quantitative record.

2.2.2. Secondary Research

Secondary evidence supplies context for product identity, stated grade characteristics, and indicated thermal uses. Manufacturer descriptions, for example, distinguish spherical alumina grades and identify applications such as thermal interfaces and thermally conductive plastics.

Such descriptions help interpret the study's categories but do not establish global sales, the distribution of applications, or a supplier's market share. Market-wide numerical statements therefore remain tied to the accepted quantitative record rather than inferred from the breadth of a product catalog.

Sources & Evidence

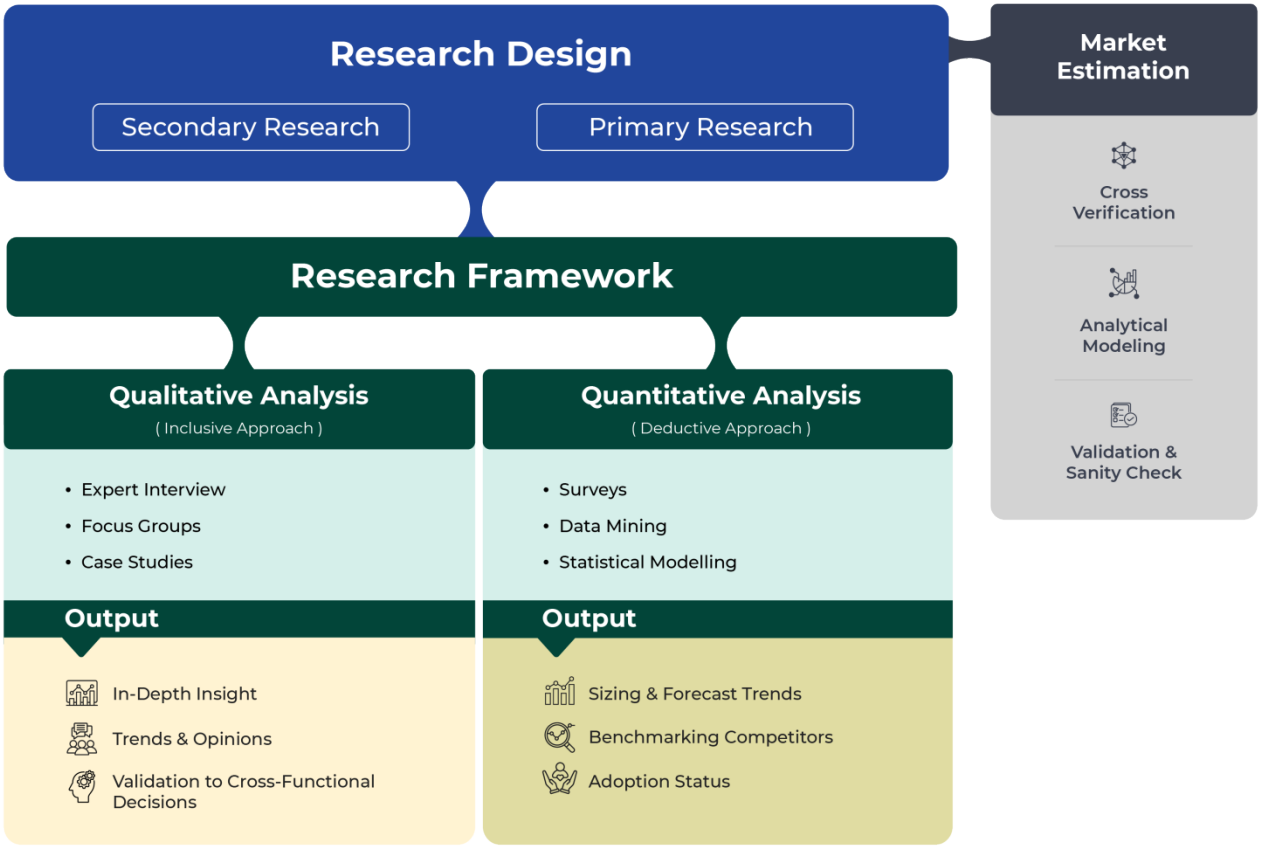
1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka's product description supplies manufacturer-specific grade characteristics and stated thermal applications as classification context, not global market measurements.
2. Spherical Alumina | Momentive Technologies
   - Momentive's manufacturer product description identifies thermal-interface and thermally conductive plastics applications and differentiates its own grades.

2.3. Research Framework

The framework links a global, powder-level definition to the accepted classification of grades, applications, end-use industries, sales channels, geographies, and identified companies. This structure lets readers distinguish a change in product mix from a change in where the powder is used or sold.

Market measurement and the forecast are interpreted within that same boundary. Competitive interpretation concerns the defined powder business, while qualitative assessment addresses adoption and classification questions that the numerical series alone cannot explain.

Figure 3. Global Thermally Conductive Spherical Alumina Powder Market, Research Framework



2.3.1. Qualitative Analysis

Qualitative analysis examines whether the defined powder boundary and accepted categories reflect commercially meaningful distinctions, including particle characteristics, ionic purity, thermal applications, and routes to buyers. It considers how a multipurpose grade may be described differently across suppliers and customers.

The analyst-led qualitative challenge layer tests explanations of demand conditions, adoption barriers, and competition against the accepted scope. Its role is to sharpen interpretation and expose classification risks, not to establish a market value or company share.

2.3.2. Quantitative Analysis

Quantitative interpretation keeps global market values tied to their stated years and treats geographic and segmentation percentages as shares rather than separately measured market values. Regional shares use the global market as their denominator; country shares use their parent region.

Each top-level segmentation axis independently describes the same market, while a child category is interpreted within its parent. Company shares describe the base year only. These controls prevent comparisons across unlike denominators from being mistaken for changes in market size or supplier position.

2.4. Market Size Estimation

Market size refers to the accepted USD value of thermally conductive spherical alumina powder within the global study boundary. The historical, base, estimated, and forecast periods have distinct roles; the value of a downstream compound or finished component is not substituted for powder-market value.

Comparisons across periods should retain this consistent product and geographic scope. Changes in application mix or intermediary involvement can affect interpretation, so a product listing or a downstream equipment trend is not itself a new estimate of powder-market revenue.

2.4.1. Top-Down Approach

The top-down perspective treats the accepted global powder-market value as the controlling scope for interpreting regional and top-level segmentation shares. It keeps a country's percentage relative to its parent region rather than reading that percentage as a direct share of the world market.

This perspective supports consistent comparison of market composition without converting shares into new monetary amounts. Overlapping geographic groupings are analytical views within the global boundary, not additional markets to add to regional coverage.

2.4.2. Bottom-Up Approach

The bottom-up perspective examines which spherical alumina powder offerings, supplier roles, thermal applications, and sales channels belong within the global market boundary. It distinguishes powder supplied to a formulator from the finished material into which that powder may be incorporated.

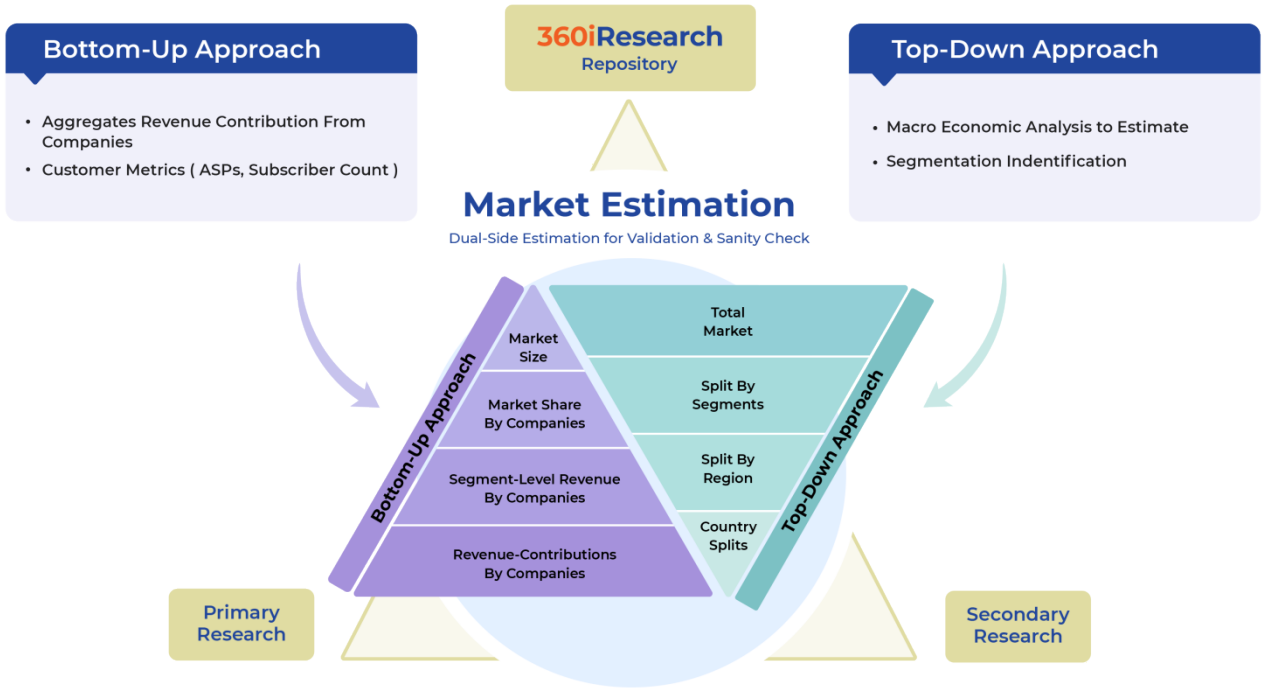
This perspective is a scope and duplication check rather than a separately published sum of supplier activity. In particular, an intermediary's resale and the original powder supply should not be interpreted as two distinct contributions to the same powder market.

2.5. Data Triangulation

Triangulation connects the accepted quantitative record with the defined product boundary and qualitative explanations of grade choice, applications, and channels. A supplier's description of a thermal use can clarify category meaning without independently confirming a market-wide allocation.

When these perspectives differ, the interpretation is narrowed to what remains consistent with the powder-level scope and accepted observations. This keeps uncertainty about a multipurpose grade or an intermediary relationship from becoming an unsupported numerical conclusion.

Figure 4. Global Thermally Conductive Spherical Alumina Powder Market, Data Triangulation



2.6. Research Outcomes

The study provides a globally bounded view of thermally conductive spherical alumina powder, organized by product characteristics, thermal application, end-use industry, sales channel, and geography. Its market values and shares retain their stated periods and denominators.

These outputs support decisions about which grade distinctions and customer applications merit attention, and where supplier comparisons require care. Qualitative interpretation informs those decisions without turning product descriptions or interviews into independent numerical estimates.

2.7. Research Assumptions

- Powder supplied for the defined thermal-filler uses remains within one global product boundary across the stated study periods.
- Top-level segmentation axes describe the market independently; child categories use their parent segment as the comparison base.
- Country shares are interpreted within parent regions, while regional shares are interpreted against the global market.
- A powder sale through an intermediary represents one market contribution, not an additional sale when the intermediary resells it.

2.8. Research Limitations

- Supplier grade descriptions are not automatically interchangeable; differences in particle-size and ionic-purity terminology can affect category comparisons.
- A powder grade may serve several thermal applications, making application-mix interpretation sensitive to how multipurpose sales are classified.
- Intermediary sales can obscure the original supplier and final thermal use; channel and industry interpretations must avoid duplicate attribution.

3. Executive Summary

3.1. Introduction

The global market for thermally conductive spherical alumina powder was USD xx.xx in the 2025 base year and is forecast at USD xx.xx in 2032. This is a powder-level market, not the value of finished thermal interfaces or electronic equipment. Its structural growth case rests on supplying electrically insulating heat-transfer fillers to increasingly demanding electronic, vehicle, and equipment applications.

Manufacturers describe spherical alumina for thermal interfaces, encapsulation materials, and thermally conductive plastics. Growing data-center electricity requirements and electric-vehicle adoption create plausible downstream demand, but neither trend converts directly into powder sales: component designs, filler selection, and customer qualification intervene. The accepted geographic composition places most 2025 market activity in Asia-Pacific, making supply relationships there important even for suppliers serving global customers.

The decisive commercial question is whether producers can turn application interest into repeatable, qualified powder supply while managing changing customer specifications and competing materials. The forecast represents an expanding market within the stated boundary, not assured growth for every supplier or category. Track qualification decisions, regional customer programs, and the mix of standard versus application-specific grades before committing resources to a particular growth thesis.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka identifies spherical alumina uses in thermal interfaces, semiconductor packaging, vehicle thermal materials, thermally conductive plastics, and heat-dissipating coatings.
2. Spherical Alumina | Momentive Technologies
   · Momentive identifies spherical alumina powder uses in thermal interfaces, conductive plastics, and electronic thermal-management products.
3. Executive summary - Key Questions on Energy and AI - IEA
   · The IEA projects continued growth in data-center electricity use while identifying infrastructure and financing constraints; powder demand is a conditional downstream inference.

3.2. CXO Perspective

Competitive advantage in thermally conductive spherical alumina powder depends on more than offering an insulating filler. Supplier portfolios distinguish particle characteristics, surface treatment, and impurity-related grades, while materials buyers must fit those grades to particular resins and thermal applications. The commercial choice is therefore where to fund application support and dependable supply, not simply how broadly to expand a catalog.

Established suppliers can combine grade breadth with customer relationships, but qualification requirements also give specialists a route into narrowly defined uses. Denka identifies thermal-interface and electronic-packaging applications, while other suppliers

describe grades suited to different formulation needs. These offerings demonstrate competition for technical fit; they do not establish that every listed grade has equal access to every buyer.

Executives should stage commitments around customer qualification and repeatable grade performance before treating downstream equipment growth as powder revenue. Monitor requests for low-impurity and treated grades, the progression of data-center and vehicle programs, and the ability to maintain supply across regions. If programs slip or alternative fillers meet the same design requirement, flexible product and channel investment is preferable to capacity justified by a single application scenario.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka describes particle-distribution adjustment, surface-treatment options, and a low-ionic-impurity type relevant to product positioning.

3.3. New Revenue Opportunities

Potential revenue themes include qualified powders for electronic thermal interfaces and packaging, vehicle thermal materials, and application-specific treated or low-impurity grades. Opportunity Mapping examines the buyer need and conditions for pursuing each theme in detail.

Sources & Evidence

1. Spherical Alumina | Momentive Technologies
   - The company's application descriptions support product matching to different downstream material needs.

3.4. Next-Generation Business Models

The most defensible business-model shift is from selling an undifferentiated powder description toward supplying qualified grade families for specific formulation needs. Manufacturers already offer distinctions in particle distribution, surface modification, and other grade characteristics. Those distinctions create a basis for technical collaboration with formulators, although a catalog feature alone does not establish a commercial premium.

Direct relationships suit customers that need coordinated grade selection and continuity across product programs. Intermediaries can help suppliers reach smaller or geographically dispersed buyers, but resale does not create a second contribution to the powder market. A supplier must decide whether a partner adds application access and service or merely separates it from the qualification decision.

Portfolio partnerships and customer-specific supply arrangements could strengthen retention where a formulation becomes difficult to change, subject to performance and continuity requirements. Producers should retain control of product identity and customer feedback while using channels selectively. Monitor whether customized grades progress into recurring commercial use; without that transition, service-intensive offerings may consume resources without improving market position.

Sources & Evidence

1. Resonac Thermal Filler Brochure
   - Resonac describes spherical alumina grades with different particle distributions and offers blended grades, supporting a differentiated portfolio model.
2. PRODUCTS | What is ADMAFINE? | Admatechs
   - Admatechs identifies spherical alumina, surface-modified products, and adjusted particle distributions, supporting differentiated grade-family offerings.

3.5. Industry Roadmap

The market's expected evolution begins with extending established spherical alumina grades into more demanding thermal-interface and packaging designs. Supplier portfolios already distinguish size, surface characteristics, and impurity-related options, giving formulators a basis for closer application matching. Progress will depend on customer acceptance of a specific grade rather than a general increase in demand for thermal management.

Through the middle of the forecast period, expanding data-center and electrified-equipment programs could widen the set of qualifying customers. At the same time, project delays, alternative fillers, and differences among regional vehicle markets may redirect demand between applications. Suppliers that can serve both established and emerging uses have more flexibility than those tied to one downstream program.

By 2032, a plausible competitive milestone is broader commercialization of application-specific powder portfolios supported by durable supplier-formulator relationships. That outcome is conditional, not a prediction of universal grade adoption. Track qualification progress, recurring orders across applications, and evidence that newer grades solve a customer constraint before moving from development commitments to less reversible investment.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka's grade range and stated applications establish an existing basis for application-specific portfolio development.
2. Executive summary - Key Questions on Energy and AI - IEA
   - Data-center demand prospects and stated bottlenecks support a staged rather than automatic thermal-material growth case.
3. Denka Company Limited - May 2026 Investor Materials Script
   - Denka discusses spherical alumina for thermal conductive molding compounds in memory applications and distinguishes ongoing development from anticipated sales.

4. Market Overview

4.1. Introduction

This global market covers spherical alumina powder supplied for thermally conductive filler uses, whether a manufacturer sells directly or an intermediary reaches the materials buyer. ■■■ ■■■■ ■■■■■■ ■■■■■ ■■ ■■■ ■■■■■■ ■■■■■■■■ Its applications span thermal interfaces, electronic encapsulation, conductive plastics, and other heat-dissipating materials; their finished-product values sit outside the powder boundary.

The market is established enough to contain differentiated supplier grade portfolios, yet growth depends on application-level decisions rather than a universal powder specification. Particle distribution, surface characteristics, and impurity-related requirements can change suitability from one formulation to another. ■■■■■■ ■■■ ■■■■■■■■■ ■■■■■■ ■■■■■■■■■ ■■■■■■■■■ ■■■■■ ■■■■■■■■■■■■■■■■■■ ■■■■■■ ■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■■■ ■■ ■■■■■■ ■■■■■■ ■■ ■■■■■■■■■ ■■■ ■■■■■ ■■■■

Figure 5. Global Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million, Growth %)

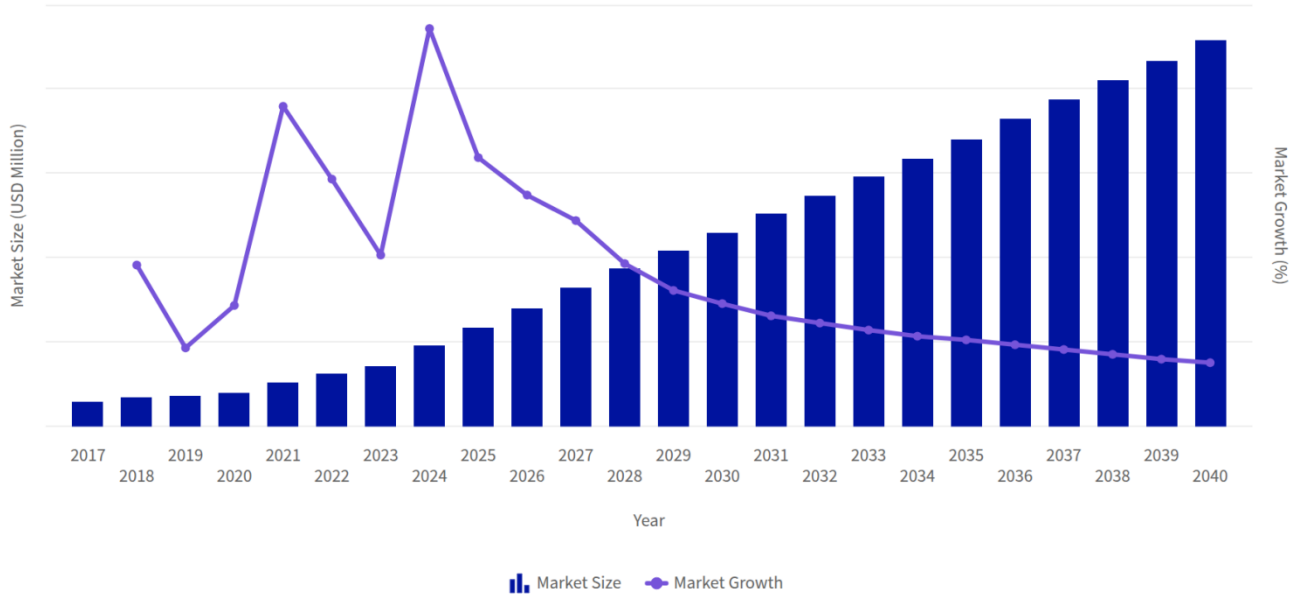


Table 2. Global Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million, Growth %)

Metric	2017	2024	2025	2026	2027	2032	2040
Market Size (USD Million)	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Market Growth (%)	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka's stated product distinctions and thermal uses support the application-specific product proposition.

2. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
3. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
4. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
5. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
6. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

7. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
8. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
9. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

10. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
11. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

4.2. Key Growth Contribution

Incremental demand may be sustained where spherical alumina helps formulators meet the combined heat-transfer, electrical-insulation, and handling needs of thermal interfaces and electronic packaging. Manufacturer offerings also connect the powder to vehicle thermal materials and conductive plastics, while data-center expansion increases attention to thermal management in electronic equipment. Converting those downstream needs into powder demand depends on grade qualification, consistent supply, and selection against alternative fillers; equipment growth alone is not evidence of an equivalent powder-market gain. Modeled growth contributions describe separate market breakdowns. They are not additive opportunities or a ranking of commercial attractiveness, returns, or investment priorities.

Figure 6. Global Thermally Conductive Spherical Alumina Powder Market, Key Growth Contribution, by Region, 2025-2032 (USD Million)

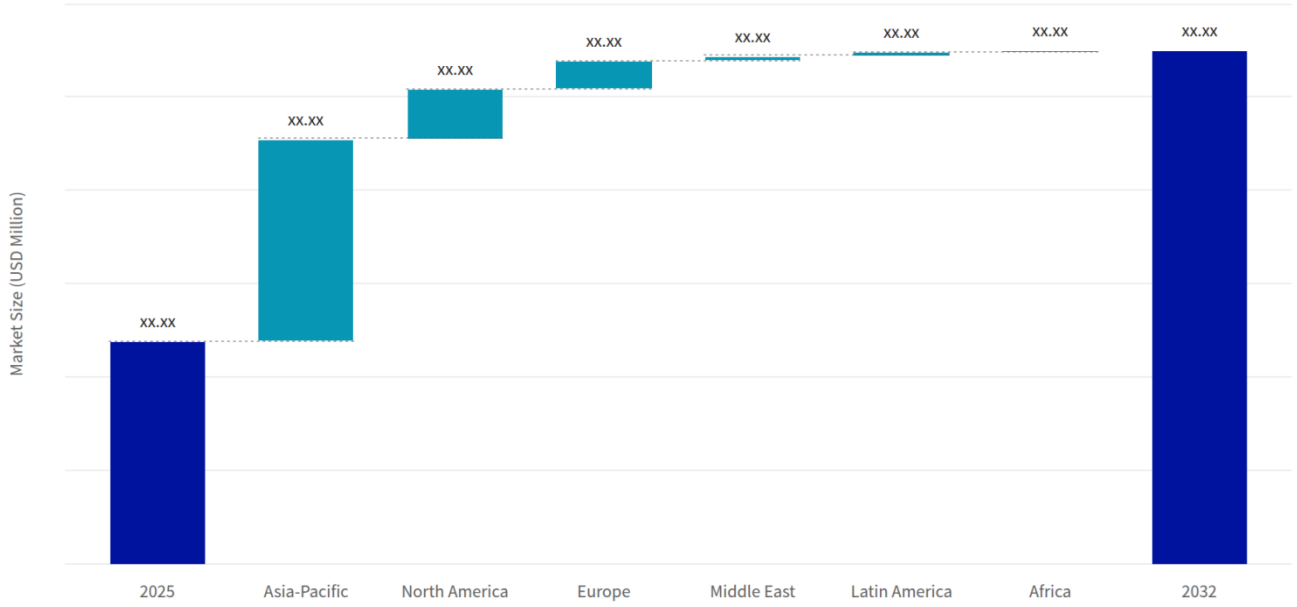


Figure 7. Global Thermally Conductive Spherical Alumina Powder Market, Key Growth Contribution, by Country, 2025-2032 (CAGR %)

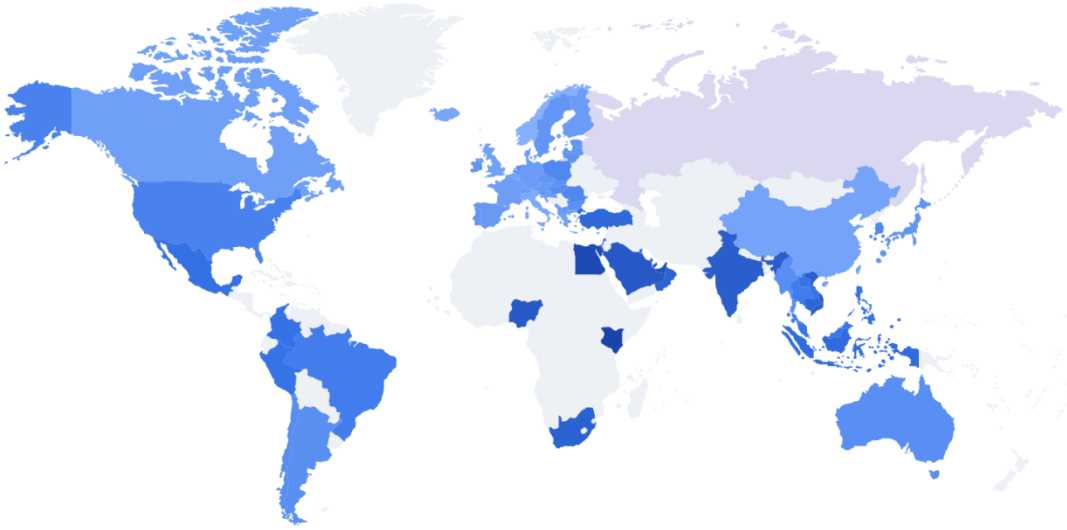


Table 3. Global Thermally Conductive Spherical Alumina Powder Market, Key Growth Contribution, 2025-2032

Scope	Leading Category	Added Market Size (USD Million)	Growth Share (%)	CAGR (%)
Application	xx.xx	xx.xx	xx.xx	xx.xx
Country	xx.xx	xx.xx	xx.xx	xx.xx
End-Use Industry	xx.xx	xx.xx	xx.xx	xx.xx
Ionic Purity Grade	xx.xx	xx.xx	xx.xx	xx.xx
Particle Size	xx.xx	xx.xx	xx.xx	xx.xx
Particle Size Distribution	xx.xx	xx.xx	xx.xx	xx.xx
Region	xx.xx	xx.xx	xx.xx	xx.xx
Sales Channel	xx.xx	xx.xx	xx.xx	xx.xx
Surface Treatment	xx.xx	xx.xx	xx.xx	xx.xx

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka's stated applications and grade options support the conditional demand mechanisms and qualification constraint.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated:

2. Executive summary - Global EV Outlook 2026 - IEA

- The IEA reports growth in electric-car adoption alongside material geographic and policy differences, supporting a conditional vehicle thermal-material opportunity.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

3. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
4. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
8. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
9. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

10. WSTS - Full-Year 2025 Global Semiconductor Market Results
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.

11. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
12. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
13. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

14. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

15. Resonac Thermal Filler Brochure

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

16. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
17. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

18. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
19. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
20. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

4.3. Industry Ecosystem & Value Chain Analysis

The value chain begins with producers of eligible spherical alumina powder and runs through direct or intermediary supply to formulators of thermal materials. ■■■■■ ■■■■■■■■■■■■ ■■■■■ ■■■■■■■■■ ■■■ ■■■■■■■■■ ■■■■■■■■■■■■■ ■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■ ■■■ ■■■■■■■■■■■ ■■■■■■■■■■■■■ ■■■■■■ Commercial value is created when a powder's characteristics enable a buyer to meet a defined formulation requirement and supply can be sustained.

■■■■■ ■■■■■■■■■ ■■■■■■■■ ■■■■■■■■■■■■■ ■■■ ■■■■■■ ■■ ■■■ ■■■■■■■ ■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■■ ■■■■■■■ ■■■■■■■ Suppliers describe differentiated distributions, blends, and surface options, while formulators can evaluate competing fillers. This creates both a route to stronger relationships and a bottleneck: an appealing powder characteristic has limited value until it works in a customer's material.

Producers should decide which application relationships justify technical and supply commitments, and intermediaries should demonstrate access that the producer cannot obtain as effectively alone. Monitor repeat qualification and continuity across programs rather than counting each handoff as separate demand. ■■■ ■■■■■■■■■■ ■■■■■■ ■■ ■ ■■■■■■■■■■ ■■■■■ ■■ ■ ■■■■■■■■ ■■■■■■■■■■■■■■ ■■■■■■■ ■■ ■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■■■■■■■■■■■ ■■■■■

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka describes grade options and multiple thermal applications that make product specification commercially important.

4.3.1. Supply-Side Analysis

Supply-side value lies in offering a powder grade that a formulator can use consistently for a defined purpose. Documented supplier portfolios vary by particle distribution, blends, and surface characteristics; those differences provide possible control points in customer selection. ■ ■■■■■■■■■■ ■■■■■■■ ■■■■■■■ ■■■■ ■■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■ ■■■■ ■■■■■ ■■■■■■■■■■■■

Manufacturers and intermediaries serve different roles. A reseller may improve access, while the producer remains responsible for the identity and continuity of the original powder. ■■■■■■■■■ ■■■■■■ ■■■■■■■■■■ ■■■■■■■ ■■■■■ ■■■■■■■■■■ ■■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■ ■■ ■■■■■■■■■■■■■ ■■■■■■■■■■ ■■■ ■■■■■ ■■■■■■■■■■ ■■■■■■■■■ ■■■■■■ ■■■■■■■ ■■ ■■■■■■■■ ■■■■■■■■■■■ ■■■■■■■ ■■ ■■ ■■■■■■■■

Sources & Evidence

1. Resonac Thermal Filler Brochure
   - Resonac's differentiated grades and blends illustrate supply-side specialization rather than a single interchangeable specification.
2. PRODUCTS | What is ADMAFINE? | Admatechs
   - Admatechs' stated product variants substantiate supplier differentiation by particle and surface characteristics.

4.3.2. Demand-Side Analysis

Formulators purchase spherical alumina as an input to a material that must satisfy its own thermal and handling needs. ■■■■■■■■■■■■■ ■■■■■■■■ ■■■■ ■■ ■■■■■■■ ■■■■■■■■■■■■ ■■■■■■■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■ ■■■ ■■■ ■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■■■■■ ■■■■■■■ ■■■ ■■■■■■ ■■■■■■■■ ■■■■■■■ ■■■■■■■■ ■■■■■■ ■■■ ■■■■■ ■■■■■■■■■■■ That intervening decision limits any direct conversion from device growth to powder demand.

■■■■■■■ ■■■ ■■■■■■■■■■■ ■■■■■■■■■■■■ ■■■■■ ■■■■■■■■■ ■■■■■■ ■■■■■■■ ■■■ ■■■■■■■ ■■■■■■ Electric-car markets differ geographically, while data-center projects face infrastructure dependencies. Powder suppliers should segment buyers by the formulation decision they control and monitor completed qualification rather than assuming that all downstream programs require the same grade.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - The manufacturer identifies thermal interfaces, vehicle materials, and semiconductor packages as relevant uses.
2. Spherical Alumina | Momentive Technologies
   - The identified thermal-interface and plastics uses support the distinction between powder purchasing and finished-material demand.
3. Executive summary - Global EV Outlook 2026 - IEA
   - The IEA describes differences in vehicle-market conditions across China, Europe, and the United States.

4.3.3. Stakeholder Analysis

Powder producers control grade identity and supply continuity; formulators determine whether a grade works in a thermal interface, encapsulant, or conductive plastic. ■■■■■■■■■■ ■■■■■■ ■■■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■■■■■ ■■■ ■■■■ ■■ ■■■ ■■■■■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■ Distributors can extend geographic access without becoming an additional source of original powder production.

These roles divide bargaining power. A formulator can compare candidate fillers, while a qualified producer may be harder to replace once a design depends on its grade. ■■■ ■■ ■■■■■■■ ■■■■■■■■■■■■■ ■■■ ■■■■■■■■■ ■■■■ ■■■■ ■■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■■■■■■■ ■■■■■■■■■■■■■■■■■ ■■■■■■■■■ ■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■ ■■■■■■■■■■■■ ■■■■■■■■■■■■■■ ■■■ ■■■ ■■■■■■■■■■■ ■■■■■■■■■ ■■■■■ ■■■■■■ ■■■■■■■■■ ■ ■■■■■■■■■■ ■■■■■■■■

Sources & Evidence

1. Spherical Alumina | Momentive Technologies
   - Momentive's stated uses connect powder suppliers, materials formulators, and equipment applications without equating their commercial values.
2. REACH explained - European Commission
   - The European Commission explains that REACH assigns substance-registration responsibilities to qualifying EU manufacturers and importers, subject to applicable exemptions.

4.4. Market Dynamics

Demand for spherical alumina powder links downstream thermal-management needs to the narrower decision to use a particular filler in a particular formulation. Electronics and vehicle programs can expand the addressable set of applications, while particle characteristics, surface treatment, and reliability requirements determine which supplier grades can participate. ■■■■ ■■■■■ ■■■ ■■■■■■ ■■■■■■■■■ ■■ ■■■■ ■■■■■■■■■ ■■■■■■■■■■ ■■■ ■■■ ■■■■ ■■ ■■■■■■■■■ ■■■■■■■■■■■■■

Supply-side differentiation can help solve formulation constraints, but it can also increase the effort needed to compare and approve alternatives. Regional vehicle conditions and data-center infrastructure bottlenecks further separate a favorable downstream trend from an immediately accessible powder sale. ■■■■■■■■■ ■■■■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■■■ ■■■■■■ ■■■■ ■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■■■ ■■ ■■■■ ■■■■■■■

The practical balance is between building a flexible grade portfolio and committing resources to a narrow customer program. A supplier with consistent offerings across thermal interfaces, packaging, and conductive plastics can redirect commercial effort if one application slows. ■■■■ ■■■■■■■■■■■ ■■■■■■■ ■■■■■■■■■■■ ■■ ■■■■■■■ ■■■■ ■■■■■■■ ■■■■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■■■■■ ■■■ ■■■■■■■■■■■■■■■■ ■■■■■■■■■■ ■■■ ■■■ ■■■■■■ ■■■■■■■■■■■

Sources & Evidence

1. New Products | Surface treated ADMAFINE | Admatechs
   · Admatechs describes surface-modified alumina and the commercial relevance of dispersibility and batch consistency in resin applications.
2. Executive summary - Global EV Outlook 2026 - IEA
   · The IEA's account of differing regional electric-car conditions supports separating vehicle demand scenarios by geography.

4.4.1. Key Drivers

4.4.1.1. Electronic thermal-management requirements

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■■■ ■■■■■■ ■■■■■■■■■■ ■■■ ■■■■■■■■■ ■■■■■ ■■ ■ ■■■■■■ ■■■ ■■ ■■■■■■■■■ ■■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■■■ ■■■■■ ■■■■■■■■■ ■■■■■■■ ■■■■■■■■■■■■ ■■■■■■■■■■ Monitor customer qualification and continued use in electronic materials; prioritize grades that solve a documented buyer requirement.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka's product description identifies thermally conductive filler uses across interfaces and electronic materials.
2. Executive summary - Key Questions on Energy and AI - IEA
   · The IEA's data-center outlook supports a potential electronics-related demand driver but does not measure spherical alumina purchasing.

4.4.1.2. Electrified-equipment applications

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Suppliers should treat electrified equipment as an application pathway with regional and customer-specific exposure. ■■■■■■■■ ■■■■■■■■■■■■■■■ ■■■■■■■■■■■■■ ■■■ ■■■■■■■■■■■ ■■■■■■■■■ ■■■■■ ■■■■■■■■■■ ■■■■■■■ ■■ ■■■■■■■■■■■ ■■■■■ ■■ ■■■■■■■■■ ■■ ■■■■■■■■ ■■■■■■■■

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - The stated vehicle-pad and in-vehicle electronics applications support a conditional vehicle-related demand mechanism.
2. Executive summary - Global EV Outlook 2026 - IEA
   - The IEA documents electric-car adoption and regional variation; its findings support downstream exposure, not a direct powder-demand estimate.

4.4.2. Key Restraints

4.4.2.1. Application-specific qualification

Application qualification can slow substitution or first adoption because buyers select powder characteristics in the context of a finished material. ■■■■■■■■■■ ■■■■■■■■■■■ ■■ ■■■■■■■■ ■■■■■■■■■■■■ ■■■ ■■■■■■■ ■■■■■■■■■■■■ ■■■■ ■ ■■■■■■■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■■ ■■■■■ ■■■ ■■■ ■■■■■■■ ■■■ ■■■■ ■■■■■■■■■■■■ ■■■■

Formulators and new suppliers therefore face a longer path from product interest to a dependable supply relationship. ■■■■■■■■■ ■■■■■■ ■■■■■■■■■■ ■■■ ■■■■■ ■■■■■■■■■■■■■■■ ■ ■■■■■■■■ ■■■■■■■■ ■■■■■ ■■■ ■■■■■■■ ■■■■■■■■■■■■ ■■■■ ■■■■■■ ■■■■■■■■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■■■ ■■■■■■ ■■ ■■■■■■■■■■■■ ■■■■

Sources & Evidence

1. PRODUCTS | What is ADMAFINE? | Admatechs
   - Documented grade differentiation supports the interpretation that performance requirements can limit direct substitutability.

4.4.2.2. Downstream project timing

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Powder suppliers exposed to a concentrated set of equipment programs should preserve flexibility across applications. ■■■■■■■■ ■■■■■■■■ ■■■■■■■■■■■■■■■ ■■■■■■■■■■■ ■■■ ■■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■ ■■■■■ ■■■■■■■■■■■■ ■■■■■ ■■■■■■■■■ ■■■■ ■■■■■■■■ ■■ ■■■■■■■■■ ■■■■■■■■■■■ ■■■■■■■■ ■■■■■■■

Sources & Evidence

1. Executive summary - Key Questions on Energy and AI - IEA
   - The IEA identifies capital-market sensitivity and infrastructure bottlenecks relevant to timing of downstream equipment demand.

4.4.3. Key Opportunities

4.4.3.1. Qualified specialty grades

Low-impurity and surface-treated spherical alumina options address customers seeking a closer match between filler characteristics and electronic-material requirements. ■■■■■■■■

RESEARCH SAMPLE REPORT

[redacted]

The addressable opening is a qualified grade for a defined formulation, particularly where standard powder does not meet the buyer's needs. [redacted]

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · The low-ionic-impurity type and treatment options provide a basis for the application-specific grade opportunity.
2. New Products | Surface treated ADMAFINE | Admatechs
   · The supplier's description supports surface-treatment differentiation as a potential answer to formulation needs, not proof of universal adoption.

4.4.3.2. Formulation-specific powder portfolios

Blended and application-specific grades may help formulators address thermal-interface or electronic-packaging needs that a single standard grade does not satisfy. [redacted]

[redacted] Monitor completed customer qualifications and recurring use; leave relative attractiveness and capture requirements to Opportunity Mapping.

Sources & Evidence

1. Resonac Thermal Filler Brochure
   · The documented blended-grade offering supports a conditional opportunity to address formulation-specific filler needs.
2. Denka Company Limited - May 2026 Investor Materials Script
   · Denka's discussion of packaging applications supports an emerging customer need without establishing universal adoption.

4.4.4. Key Challenges

4.4.4.1. Maintaining qualified product fit

Achieving a formulation fit once is not the same as maintaining it across a customer's continuing requirements. [redacted]

Producers should align product descriptions and supply commitments with the specific qualified use, while formulators should retain a clear basis for comparing alternatives. [redacted]

Sources & Evidence

1. New Products | Surface treated ADMAFINE | Admatechs
   · Surface-treatment and resin-compatibility distinctions support qualifying a specific grade against customer needs.

4.4.4.2. Cross-border classification and sourcing

A global sales strategy must account for the import treatment of the product actually shipped. ■■■■ ■■■■■■■■ ■■■■■■■■■■■■■ ■■■■■ ■■■■■■■■■■■■■■ ■■■■ ■■■■■■■■■■■■■■■■ ■■■■■■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■■■■■ ■■■■■■■ ■■■■■■ ■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■ ■■■■■■■■■■ ■■■■■■■■■■■■

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Sources & Evidence

1. What is the classification for a good I am trying to import or what is the duty for the good I'm importing? - USITC
   · The USITC's classification guidance supports verifying import treatment before choosing a cross-border supply route.

4.5. Porter's Five Forces Analysis

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Entry requires a product that can meet customer requirements consistently, not merely an alumina listing. ■■■■■■■■■ ■■■■■■■ ■■■■■■■■■■■■■ ■■■■ ■■■■■■■■■ ■■■■■■■■ ■■ ■■■■■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■■ ■■■■■■■■■■■■■■■■■ ■■■ ■■■■■■■■■■■ ■■■■■■ ■■■■ ■■■ ■■■■■■■■■ ■■ ■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■■ Incumbents and entrants should monitor qualification outcomes and competing filler selections before assuming that product differentiation will translate into durable customer retention.

Sources & Evidence

1. Resonac Thermal Filler Brochure
   · The supplier's grade and blend descriptions support differentiation through product fit, with customer access remaining a separate competitive question.
2. US20240308867A1 - Spherical alumina particles and resin composition
   · A published spherical-alumina patent application addresses particle attributes and resin uses; an application alone does not establish a granted or market-wide exclusive right.

4.6. PESTLE Analysis

Electronics investment and vehicle adoption create economic and technological demand pathways, but infrastructure constraints and financing conditions can alter their timing. In the European Union, applicable REACH responsibilities affect substance-market access; they should not be confused with a blanket rule for every finished thermal product. ■■■ ■■■■ ■■■■■■■■ ■■■■■■■■■■■■■■■ ■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■ ■■■ ■■■■■■ ■ ■■■■■■■■■■■ ■■■■■■■■■■■ ■■■■■■■■■ ■■■■■■ ■■■■■■ ■■■■■ ■■■■■■■■■ ■■ ■■■■■■■■ ■■■■■■■ ■■■ ■■■■■■ ■■■■ ■■■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■ ■■■■■■■ ■■■■■■■■ ■■■■ ■■■■■■ ■■■■■■ ■■■ ■■ ■■■■■■ ■■■■■■■ ■■■ ■■■■■■■ ■■■■■■■■

Sources & Evidence

1. Executive summary - Key Questions on Energy and AI - IEA
   - The IEA describes data-center investment sensitivity to financing conditions and physical infrastructure constraints.
2. REACH explained - European Commission
   - EU chemical-market access depends on the applicable substance identity and supplier or importer responsibilities.
3. What is the classification for a good I am trying to import or what is the duty for the good I'm importing? - USITC
   - The USITC explains that U.S. import treatment depends on correct product classification, origin, applicable preferences, and potentially additional duties.

4.7. Market Outlook

The accepted global market series rises from USD xx.xx in 2025 to a forecast USD xx.xx in 2032. ■■■ ■■■■■■■■■■ ■■■■■■ ■■ ■■■■■■■■■ ■■■ ■■ ■■■■■■■■■ ■■■■■■■■■ ■■■■■■■■ ■■ ■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■■ ■■ ■■■■■■■■■■■■■■■■■■■■■ ■■■■■ ■■■ ■■■■■■■■■ ■■■■■■■■ ■■■■■■■■■■■■■ Those endpoints describe the defined powder market, not the value of downstream systems.

Upside depends on materials buyers selecting spherical alumina in programs that proceed to recurring production. Denka's discussion of packaging applications and differing vehicle conditions illustrates why one end use cannot stand in for the whole market. ■■■■■■■■■■■■ ■■■■■■■■■■■■■■■ ■■■ ■■■■■■■■■ ■■■■■■■■■■■ ■■■■■■ ■■ ■■■■■■■■■■ ■■■■■■ ■■■■ ■■■■ ■■■■■■ ■■■■■■■■ ■■ ■■■■■■■■ ■■■■■■■■■■ ■■ ■■■■■■■■

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Sources & Evidence

1. Executive summary - Key Questions on Energy and AI - IEA
   - The data-center outlook identifies infrastructure dependencies and scenario uncertainty relevant to the integrated forecast interpretation.

2. Denka Company Limited - May 2026 Investor Materials Script
   · Denka reports differing conditions between thermal molding compound applications and its vehicle-related business, illustrating application-specific demand risk.

4.7.1. Near-Term Market Outlook (0-2 Years)

For 2026-2027, the market enters its forecast period from a 2025 base of USD xx.xx; the accepted 2026 estimate is USD xx.xx. ■■■ ■■■■■■■■■ ■■■■■■■■■■ ■■■■ ■■ ■■■■■■■ ■■■■■■■■■■■■■■■■■ ■■■ ■■■■■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■■■■■■■ ■■■■ ■■■■■■■■■ ■■■■■■■ ■■■■■■■ Data-center investment provides a downstream catalyst, while infrastructure bottlenecks can delay the equipment and materials decisions tied to it.

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Sources & Evidence

1. Executive summary - Key Questions on Energy and AI - IEA
   · The IEA identifies near-term bottlenecks alongside projected data-center growth, supporting a conditional 2026-2027 outlook.

4.7.2. Medium-Term Market Outlook (3-5 Years)

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Producers should compare the durability of demand across applications rather than relying on one downstream forecast. Watch for a grade progressing beyond evaluation into continued commercial use and for customer requirements that justify a distinct offering. ■■ ■■■■■■■ ■■■■■■■■ ■■■■■■ ■■■■■ ■■■■■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■■ ■■■■■■ ■■■■ ■■■■■■■■ ■■■■ ■ ■■■■■■■■ ■■■■■■■■■ ■■■■■ ■■■■■

Sources & Evidence

1. Executive summary - Global EV Outlook 2026 - IEA
   · Vehicle market differences and policy sensitivity support monitoring customer programs rather than assuming uniform adoption.
2. Denka Company Limited - May 2026 Investor Materials Script
   · Denka's account of continuing packaging-related qualification and development supports a cautious medium-term commercialization scenario.

4.7.3. Long-Term Market Outlook (5-10 Years)

For 2031-2032, the forecast endpoint is USD xx.xx in 2032. ■■■■■■■■■ ■■■■■■■■■ ■■■■■ ■■■■■■■■ ■■■■■■■■■ ■■■■■■ ■■■■ ■■ ■■■■■■■ ■■ ■■■■■■■■■■ ■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■■ ■■■■■■■

The longer horizon allows more customer programs to mature, but also more scope for alternative fillers and changing formulations.

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Sources & Evidence

1. Executive summary - Key Questions on Energy and AI - IEA
   · The IEA identifies possible longer-term upside if infrastructure constraints ease, supporting a conditional 2031-2032 scenario.

4.8. Go-to-Market Strategy

Enter through a defined formulation need rather than a broad claim to serve all thermal-management customers. ■ ■■■■■■ ■■■■■■■■ ■■■■■■ ■■■■■■ ■ ■■■■■■■■■■ ■■■ ■■ ■■■■■■■■■■■■■■■■■■ ■■■■■■■■■■ ■■ ■■■■■■■■■■■■■■■■■■ ■■■■■■ ■■■ ■■■■■■■■ ■■■■■■ ■■■■■■■■■■■■■■■ ■■■■■■■■ ■■ ■■■■■ ■■■■ Established supplier offerings show that application distinctions are commercially meaningful; they do not prove that an unqualified entrant can displace an incumbent.

Prioritize direct engagement where a formulator makes repeated grade decisions and use intermediaries where local access or customer service adds value. Sequence geographic expansion around identified buyers and viable supply routes, with particular attention to Asia-Pacific's role in the accepted market composition. ■■■ ■■ ■■■ ■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■■ ■■■■■■■■■■ ■■■■■■■■■■ ■■■ ■■■■■■ ■■■■■■■■■■■■■■■■■ ■■■■■■ ■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■ ■■■■■ ■■ ■■■■■■ ■■■■■■■■■■

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Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka's grade options and thermal uses support a qualification-led supplier proposition.
2. Spherical Alumina | Momentive Technologies
   · Momentive describes uses in thermal interfaces and conductive plastics that support application-specific positioning.
3. REACH explained - European Commission
   · The Commission's REACH explanation supports checking EU market-access responsibilities when selecting import and distribution routes.
4. What is the classification for a good I am trying to import or what is the duty for the good I'm importing? - USITC
   · Classification and origin-dependent import treatment are relevant to regional channel and sourcing choices.

5. Market Insights

5.1. Consumer Insights & End-User Perspective

[redacted] Its job is to meet the material's thermal and electrical requirements while retaining workable handling characteristics and consistent supply. Denka and Momentive identify different grade attributes for these uses, which helps explain why a buyer evaluates a specific offering rather than accepting an alumina designation alone.

[redacted] A lower-effort sourcing change is attractive only if it preserves that fit; a specialty grade may justify greater commitment where it resolves a requirement the current choice does not meet. Producers should ask which application decision the buyer controls, support comparison against realistic alternatives, and watch repeat acceptance rather than interpreting initial interest as willingness to make a lasting change.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka describes spherical alumina grades with differing particle characteristics, low-ionic-impurity options, and possible surface treatments for thermal-material uses. ([denka.co.jp](https://www.denka.co.jp/eng/product/detail_00040/))
2. Spherical Alumina | Momentive Technologies
   · Momentive describes spherical alumina for thermal interfaces and conductive plastics, including thermal conduction and electrical insulation characteristics. ([momentivetech.com](https://www.momentivetech.com/products/ceramics/ceramic-powders-solids/ceramic-powders/spherical-oxide-powders/spherical-alumina))

5.2. Consumer Experience Benchmarking

[redacted] Relevant dimensions include consistency of the qualified grade, suitability of its particle distribution and surface characteristics, impurity-related requirements, continuity of supply, and responsiveness when an application changes. Denka and Momentive describe different grade characteristics and uses, providing comparison points but not proof of equivalent results in a customer's material.

The useful peer set is therefore the powders a buyer could realistically approve for the same formulation, supplemented by alternative insulating fillers where the design permits substitution. A supplier with a broad portfolio may still lose on repeatability or service for a particular use; a specialist may win narrowly without serving every application. [redacted]

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka's grade distinctions and stated uses provide application-relevant comparison dimensions, not proof of equivalence in a customer's formulation.
2. Spherical Alumina | Momentive Technologies
   · Momentive presents distinct particle-distribution characteristics for its listed spherical-alumina grades.

5.3. Opportunity Mapping

Electronic packaging and thermal interfaces are the clearest application-led opportunities for suppliers able to work with materials formulators. Denka identifies semiconductor-package sheets and encapsulation fillers, and Momentive identifies interface materials and electrically insulating thermal-management products. ■■■■■■ ■■■■ ■ ■■■■■ ■■■■ ■■■■ ■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■ ■■■■■■■ ■■■■■■ ■■ ■■■■■■■■ ■■■■■■■■■■■ ■■■■ ■■■■■■■■■■■ ■■■■■ ■■■■■■ ■■■■■■■■■■■ ■■ ■ ■■■■■■■■■■■■ ■■■■■■■■■■■ ■■■ ■■■ ■■■■■■■■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■ ■■■■■■■■■■ ■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■■ ■■■■■■■■ ■■■■ ■■■■■■■■■ ■■■■

Specialty grades offer a more selective opening. ■■■■■■■ ■■■■■■■■■■■■■■■■■■ ■■■ ■■■■■■■■■■■■■■■■ ■■■■■■■ ■■■■ ■■■ ■ ■■■■■■■■ ■■■ ■■■■■■■ ■■■■■■■■■■■■ ■■■■■■ ■ ■■■■■■■■ ■■■■■■ ■■■■■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■ ■■ ■ ■■■■■■■■■■ ■■■■ ■ ■■■■■■■■■■ ■■■■■■■■■■ ■■■■ ■■ ■■■■■■■■ ■■■■■■■■■ ■■■■■■■■ ■■■■ ■■■ ■■■■■■■■ Development effort and qualification risk make this less accessible than its technical promise suggests: suppliers should establish the requirement and a repeatable supply proposition before expanding a specialty portfolio.

Vehicle thermal materials and data-center equipment provide additional pathways, but their downstream growth is not a measure of powder revenue or profitability. ■■■■■■■ ■■■■■■■■ ■■■■■■■ ■■ ■■■■■■■■ ■■■ ■■■■■■■■■■■ ■■■■■■■■■ ■■■■■ ■■■■■■■■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■■■■ ■■■■■■■■■ ■■■■ ■■■■■■■■■■■ ■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■■ ■■ ■■■■■■■ ■■■ ■■■■■■■ ■■■■■ ■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■■ ■■■■■■■■■■■ ■■■■■ Prioritize by qualification progress, customer access, and exposure to project delays-not by equipment growth alone-and defer less reversible commitments until continuing powder demand is evident.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka identifies thermal-interface materials, semiconductor-package materials, vehicle-related thermal uses, and differentiated grade options.
2. Spherical Alumina | Momentive Technologies
   · Momentive identifies thermal-management and interface applications relevant to the opportunity assessment.
3. Executive summary - Key Questions on Energy and AI - IEA
   · The IEA's data-center outlook supports a downstream application pathway while identifying constraints on project timing.
4. Trends in electric cars | Global EV Outlook 2026 | IEA
   · The IEA documents uneven electric-car market development across countries, supporting geographically selective vehicle-application assessment.

5.4. Distribution Channel Analysis

[redacted] Intermediaries can extend reach and provide local stocking or service: GNPGraystar lists spherical alumina for thermal uses and describes its distribution and processing capabilities. That channel role is distinct from original powder manufacture, and resale must not be treated as additional powder-market demand.

The channel trade-off is access versus control of product identity, technical feedback, and supply commitments. [redacted] Import obligations can differ by jurisdiction and party, making route design a commercial as well as a compliance decision.

Sources & Evidence

1. Spherical Alumina | GNPGraystar Specialty Materials
   - GNPGraystar lists spherical alumina and describes filler and thermal-management uses.
2. Certifications & Accreditations | GNPGraystar Specialty Materials
   - GNPGraystar describes its quality-management scope as distribution and processing of ceramic raw materials, supporting the distinction between an intermediary role and original manufacture.
3. 1910.1200 - Hazard Communication | Occupational Safety and Health Administration
   - OSHA's distributor provisions support assigning responsibility for required product information when selecting a sales channel.

5.5. Pricing Trend Analysis

[redacted] Denka distinguishes low-ionic-impurity and surface-treatment options, while Momentive describes particle-distribution differences. A specialized offering may strengthen a supplier's negotiating position where it addresses a defined requirement, but a catalog distinction alone does not establish a durable premium.

Pass-through depends on the buyer relationship and supply route. Energy exposure, import treatment, and intermediary service can affect a supplier's costs, while a formulator's ability to compare qualified alternatives limits what can be passed on. [redacted]

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka identifies low-ionic-impurity and surface-treatment options; the commercial-pricing implications in the narrative are conditional analysis, not reported prices.
2. Spherical Alumina | Momentive Technologies
   · Momentive's differentiated grades support discussion of grade-specific negotiation without establishing any price outcome.
3. What is the classification for a good I am trying to import or what is the duty for the good I'm importing? - USITC
   · USITC guidance supports treating import conditions as a possible supplier cost exposure, without asserting a price outcome.
4. The Denka Way, Autumn 2022 | Denka Company Limited
   · Denka discusses emissions-related cost exposure at its Singapore operations, supporting a conditional energy-cost consideration rather than a market-wide price claim.

5.6. Regulatory Compliance & Standards Framework

Market access depends on the substance and supply route actually involved. ■■ ■■■ ■■■■■■■■ ■■■■■■■■ ■■■■■ ■■■■■ ■■■■■■■ ■■■■■■■■■■■ ■■■■■■■■■■■■■■■ ■■ ■■■■■■■■■■■■ ■■■ ■■■■■■■■■ ■■■■ ■■■ ■■■■■■■■■■ ■■■■■■ ■■ ■■■■■■■■ ■■■■■■ ■■■■■■■■ ■■■ ■■■ ■■ ■■■■■■■■ ■■■■■■ ■■■■■■■■■■ ■■■ ■■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■■■■■■ ■■■ ■■■■ ■■■■■■■■■■■■ ■■■■■■■■■■■■■■■■■■■■ ■■■■■■ ■■■■■■ ■■ ■■■ ■■■■■■■■■ ■■■■■■■■■■■■■■ ■■■ ■■■ ■■■■■■■■■ ■■■■■■ ■■■■ ■■■■■■■■■■■■ ■■■■■■■■■■■ ■■■ ■■■■■■■■■■■■ ■■■■■■■■ ■■■■■■■■■■■■ Neither framework should be presented as a blanket approval of a finished thermal component.

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Sources & Evidence

1. REACH explained - European Commission
   · European Commission guidance describes REACH registration responsibilities for qualifying manufacturers and importers of substances in the European Economic Area. ([single-market-economy.ec.europa.eu](https://single-market-economy.ec.europa.eu/sectors/chemicals/reach/reach-explained_en?utm_source=openai))

2. What is the classification for a good I am trying to import or what is the duty for the good I'm importing? - USITC
   · USITC explains that import classification and origin affect duty treatment and that additional measures may apply depending on the product and origin. ([usitc.gov](https://www.usitc.gov/faq/question/what_classification_good_i_am_trying_import_or.htm))
3. US20240308867A1 - Spherical alumina particles and resin composition
   · A published patent application describes spherical alumina in resin compositions for heat-dissipating uses; its publication alone does not establish an enforceable claim.
4. 1910.1200 - Hazard Communication | Occupational Safety and Health Administration
   · OSHA's Hazard Communication Standard assigns hazard-classification and applicable information-transmission responsibilities to chemical manufacturers, importers, and distributors.
5. RoHS Directive | European Commission
   · The European Commission describes substance restrictions applying to electrical and electronic equipment, distinct from REACH duties for a powder substance.
6. Applying for Patents | USPTO
   · USPTO explains that patent applications can be published before a patent is granted, supporting the distinction between publication and granted rights.

5.7. ESG & Sustainability Analysis

Spherical alumina's role in heat-dissipating materials creates a potential sustainability benefit when it helps a finished design manage heat effectively; the benefit belongs to the qualified application and should not be assumed for every powder sale. Producers also face an environmental trade-off from the energy and emissions associated with their own operations. ▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪ ▪▪▪ ▪ ▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪ ▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪▪

Materials buyers seeking lower-impact supply should compare credible product-specific information alongside thermal suitability and continuity, rather than infer a powder's footprint from a corporate commitment. ▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪▪▪▪▪ ▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪▪ Monitor customer information requests and facility-level energy or emissions measures before treating sustainability positioning as a source of market access.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka identifies heat-dissipating uses; an environmental benefit remains conditional on the finished application.
2. The Denka Way, Autumn 2022 | Denka Company Limited
   · Denka describes emissions-reduction work at its Singapore sites; this is company-specific operational context, not a market-wide powder footprint.
3. Carbon Tax | National Environment Agency, Singapore
   · Singapore's National Environment Agency describes the carbon-tax framework applying to taxable facilities; applicability to an individual powder operation is not assumed.

5.8. Disruption & Risk Scenarios

[redacted] Powder producers serving a narrow set of formulators would be most exposed; an announced facility is not a confirmed spherical-alumina order. Suppliers should watch customer qualification milestones and repeat demand, and keep commitments flexible until projects advance.

A different disruption would arise if a formulator selects another insulating filler or redesigns a thermal interface around a different material. Spherical alumina suppliers would then face a product-fit problem even if the downstream equipment market grows. [redacted]

[redacted] If origin-dependent duties or import responsibilities alter a route's commercial viability, an intermediary may need to change sourcing without changing the end customer's specification. Exporters should confirm treatment for the actual product and origin before making supply commitments, while preserving traceability to the qualified grade.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka's identified applications establish where a changed filler choice could affect a supplier; substitution and mitigation are conditional scenarios.
2. Spherical Alumina | Momentive Technologies
   · Momentive's application and grade descriptions support the product-fit exposure used in the conditional substitution scenario.
3. Executive summary - Key Questions on Energy and AI - IEA
   · The IEA identifies infrastructure, component, and financing bottlenecks that support the conditional data-center delay scenario.
4. What is the classification for a good I am trying to import or what is the duty for the good I'm importing? - USITC
   · USITC guidance supports the conditional import-treatment disruption scenario without assigning a duty to spherical alumina.

5.9. Return on Investment & Cost-Benefit Analysis

[redacted] Benefits may include broader access to thermal-interface and packaging programs and stronger customer retention. The counterweights are qualification effort, specialized supply commitments, and the risk that an alternative filler meets the same requirement.

For a formulator, a suitable spherical grade can offer a better match between thermal performance, electrical insulation, and material handling, but switching entails comparison and approval work. Neither party should assume a favorable return from downstream equipment growth alone. [redacted]



[redacted]

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka identifies application-specific uses that make customer qualification and continuing fit relevant to a producer's investment decision.
2. Spherical Alumina | Momentive Technologies
   - Momentive's listed material applications support the assessment of producer and formulator benefits, subject to customer fit.
3. Executive summary - Key Questions on Energy and AI - IEA
   - Reported financing and infrastructure dependencies support caution about treating downstream growth as an assured producer return.

6. Cumulative Impact of Artificial Intelligence 2026

[redacted] The IEA reports growth in electricity use by AI-focused data centers and identifies tighter infrastructure and component bottlenecks. That creates a plausible need for thermal-management materials, but it does not establish that a particular server design will select spherical alumina or that a planned facility will generate a powder order.

[redacted] This demonstrates a research use case, not established deployment across powder suppliers: models could help formulators compare candidate material designs, while commercial value still depends on reliable data, customer qualification, and repeatable grade supply. Suppliers should monitor whether AI-assisted materials work produces accepted commercial applications, and avoid treating experimental results or data-center investment as a direct measure of powder-market gains.

Sources & Evidence

1. Executive summary - Key Questions on Energy and AI - IEA
   · The IEA reports growth in electricity use by AI-focused data centers and identifies grid, equipment, chip, and financing constraints; powder demand is a conditional downstream inference. ([iea.org](https://www.iea.org/reports/key-questions-on-energy-and-ai/executive-summary))
2. Data-driven engineering and analysis of polymer composites with high thermal conductivity | Composites Science and Technology
   · A peer-reviewed original study reports machine-learning-guided design of a polymer composite using spherical alumina; it establishes a research example, not market-wide commercial adoption. ([sciencedirect.com](https://www.sciencedirect.com/science/article/pii/S0266353825003689?utm_source=openai))

7. Thermally Conductive Spherical Alumina Powder Market, by Particle Size

Medium Powder is the largest captured particle-size category in the 2025 base-year mix, while Fine Powder and Submicron Powder gain share in the 2032 forecast. ■■■■■■■■ ■■■■■■■■■■ ■■■■ ■■■ ■■■■ ■■ ■ ■■■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■ ■■■■■■■ ■■■■■■■ ■■■■■■ ■■■■ ■■■ ■■■■■■ ■■■■■■■■ ■■■■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■■ ■■■■■■ These study categories are not a universal cross-supplier specification.

Coarse Powder remains a distinct option rather than a grade to replace automatically as the mix changes. A formulator should compare the actual offered distribution and material fit, while producers should monitor which sizes progress to recurring qualifications. ■ ■■■■■ ■■ ■■■■■■■■ ■■■■■ ■■■■ ■■■ ■■■■■■■■■ ■■■■ ■ ■■■■■ ■■■ ■■■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■ ■■■■■■■■■■■ ■■■ ■■■■■■■■■■

Figure 8. Global Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2025 (%)

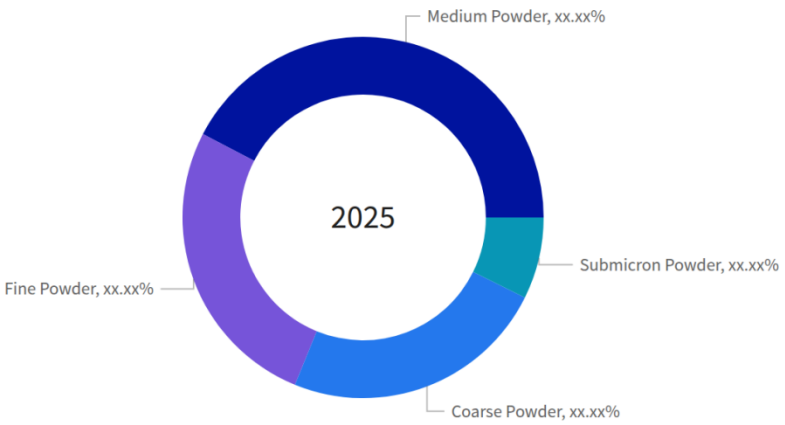


Figure 9. Global Thermally Conductive Spherical Alumina Powder Market, by Particle Size, 2032 (USD Million)

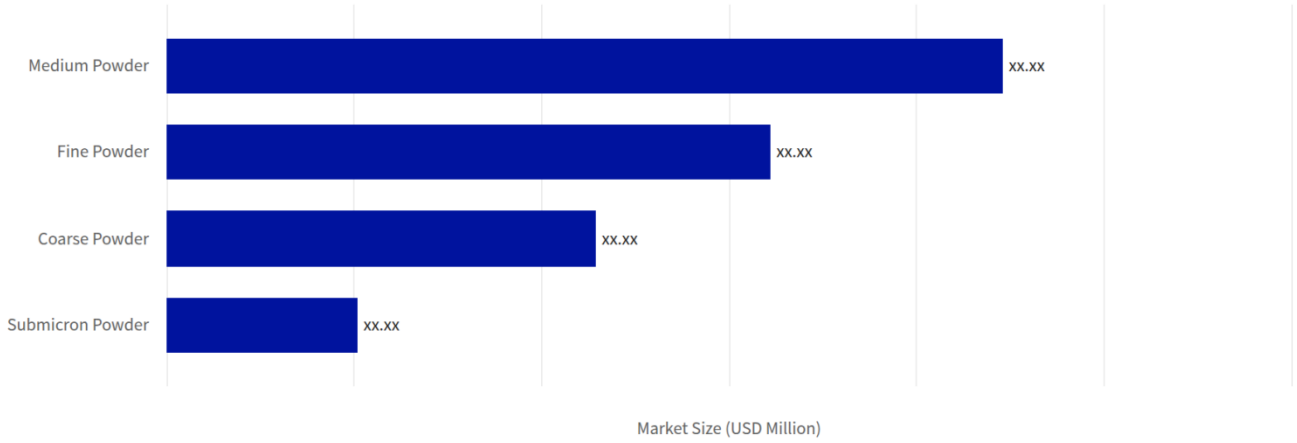


Table 4. Global Thermally Conductive Spherical Alumina Powder Market, by Particle Size growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 5. Global Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka describes spherical alumina particle-range, surface-treatment, and low-ionic-impurity options for thermal materials.
   - Taxonomy evidence: The supplier presents thermally conductive spherical alumina with D50-specified grades spanning submicron to coarse sizes.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
2. PRODUCTS | Product List / Alumina | Admatechs
   - Admatechs provides a supplier example of fine spherical alumina offerings.
   - Taxonomy evidence: The supplier lists high-purity spherical alumina and identifies thermally conductive resin filler as an application.
3. Silica/Alumina Spherical Particle | NIPPON STEEL Chemical & Material
   - The supplier distinguishes its spherical alumina particles from its separately described spherical silica products.
4. Silica/Alumina Spherical Particles | NIPPON STEEL Chemical & Material
   - Taxonomy evidence: Spherical alumina presented for heat-dissipation fillers is listed in D50-specified grade series.
5. Spherical Alumina Powders | AdValue Technology
   - Taxonomy evidence: The supplier lists spherical-alumina grades for thermally conductive fillers with D50 values ranging from approximately xx.xx to xx.xx micrometers.

6. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
7. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
8. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
9. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
10. Denka FY2024 Third-Quarter Results Presentation - Q&A
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

11. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
    - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
    - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
    - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
    - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
12. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
    - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
    - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
13. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

14. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
15. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

7.1. Medium Powder

Table 6. Global Thermally Conductive Spherical Alumina Powder Market Size, by Medium Powder, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 7. Global Thermally Conductive Spherical Alumina Powder Market Size, by Medium Powder, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 8. Global Thermally Conductive Spherical Alumina Powder Market Size, by Medium Powder, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: The grade tables include D50 values between xx.xx and xx.xx micrometers.
   - Taxonomy evidence: Its listed spherical-alumina grades include D50 values between xx.xx and xx.xx micrometers.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
2. Silica/Alumina Spherical Particles | NIPPON STEEL Chemical & Material
   - Taxonomy evidence: The alumina grade tables include D50 values of xx.xx and xx.xx micrometers.
3. Spherical Alumina Powders | AdValue Technology
   - Taxonomy evidence: Its listed thermal-filler powder grades include D50 values of approximately xx.xx xx.xx and xx.xx micrometers.

4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
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7. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
8. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

9. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
10. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
11. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

12. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
13. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

14. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

15. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

16. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
17. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
18. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

19. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

7.2. Fine Powder

Table 9. Global Thermally Conductive Spherical Alumina Powder Market Size, by Fine Powder, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 10. Global Thermally Conductive Spherical Alumina Powder Market Size, by Fine Powder, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 11. Global Thermally Conductive Spherical Alumina Powder Market Size, by Fine Powder, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: The standard and low-sodium grade tables include D50 values below xx.xx micrometers and above xx.xx micrometer.
   - Taxonomy evidence: Its listed spherical-alumina grades include D50 values between xx.xx and xx.xx micrometers.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
2. Silica/Alumina Spherical Particles | NIPPON STEEL Chemical & Material
   - Taxonomy evidence: The alumina grade tables include D50 values of xx.xx and xx.xx micrometers.
3. Spherical Alumina Powders | AdValue Technology
   - Taxonomy evidence: Its listed thermal-filler powder grades include D50 values of approximately xx.xx and xx.xx micrometers.

4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
5. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
6. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
7. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
8. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

9. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
10. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
11. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

12. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
13. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

14. WSTS - Full-Year 2025 Global Semiconductor Market Results
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
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    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
17. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
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19. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

7.3. Coarse Powder

Table 12. Global Thermally Conductive Spherical Alumina Powder Market Size, by Coarse Powder, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 13. Global Thermally Conductive Spherical Alumina Powder Market Size, by Coarse Powder, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 14. Global Thermally Conductive Spherical Alumina Powder Market Size, by Coarse Powder, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: The grade tables include D50 values above xx.xx micrometers.
   - Taxonomy evidence: Its listed spherical-alumina grades include D50 values above xx.xx micrometers.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
2. Silica/Alumina Spherical Particles | NIPPON STEEL Chemical & Material
   - Taxonomy evidence: The alumina grade tables include a D50 value of xx.xx micrometers.
3. Spherical Alumina Powders | AdValue Technology
   - Taxonomy evidence: Its listed thermal-filler powder grades include a D50 value of approximately xx.xx micrometers.

4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
5. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
6. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
7. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
8. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

9. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
10. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
11. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

12. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
13. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

14. WSTS - Full-Year 2025 Global Semiconductor Market Results
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

15. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

16. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
17. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
18. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

19. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

7.4. Submicron Powder

Table 15. Global Thermally Conductive Spherical Alumina Powder Market Size, by Submicron Powder, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 16. Global Thermally Conductive Spherical Alumina Powder Market Size, by Submicron Powder, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 17. Global Thermally Conductive Spherical Alumina Powder Market Size, by Submicron Powder, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: Published spherical-alumina grade tables show submicron D50 values, including xx.xx micrometers.
   - Taxonomy evidence: Its listed super-fine spherical-alumina grades have D50 values below xx.xx micrometer.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
2. Products | Product List / Alumina | Admatechs
   - Taxonomy evidence: The alumina product listing identifies a regular spherical grade with median particle diameter of approximately xx.xx-xx.xx micrometers and lists thermal conductive compounds as an application.
   - Taxonomy evidence: Its listed regular spherical-alumina grade includes an average particle size of approximately xx.xx micrometers.

3. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
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   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

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   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
9. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
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   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
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    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

11. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
12. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

13. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

14. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

15. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
16. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
17. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

18. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

8. Thermally Conductive Spherical Alumina Powder Market, by Particle Size Distribution

[redacted] Suppliers describe both narrow distributions and adjustable blends, making this axis different from a simple fine-versus-coarse comparison: it concerns how the offered particle populations are arranged within a grade.

Blends may give a formulator another way to meet a defined material requirement, but a supplier's ability to offer one does not establish superior results in every application. [redacted] Monitor repeat acceptance of a specified blend rather than treating the forecast mix as an instruction to replace individual grades.

Figure 10. Global Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2025 (%)

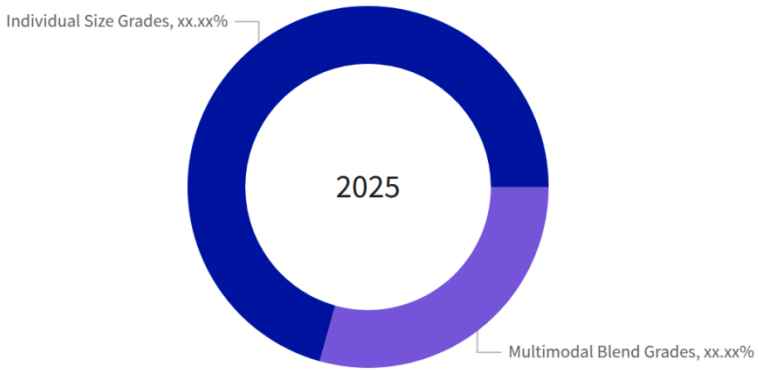


Figure 11. Global Thermally Conductive Spherical Alumina Powder Market, by Particle Size Distribution, 2032 (USD Million)

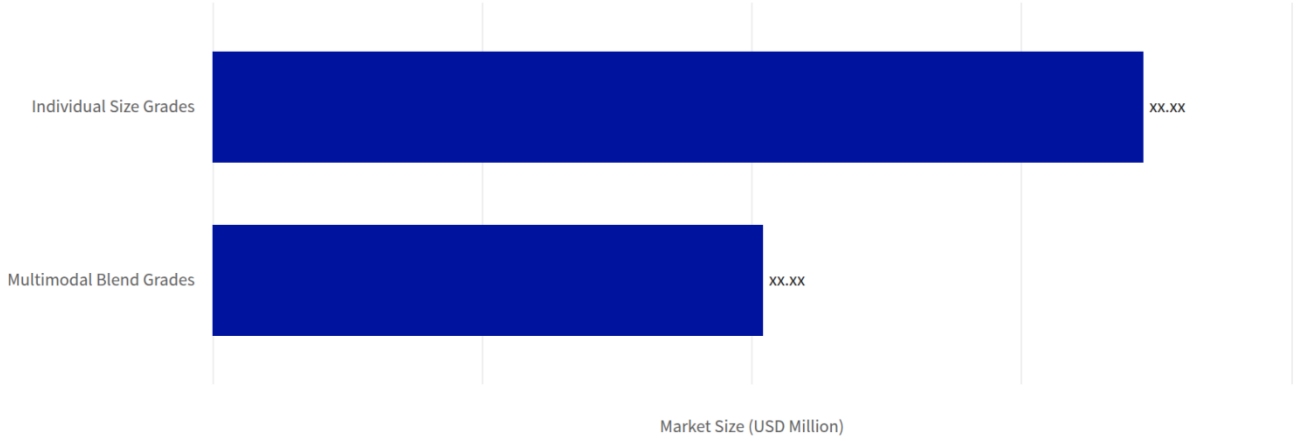


Table 18. Global Thermally Conductive Spherical Alumina Powder Market, by Particle Size Distribution growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 19. Global Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka describes adjustable particle distribution for its spherical alumina.
2. Spherical aluminum oxide powder | Jiangsu NOVORAY New Material Co., Ltd
   - NOVORAY describes spherical alumina powder with adjustable particle distributions, including narrow and multimodal options.

3. Resonac Thermal Filler Brochure
   - Taxonomy evidence: The spherical-alumina CB grade tables distinguish individually listed grades from a separately designated blended series.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
5. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
6. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
7. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.

8. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
9. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
10. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
    - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
    - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
11. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

12. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
13. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

8.1. Individual Size Grades

Table 20. Global Thermally Conductive Spherical Alumina Powder Market Size, by Individual Size Grades, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 21. Global Thermally Conductive Spherical Alumina Powder Market Size, by Individual Size Grades, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 22. Global Thermally Conductive Spherical Alumina Powder Market Size, by Individual Size Grades, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Resonac Thermal Filler Brochure

- Taxonomy evidence: Individual spherical-alumina CB grades have both sharp and broad distributions; broad distribution alone does not designate a supplier-sold blend.
- Taxonomy evidence: Resonac lists individual spherical-alumina CB grades with both sharp and broad particle-size distributions.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.

2. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
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   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
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   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
5. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
6. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

7. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
8. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
9. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

10. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
11. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

12. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
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- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

13. International Energy Agency - Global EV Outlook 2026 Executive Summary

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
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14. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
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    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
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16. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

17. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

8.2. Multimodal Blend Grades

Table 23. Global Thermally Conductive Spherical Alumina Powder Market Size, by Multimodal Blend Grades, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 24. Global Thermally Conductive Spherical Alumina Powder Market Size, by Multimodal Blend Grades, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 25. Global Thermally Conductive Spherical Alumina Powder Market Size, by Multimodal Blend Grades, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Resonac Thermal Filler Brochure

   · Taxonomy evidence: The spherical-alumina CB Blend Series is expressly described as bimodal grades for resin fillers.

   · Taxonomy evidence: Resonac separately lists CB Blend Series spherical-alumina grades as bimodal grades offered for resin fillers.

   · Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.

   · Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.

2. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
3. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
4. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
5. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
6. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

7. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
8. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
9. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

10. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
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- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
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- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

9. Thermally Conductive Spherical Alumina Powder Market, by Surface Treatment

[redacted] Denka describes surface-treatment options, and Bestry lists treated alumina families for particular thermal-material uses. The distinction concerns the grade supplied to a formulator, not a claim that all powder without a treatment label has an identical surface.

[redacted] Suppliers should develop treated offerings around identified applications; buyers should compare them with an approved standard grade. Monitor continuing use after qualification before assuming that greater forecast share means universal adoption.

Figure 12. Global Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2025 (%)

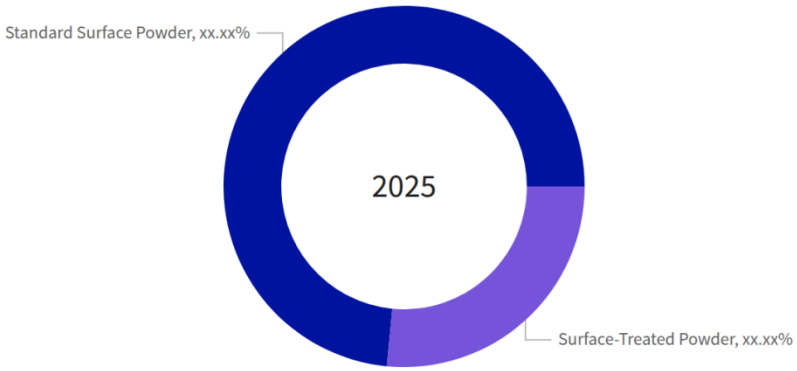


Figure 13. Global Thermally Conductive Spherical Alumina Powder Market, by Surface Treatment, 2032 (USD Million)

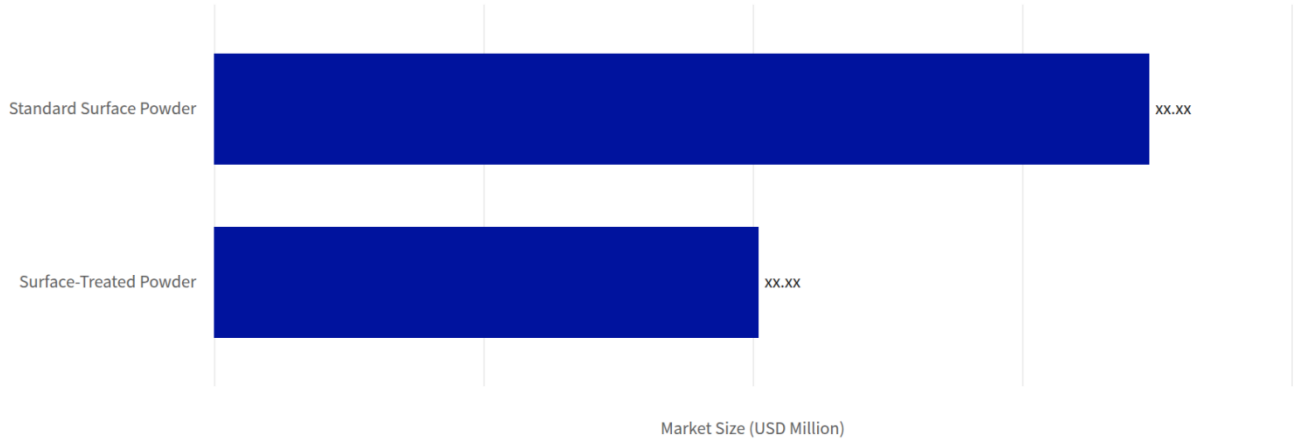


Table 26. Global Thermally Conductive Spherical Alumina Powder Market, by Surface Treatment growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 27. Global Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka identifies surface-treatment options for its spherical alumina.
   - Taxonomy evidence: The supplier describes possible particle-surface treatments but does not establish treatment status for every listed standard grade.
   - Taxonomy evidence: The supplier identifies a standard grade type and says various surface treatments are possible for its spherical alumina.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
2. Alumina | Bestry
   - Bestry lists spherical alumina families and surface-treated alumina families, including an option described for potting products.
3. Products | What Is ADMAFINE? | Admatechs
   - Taxonomy evidence: The supplier distinguishes its base spherical-oxide products from secondary products with modified particle surfaces; its line includes alumina.
4. Spherical Alumina | ASPP Co., Ltd.
   - Taxonomy evidence: The seller distinguishes spherical-alumina surface-treatment types and says powder can be shipped with a specified treatment.
5. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
6. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.

7. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
8. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
9. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
10. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
    - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
    - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
    - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
    - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
11. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
    - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
    - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

12. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
13. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
14. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
15. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.

9.1. Standard Surface Powder

Table 28. Global Thermally Conductive Spherical Alumina Powder Market Size, by Standard Surface Powder, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 29. Global Thermally Conductive Spherical Alumina Powder Market Size, by Standard Surface Powder, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 30. Global Thermally Conductive Spherical Alumina Powder Market Size, by Standard Surface Powder, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: A standard type is identified, without establishing that every such grade is physically untreated.
   - Taxonomy evidence: The catalog labels a spherical-alumina grade family as a standard type; the page does not establish that every standard grade is physically untreated.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
2. Products | What Is ADMAFINE? | Admatechs
   - Taxonomy evidence: The described base product provides a commercial counterpart to separately described surface-modified products, without verifying the surface status of every individual sale.
3. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
4. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
5. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
6. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
7. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
9. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
10. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

11. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
12. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

13. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

14. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

15. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
16. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
17. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

18. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

9.2. Surface-Treated Powder

Table 31. Global Thermally Conductive Spherical Alumina Powder Market Size, by Surface-Treated Powder, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 32. Global Thermally Conductive Spherical Alumina Powder Market Size, by Surface-Treated Powder, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 33. Global Thermally Conductive Spherical Alumina Powder Market Size, by Surface-Treated Powder, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: The supplier states that its spherical alumina can receive various surface treatments.
   - Taxonomy evidence: The supplier states that its spherical alumina can be supplied with various surface treatments.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
2. Products | What Is ADMAFINE? | Admatechs
   - Taxonomy evidence: The supplier describes spherical-oxide products whose particle surfaces are modified and states that the product line includes alumina.
3. Spherical Alumina | ASPP Co., Ltd.
   - Taxonomy evidence: The seller explicitly offers shipment of spherical alumina with a specified particle-surface treatment.

4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
5. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
6. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
7. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
8. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

9. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
10. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
11. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

12. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
13. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

14. WSTS - Full-Year 2025 Global Semiconductor Market Results
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

15. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

16. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
17. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
18. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

19. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

20. Resonac Thermal Filler Brochure

· Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.

10. Thermally Conductive Spherical Alumina Powder Market, by Ionic Purity Grade

[illegible] Denka offers a low-impurity option for electronic materials, and Admatechs describes impurity-related characteristics for its spherical alumina. These are reasons to examine purity for a particular reliability-sensitive use, not evidence of one harmonized threshold across producers.

Buyers should define the requirement for their finished material before comparing supplier labels; a low-impurity designation alone does not establish application approval. Producers considering a specialized grade should prioritize customers whose qualification criteria make the distinction consequential. [illegible]

Figure 14. Global Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2025 (%)

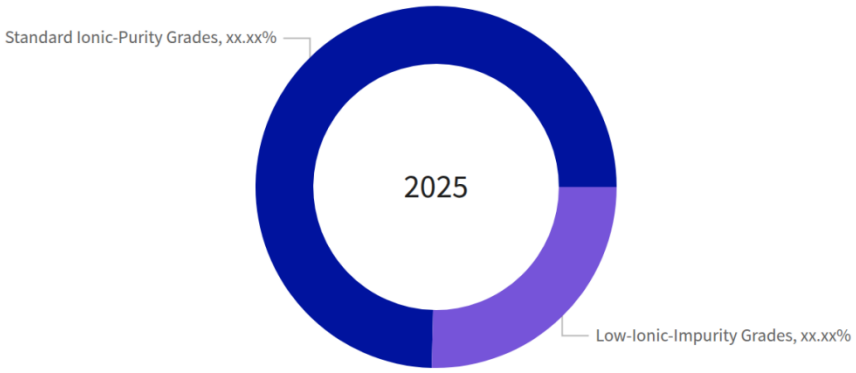


Figure 15. Global Thermally Conductive Spherical Alumina Powder Market, by Ionic Purity Grade, 2032 (USD Million)

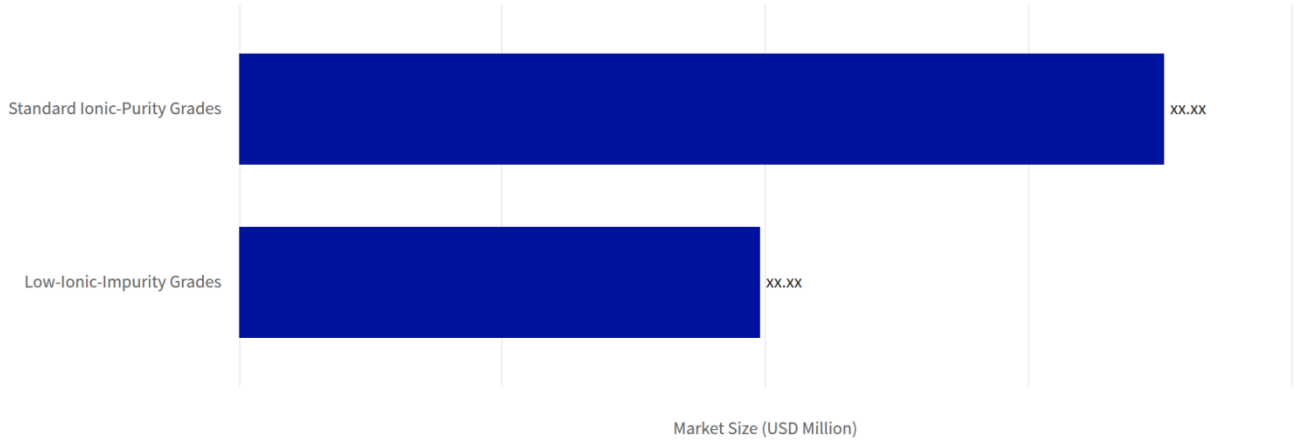


Table 34. Global Thermally Conductive Spherical Alumina Powder Market, by Ionic Purity Grade growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 35. Global Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka offers a low-ionic-impurity type for electronic-material uses.
   - Taxonomy evidence: The supplier separately labels standard and low-sodium spherical-alumina types; the distinction does not supply a cross-supplier ionic threshold.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
2. PRODUCTS | Product List / Alumina | Admatechs
   - Admatechs describes impurity-related characteristics for its spherical alumina offered for thermally conductive compounds.
3. Spherical Alumina | Momentive Technologies
   - Taxonomy evidence: The spherical-alumina thermal-filler listing separately presents regular-soda and low-soda grades.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
5. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
6. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

7. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
8. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
9. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
10. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
    - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
    - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

11. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
12. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
13. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

10.1. Standard Ionic-Purity Grades

Table 36. Global Thermally Conductive Spherical Alumina Powder Market Size, by Standard Ionic-Purity Grades, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 37. Global Thermally Conductive Spherical Alumina Powder Market Size, by Standard Ionic-Purity Grades, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 38. Global Thermally Conductive Spherical Alumina Powder Market Size, by Standard Ionic-Purity Grades, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: A spherical-alumina grade family is explicitly designated standard type.
   - Taxonomy evidence: Denka expressly labels a spherical-alumina product family as its standard type.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
2. Spherical Alumina | Momentive Technologies
   - Taxonomy evidence: The supplier labels one spherical-alumina product group Regular Soda Grades.
   - Taxonomy evidence: Momentive lists regular-soda spherical-alumina grades among its thermal-management filler powders.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
3. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
4. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
5. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
6. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
7. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
9. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
10. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

11. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
12. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

13. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

14. International Energy Agency - Global EV Outlook 2026 Executive Summary

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

15. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
16. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
17. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

18. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

10.2. Low-Ionic-Impurity Grades

Table 39. Global Thermally Conductive Spherical Alumina Powder Market Size, by Low-Ionic-Impurity Grades, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 40. Global Thermally Conductive Spherical Alumina Powder Market Size, by Low-Ionic-Impurity Grades, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 41. Global Thermally Conductive Spherical Alumina Powder Market Size, by Low-Ionic-Impurity Grades, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: A separate low-sodium type is identified for electronic-material reliability needs.
   - Taxonomy evidence: Denka separately offers a low-sodium spherical-alumina type and identifies low ionic impurities as relevant to electronic-material reliability.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
2. Spherical Alumina | Momentive Technologies
   - Taxonomy evidence: The supplier separately labels a group Low Soda Grades, without defining a universal low-ion threshold.
   - Taxonomy evidence: Momentive separately lists low-soda spherical-alumina grades; the designation supports a reduced-sodium category without establishing a universal ionic-purity threshold.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.

3. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
4. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
5. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
6. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
7. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
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9. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
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   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
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    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
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11. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
12. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

13. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

14. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

15. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
16. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
17. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

18. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

11. Thermally Conductive Spherical Alumina Powder Market, by Application

Thermal Interface Materials lead the captured 2025 application mix, while Encapsulation & Potting Compounds and Heat-Dissipating Substrates gain share toward 2032. Manufacturer descriptions connect spherical alumina to interfaces, electronic packaging, conductive plastics, and substrate materials. ■■■■■■■■■■■■■■■■ ■■■■■■■■ ■■■ ■ ■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■ ■■■ ■■■■■ ■■■■■■■■ ■■■ ■■■■■■■ ■■■ ■■ ■■■■■■■■ ■■■■ ■■■■■■■■■ ■■■ ■■■■■■■

These applications place different demands on the finished material, so downstream equipment growth cannot be assigned directly to powder sales. Suppliers should prioritize the formulator and grade decision in each application, including the distinct needs of Thermally Conductive Plastics. ■■■■■ ■■■■■■■■■ ■■■■■■■■■■■■■■■ ■■■ ■■■■■■■■■ ■■■ ■■■■■■■ ■■■■■ ■■■■■■■■■ ■■ ■■■■■■■■■■■■■■■■■■ ■■■■■ ■■ ■■■■■ ■■■■■■■■■ ■■■■■■■■

Figure 16. Global Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2025 (%)

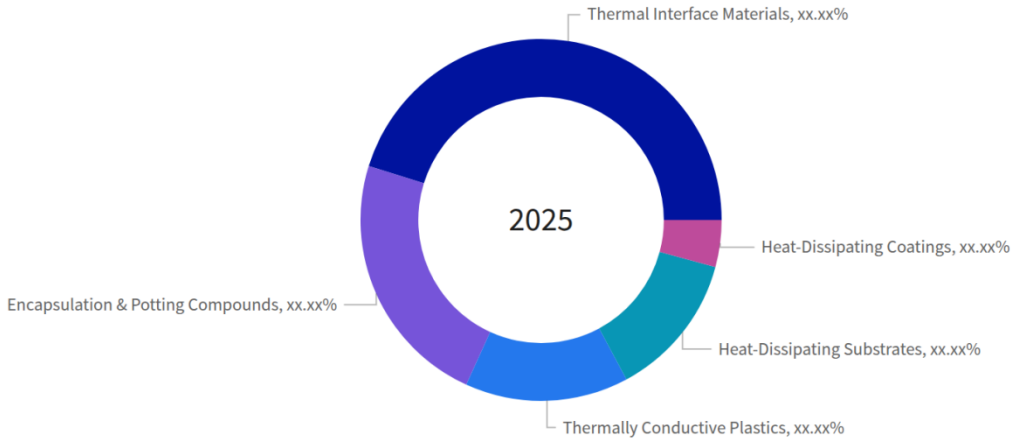


Figure 17. Global Thermally Conductive Spherical Alumina Powder Market, by Application, 2032 (USD Million)

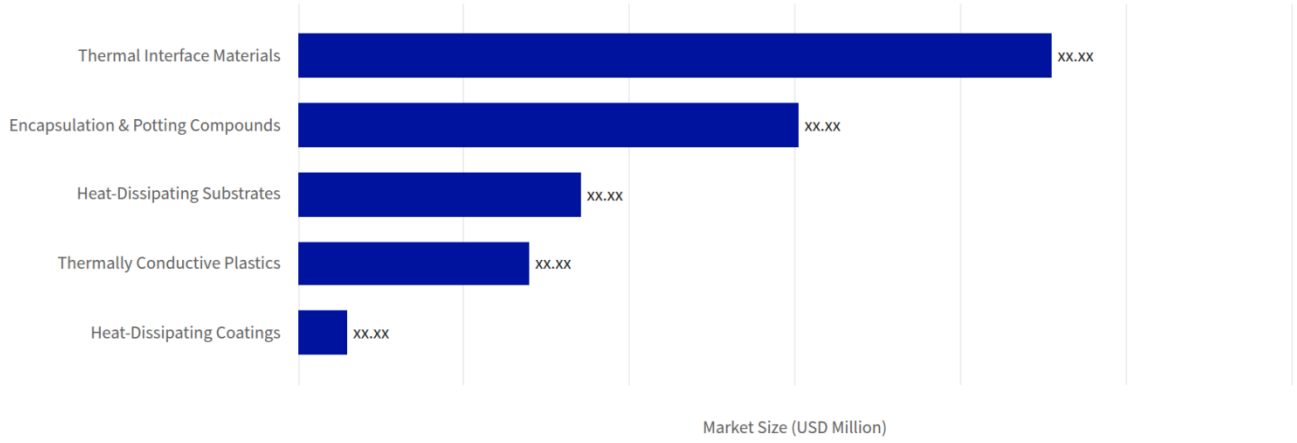


Table 42. Global Thermally Conductive Spherical Alumina Powder Market, by Application growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 43. Global Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka identifies thermal-interface, semiconductor-package, conductive-plastic, and heat-dissipating-paint uses.
   - Taxonomy evidence: The stated powder uses span interface materials, semiconductor molding compounds, thermal plastics, and heat-dissipating paint; nonthermal uses are also listed and require exclusion from thermal-use sales.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
2. Spherical Alumina | Momentive Technologies
   - Momentive identifies spherical alumina uses in thermal-interface materials and thermally conductive plastics.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
3. Electronics and electric appliance | Jiangsu NOVORAY New Material Co., Ltd
   - NOVORAY describes electronic encapsulation, laminate, and thermal-interface applications for spherical aluminum oxide.
4. Hi-Cool Alumina-based Thermally Conductive Fillers | Spaeter
   - Taxonomy evidence: The supplier's thermal-filler page distinguishes interface materials, formed thermal plastics, circuit boards, and sealing materials as commercial applications; these are material functions, not an observed Global powder-sales split.

5. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
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    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
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    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
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    - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
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    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

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    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
14. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
15. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
16. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
17. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.

11.1. Thermal Interface Materials

Table 44. Global Thermally Conductive Spherical Alumina Powder Market Size, by Thermal Interface Materials, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 45. Global Thermally Conductive Spherical Alumina Powder Market Size, by Thermal Interface Materials, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 46. Global Thermally Conductive Spherical Alumina Powder Market Size, by Thermal Interface Materials, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: The supplier identifies thermal pads, sheets, and pastes as uses for its spherical-alumina filler.
   - Taxonomy evidence: The spherical-alumina product page identifies thermal-interface pads, sheets, and pastes as filler uses.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
2. Spherical Alumina | Momentive Technologies
   - Taxonomy evidence: The powder description identifies pads, tapes, and epoxies inserted between components as thermal-interface materials.
   - Taxonomy evidence: The spherical-alumina powder page identifies pads, tapes, and epoxies used between components as thermal-interface applications.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.

3. Hi-Cool Alumina-based Thermally Conductive Fillers | Spaeter
   - Taxonomy evidence: The listed applications include heat-sink sheets and heat-dissipation greases.
4. A View From Henkel North America: Chanhassen | Henkel
   - Taxonomy evidence: A downstream thermal-material formulator describes interface materials as filling voids between a heat-generating device and heat sink or housing. This supports the functional boundary, not a powder-specific sales allocation.
   - Taxonomy evidence: A thermal-interface-material formulator describes the interface function as filling voids to transfer heat between a device and a heat sink or housing; this clarifies the boundary against sealing compounds and formed plastics.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
5. Electronics and Electric Appliance Applications | NOVORAY
   - Taxonomy evidence: The application page names spherical aluminum oxide powder as a heat-conducting filler for thermal-interface gaskets and greases.
6. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
7. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
8. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
9. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
10. Denka FY2024 Third-Quarter Results Presentation - Q&A
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

11. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
    - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
    - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
    - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
    - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
12. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
    - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
    - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
13. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

14. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
15. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

16. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

17. International Energy Agency - Global EV Outlook 2026 Executive Summary

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

18. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
19. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
20. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

21. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

22. Denka Company Limited - FY2025 Results Presentation

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.

11.2. Encapsulation & Potting Compounds

Table 47. Global Thermally Conductive Spherical Alumina Powder Market Size, by Encapsulation & Potting Compounds, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 48. Global Thermally Conductive Spherical Alumina Powder Market Size, by Encapsulation & Potting Compounds, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 49. Global Thermally Conductive Spherical Alumina Powder Market Size, by Encapsulation & Potting Compounds, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: The powder is listed as a filler for semiconductor-package epoxy molding compounds.
   - Taxonomy evidence: The page lists epoxy molding compounds for semiconductor packages among the powder's uses.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
2. Hi-Cool Alumina-based Thermally Conductive Fillers | Spaeter
   - Taxonomy evidence: The supplier identifies semiconductor sealing resins and sealant materials among its thermal-alumina applications.
3. Electronics and Electric Appliance Applications | NOVORAY
   - Taxonomy evidence: The page identifies spherical aluminum oxide in heat-conducting molding compounds and in material used to fix and seal power devices.

4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
5. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
6. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
7. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
8. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

9. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
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   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
10. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
11. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

12. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
13. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

14. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
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- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
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- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.

15. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
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    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

16. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
17. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
18. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

19. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

20. Denka Company Limited - FY2025 Results Presentation

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.

11.3. Thermally Conductive Plastics

Table 50. Global Thermally Conductive Spherical Alumina Powder Market Size, by Thermally Conductive Plastics, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 51. Global Thermally Conductive Spherical Alumina Powder Market Size, by Thermally Conductive Plastics, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 52. Global Thermally Conductive Spherical Alumina Powder Market Size, by Thermally Conductive Plastics, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: Thermal plastic is listed as a powder-filler use.
   - Taxonomy evidence: The page identifies thermal plastics as a powder-filler use.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
2. Spherical Alumina | Momentive Technologies
   - Taxonomy evidence: The powder description identifies thermally conductive plastics used in hardware.
   - Taxonomy evidence: The page describes thermally conductive plastics made for hardware components using conductive powder fillers.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
3. Hi-Cool Alumina-based Thermally Conductive Fillers | Spaeter
   - Taxonomy evidence: Its thermal-alumina applications include formed engineering-plastic components such as heat sinks and housings.

4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
5. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
6. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
7. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

16. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
17. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
18. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

19. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

11.4. Heat-Dissipating Substrates

Table 53. Global Thermally Conductive Spherical Alumina Powder Market Size, by Heat-Dissipating Substrates, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 54. Global Thermally Conductive Spherical Alumina Powder Market Size, by Heat-Dissipating Substrates, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 55. Global Thermally Conductive Spherical Alumina Powder Market Size, by Heat-Dissipating Substrates, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Spherical Alumina | Momentive Technologies
   - Taxonomy evidence: The supplier identifies printed-circuit-board base materials among heat-dissipation applications.
   - Taxonomy evidence: The page identifies printed circuit boards among base-material applications for thermal dissipation.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
2. Hi-Cool Alumina-based Thermally Conductive Fillers | Spaeter
   - Taxonomy evidence: High-thermal-conductivity circuit boards and copper-clad laminates are identified as thermal-alumina applications; the page covers multiple alumina morphologies, so spherical-grade attribution requires care.
3. Electronics and Electric Appliance Applications | NOVORAY
   - Taxonomy evidence: The page identifies spherical aluminum oxide products as fillers for high-thermal-conductivity copper-clad laminates.

4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
5. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
6. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
7. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
8. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

9. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
10. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
11. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

12. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
13. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

14. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.

15. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

16. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
17. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
18. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

19. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

20. Denka Company Limited - FY2025 Results Presentation

· Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.

11.5. Heat-Dissipating Coatings

Table 56. Global Thermally Conductive Spherical Alumina Powder Market Size, by Heat-Dissipating Coatings, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 57. Global Thermally Conductive Spherical Alumina Powder Market Size, by Heat-Dissipating Coatings, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 58. Global Thermally Conductive Spherical Alumina Powder Market Size, by Heat-Dissipating Coatings, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: Heat-dissipating paint is listed separately from heat-shielding paint; the latter is not automatically an eligible use.
   - Taxonomy evidence: The page identifies heat-dissipating paint as a spherical-alumina filler use; it separately lists heat-shielding paint, which is not automatically an eligible thermal-management use.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

2. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
3. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
4. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
5. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
6. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

7. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
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   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
8. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
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9. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

10. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
11. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

12. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

13. International Energy Agency - Global EV Outlook 2026 Executive Summary

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

14. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
15. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
16. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

17. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

12. Thermally Conductive Spherical Alumina Powder Market, by End-Use Industry

Transportation Equipment and Consumer Electronics & Appliances are prominent in the captured 2025 industry mix; Data Center & Telecommunications Equipment gains share in the forecast. Industrial & Energy Equipment and Medical Equipment remain distinct destinations. ■■■■■ ■■■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■ ■■■■■■■■ ■■■■ ■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■

Electric-vehicle adoption and data-center development can increase opportunities for qualified thermal materials, but their paths differ by country and project. Powder suppliers should establish whether a formulator's specific grade is used in the relevant equipment program before assigning commercial effort. ■■■■■■■ ■■■■■■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■ ■■ ■■■■■■ ■■■■ ■■■ ■■■■■ ■ ■■■■■■■■■■■■■ ■■■■■■ ■■■■■■■■■■

Figure 18. Global Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2025 (%)

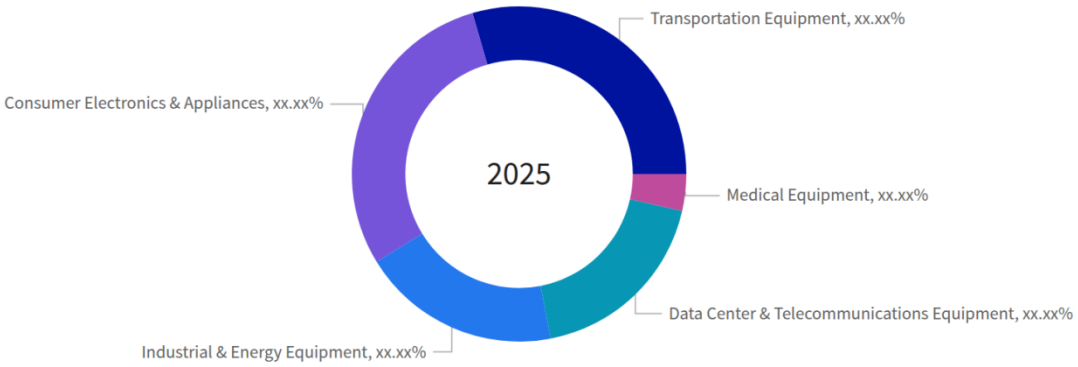


Figure 19. Global Thermally Conductive Spherical Alumina Powder Market, by End-Use Industry, 2032 (USD Million)

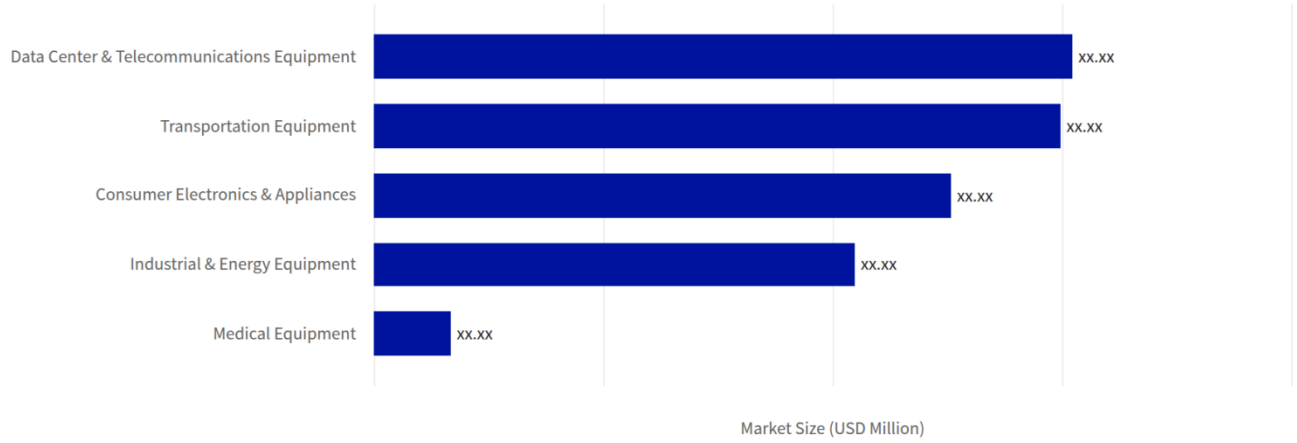


Table 59. Global Thermally Conductive Spherical Alumina Powder Market, by End-Use Industry growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 60. Global Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka identifies battery-related and in-vehicle electronic thermal-material uses, supporting the interpretation of transportation demand pathways.
2. Spherical Alumina | Momentive Technologies
   - Momentive connects its powder offering to automotive, healthcare, and electronic equipment applications.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.

3. Trends in electric cars | Global EV Outlook 2026 | IEA
   - The IEA describes geographically differing electric-car market conditions, including developments in China, Europe, and Brazil.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
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   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
4. Energy demand from AI - Energy and AI | IEA
   - The IEA identifies data-center development in the United States and China and a Southeast Asian hub involving Singapore and southern Malaysia; this is downstream context, not powder demand.
5. North American Industry Classification System: Manufacturing Industry Descriptions | U.S. Census Bureau
   - Taxonomy evidence: The official industry description distinguishes intermediate printed circuit assemblies from finished products and classifies finished products by their final manufacturing activity. The proposed end-use axis adapts that final-equipment distinction; it is not an official powder-market classification.
6. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
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11. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
    - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
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    - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
    - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
12. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
13. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
14. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

15. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.
16. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
17. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
18. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.

12.1. Transportation Equipment

Table 61. Global Thermally Conductive Spherical Alumina Powder Market Size, by Transportation Equipment, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 62. Global Thermally Conductive Spherical Alumina Powder Market Size, by Transportation Equipment, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 63. Global Thermally Conductive Spherical Alumina Powder Market Size, by Transportation Equipment, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: Identified uses include battery heat-dissipation pads for electric and hybrid vehicles and thermal paste for onboard electrical equipment.
   - Taxonomy evidence: Examples include heat-dissipation pads for electric-vehicle batteries and thermal paste for onboard electrical equipment.
2. Spherical Alumina | Momentive Technologies
   - Taxonomy evidence: Automotive and aerospace parts are listed as destinations for the powder-containing thermal plastics.
   - Taxonomy evidence: The thermally conductive plastics applications explicitly include automotive and aerospace parts.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.

3. FY2022 Results Presentation | Denka Company Limited
   - Taxonomy evidence: The dated producer presentation discusses electric-vehicle demand in its spherical-alumina product discussion; it does not give a Global destination split.
   - Taxonomy evidence: In its FY2022 product discussion, Denka separately discusses electric-vehicle demand for spherical alumina. This is a dated producer observation, not a Global share estimate.
4. Spherical Oxide Powders | Momentive Technologies
   - Taxonomy evidence: The supplier names electric vehicles among markets for its spherical-oxide thermal fillers; it discusses spherical alumina and spherical silica together, without attributing market quantities to either.
   - Taxonomy evidence: The company's spherical-oxide powder page identifies its spherical alumina among thermal fillers for interface materials serving electric-vehicle applications.
5. A View From Henkel North America: Chanhassen | Henkel
   - Taxonomy evidence: The formulator identifies electric-vehicle battery modules among destinations for its thermal-management materials.
   - Taxonomy evidence: Its thermal-management examples include electric-vehicle battery modules.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
6. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
7. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
8. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
9. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
10. Denka FY2024 Third-Quarter Results Presentation - Q&A
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

11. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
    - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
    - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
    - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
    - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
12. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
    - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
    - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
13. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

14. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
15. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

16. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

17. International Energy Agency - Global EV Outlook 2026 Executive Summary

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

18. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
19. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
20. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

21. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

22. Denka Company Limited - FY2025 Results Presentation
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

23. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.

12.2. Consumer Electronics & Appliances

Table 64. Global Thermally Conductive Spherical Alumina Powder Market Size, by Consumer Electronics & Appliances, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 65. Global Thermally Conductive Spherical Alumina Powder Market Size, by Consumer Electronics & Appliances, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 66. Global Thermally Conductive Spherical Alumina Powder Market Size, by Consumer Electronics & Appliances, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. FY2022 Results Presentation | Denka Company Limited
   - Taxonomy evidence: The dated spherical-alumina product discussion specifically identifies consumer-electronics demand, including smartphones, personal computers, and home appliances.
   - Taxonomy evidence: The FY2022 spherical-alumina product discussion explicitly identifies consumer-electronics demand, including smartphones, personal computers, and home appliances.
2. Spherical Oxide Powders | Momentive Technologies
   - Taxonomy evidence: Consumer electronics is a named market for the supplier's spherical-oxide thermal fillers, without a separate alumina allocation.
   - Taxonomy evidence: Consumer electronics is an explicitly named market for the company's spherical-oxide thermal fillers.
3. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
4. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
5. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
6. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
7. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
9. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
10. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

11. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
12. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

13. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
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- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
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- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

14. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

15. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
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    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
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    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
16. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
17. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

18. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

19. Spherical Alumina | Momentive Technologies
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.

12.3. Industrial & Energy Equipment

Table 67. Global Thermally Conductive Spherical Alumina Powder Market Size, by Industrial & Energy Equipment, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 68. Global Thermally Conductive Spherical Alumina Powder Market Size, by Industrial & Energy Equipment, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 69. Global Thermally Conductive Spherical Alumina Powder Market Size, by Industrial & Energy Equipment, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Spherical Oxide Powders | Momentive Technologies
   - Taxonomy evidence: Renewable energy is a named destination for the supplier's spherical-oxide thermal fillers; alumina-specific sales are not identified.
   - Taxonomy evidence: Renewable energy is an explicitly named market for the company's spherical-oxide thermal fillers; the page discusses spherical alumina and spherical silica together and does not allocate sales between them.
2. A View From Henkel North America: Chanhassen | Henkel
   - Taxonomy evidence: The formulator identifies factory equipment and power-generation or conversion technologies as destinations; this is downstream corroboration, not evidence of spherical-alumina sales into them.
   - Taxonomy evidence: Its thermal-management examples include industrial factory equipment and power generation and conversion technologies. This corroborates a downstream destination, not powder-specific sales.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.

3. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
4. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
5. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
6. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
7. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
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9. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
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13. WSTS - Full-Year 2025 Global Semiconductor Market Results

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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
16. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
17. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

18. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

12.4. Data Center & Telecommunications Equipment

Table 70. Global Thermally Conductive Spherical Alumina Powder Market Size, by Data Center & Telecommunications Equipment, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 71. Global Thermally Conductive Spherical Alumina Powder Market Size, by Data Center & Telecommunications Equipment, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 72. Global Thermally Conductive Spherical Alumina Powder Market Size, by Data Center & Telecommunications Equipment, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: The product's stated thermal-paste uses include 5G communication base stations.
   - Taxonomy evidence: The listed thermal-paste uses include 5G communication base stations.
2. Spherical Oxide Powders | Momentive Technologies
   - Taxonomy evidence: Artificial-intelligence and telecommunications systems are named markets for the supplier's spherical-oxide thermal fillers; the page does not separate alumina from silica sales.
   - Taxonomy evidence: The stated markets for spherical-oxide thermal fillers include artificial-intelligence and telecommunications systems.
3. A View From Henkel North America: Chanhassen | Henkel
   - Taxonomy evidence: Its stated thermal-management destinations include data-center transceivers and 5G base stations.
   - Taxonomy evidence: Its thermal-management examples separately identify data-center transceivers and 5G base stations.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.

4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
5. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
6. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
7. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
8. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

9. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
10. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
11. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

12. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
13. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

14. WSTS - Full-Year 2025 Global Semiconductor Market Results
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.

15. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

16. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
17. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
18. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

19. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.
20. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.

12.5. Medical Equipment

Table 73. Global Thermally Conductive Spherical Alumina Powder Market Size, by Medical Equipment, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 74. Global Thermally Conductive Spherical Alumina Powder Market Size, by Medical Equipment, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 75. Global Thermally Conductive Spherical Alumina Powder Market Size, by Medical Equipment, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Spherical Alumina | Momentive Technologies
   - Taxonomy evidence: Healthcare equipment is listed as a possible destination for the powder-containing thermal plastics; realized destination-specific sales are not stated.
   - Taxonomy evidence: The thermally conductive plastics applications explicitly include healthcare equipment; this establishes an identified application, not sales volume.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
2. Henkel Opens Electronics Application Center in Bengaluru | Henkel
   - Taxonomy evidence: A thermal-management application center identifies medical electronics as a distinct target sector. This supports the end-use distinction but does not establish spherical-alumina powder purchases.

3. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
4. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
5. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
6. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
7. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
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   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
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9. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
10. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

11. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
12. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

13. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

14. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

15. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
16. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
17. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

18. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

13. Thermally Conductive Spherical Alumina Powder Market, by Sales Channel

Manufacturer-Direct Sales account for more of the captured channel mix in 2025 and gain share toward 2032, while Intermediary-Mediated Sales remain a separate route to materials buyers. Direct engagement can keep a producer close to a formulator's grade decision; an intermediary can provide access to customers outside that relationship. ■■■■■■■ ■■■■■ ■■■■■■■ ■■■ ■■■■■■■■ ■■ ■■■ ■■■■■■■■ ■■■■■■■

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Figure 20. Global Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2025 (%)

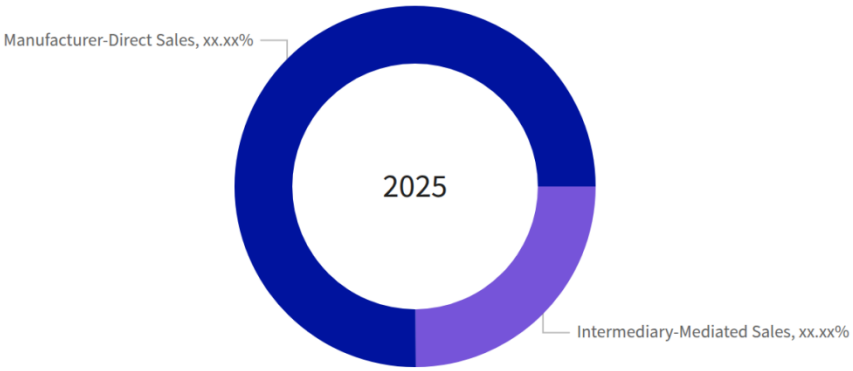


Figure 21. Global Thermally Conductive Spherical Alumina Powder Market, by Sales Channel, 2032 (USD Million)

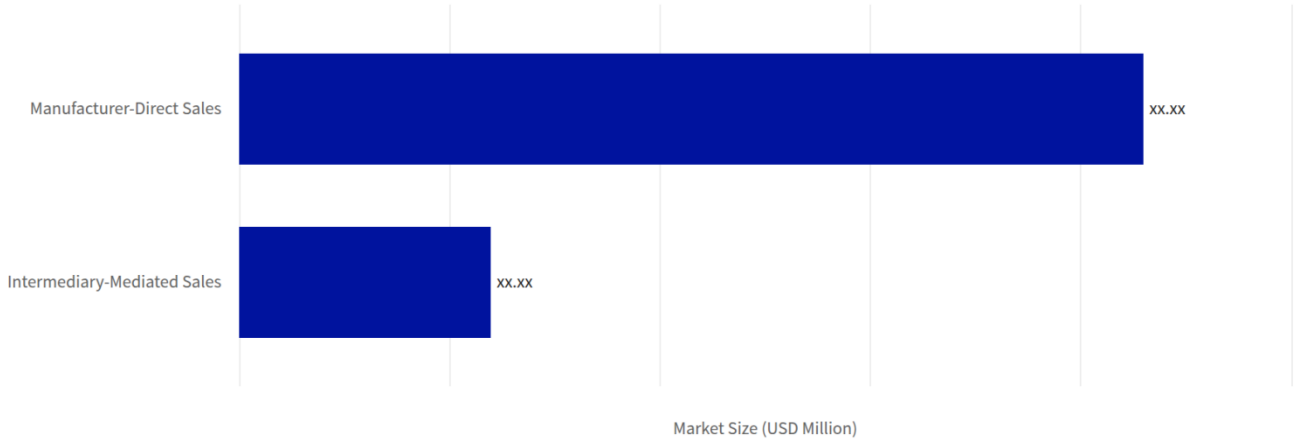


Table 76. Global Thermally Conductive Spherical Alumina Powder Market, by Sales Channel growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 77. Global Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Spherical Alumina | GNPGraystar Specialty Materials
   - GNPGraystar's listing demonstrates an intermediary route for an identified spherical-alumina offering; it does not identify the original manufacturer.
2. Estone Products | Topco Technologies Corporation
   - Topco's listing illustrates access to an identified producer's powder series through an intermediary.

3. Aluminium Oxide | Sibelco
   - Taxonomy evidence: The supplier describes a European distributorship for another manufacturer's spherical-alumina thermal-interface products, establishing an intermediary route distinct from powder manufacture.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
5. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
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   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
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   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
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   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
11. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
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   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

12. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
13. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
14. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

13.1. Manufacturer-Direct Sales

Table 78. Global Thermally Conductive Spherical Alumina Powder Market Size, by Manufacturer-Direct Sales, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 79. Global Thermally Conductive Spherical Alumina Powder Market Size, by Manufacturer-Direct Sales, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 80. Global Thermally Conductive Spherical Alumina Powder Market Size, by Manufacturer-Direct Sales, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Taxonomy evidence: The manufacturer's own product page supplies a company sales contact; it demonstrates a manufacturer-operated route, not a Global channel share.
   - Taxonomy evidence: Denka lists its own spherical-alumina powder for thermally conductive fillers and provides a company product-sales contact.
2. Resonac Thermal Filler Brochure
   - Taxonomy evidence: The manufacturer directs prospective buyers of its thermal-filler products to its sales offices.
   - Taxonomy evidence: Resonac identifies its spherical-alumina filler products and directs prospective customers to its own sales offices, supporting a manufacturer-operated sales route.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
3. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
4. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
5. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
6. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
7. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
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   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
9. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
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10. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

11. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
12. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

13. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
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- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.

14. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

15. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
16. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
17. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

18. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

13.2. Intermediary-Mediated Sales

Table 81. Global Thermally Conductive Spherical Alumina Powder Market Size, by Intermediary-Mediated Sales, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 82. Global Thermally Conductive Spherical Alumina Powder Market Size, by Intermediary-Mediated Sales, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 83. Global Thermally Conductive Spherical Alumina Powder Market Size, by Intermediary-Mediated Sales, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Aluminium Oxide | Sibelco

   · Taxonomy evidence: The stated agreement covers distribution of Momentive spherical alumina for thermal-interface applications in Europe; resale does not constitute additional powder production.

   · Taxonomy evidence: Sibelco states that it markets Momentive spherical-alumina products for thermal-interface applications in Europe under a distributorship agreement, establishing an intermediary route rather than separate powder manufacture.

   · Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

   · Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

2. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
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12. WSTS - Full-Year 2025 Global Semiconductor Market Results

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
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13. International Energy Agency - Global EV Outlook 2026 Executive Summary

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- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

14. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
15. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
16. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

17. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

14. Thermally Conductive Spherical Alumina Powder Market, by Region

[redacted] Its position connects established Asian powder offerings with electronics and thermal-material supply chains. North America gains forecast share, while Europe's share eases; these are changes in global composition, not claims that either region's powder market contracts.

Regional strategies should not treat Asia-Pacific as one customer or regulatory system. China, Japan, South Korea, and Southeast Asian manufacturing locations offer different producer, formulator, and equipment relationships. [redacted]

Figure 22. Global Thermally Conductive Spherical Alumina Powder Market, by Region: Market share evolution, 2025-2032

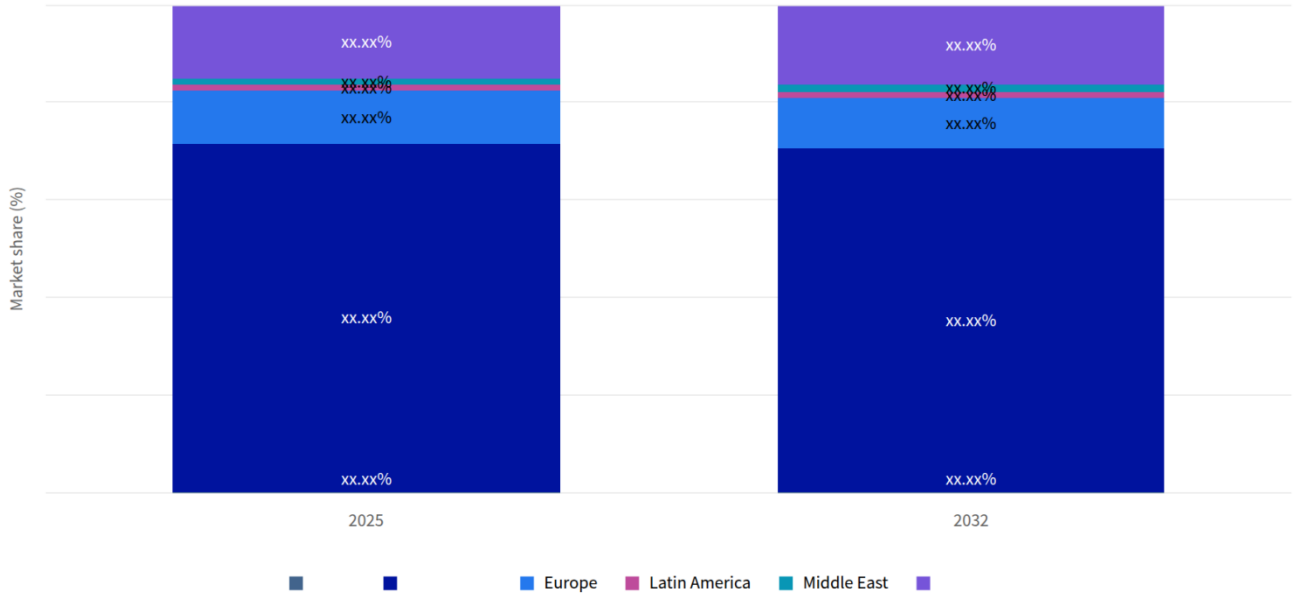


Figure 23. Global Thermally Conductive Spherical Alumina Powder Market, by Region: Market size by category, 2025

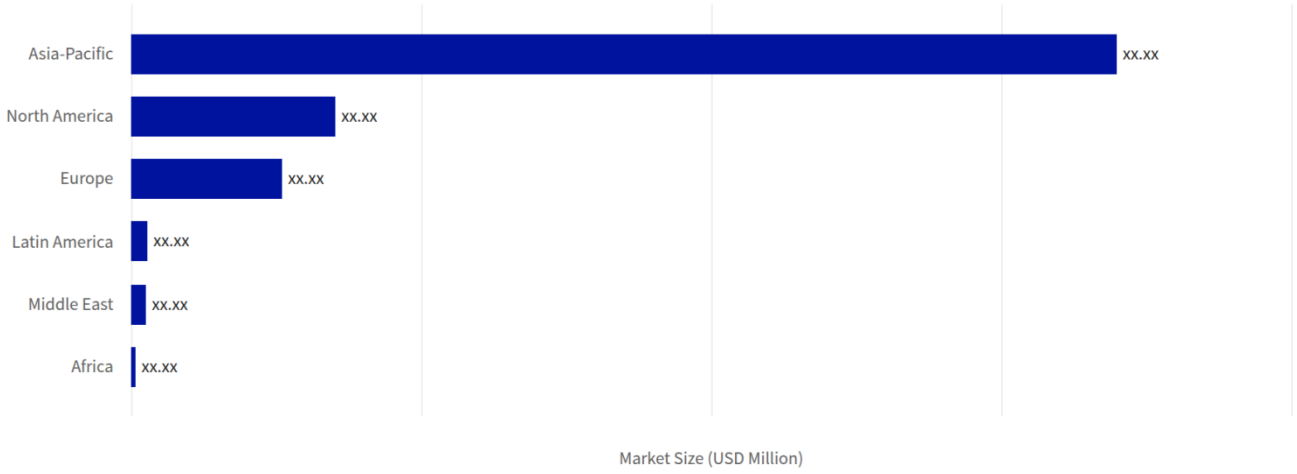


Figure 24. Global Thermally Conductive Spherical Alumina Powder Market, Regional growth by Sales Channel, 2025-2032 (CAGR %)

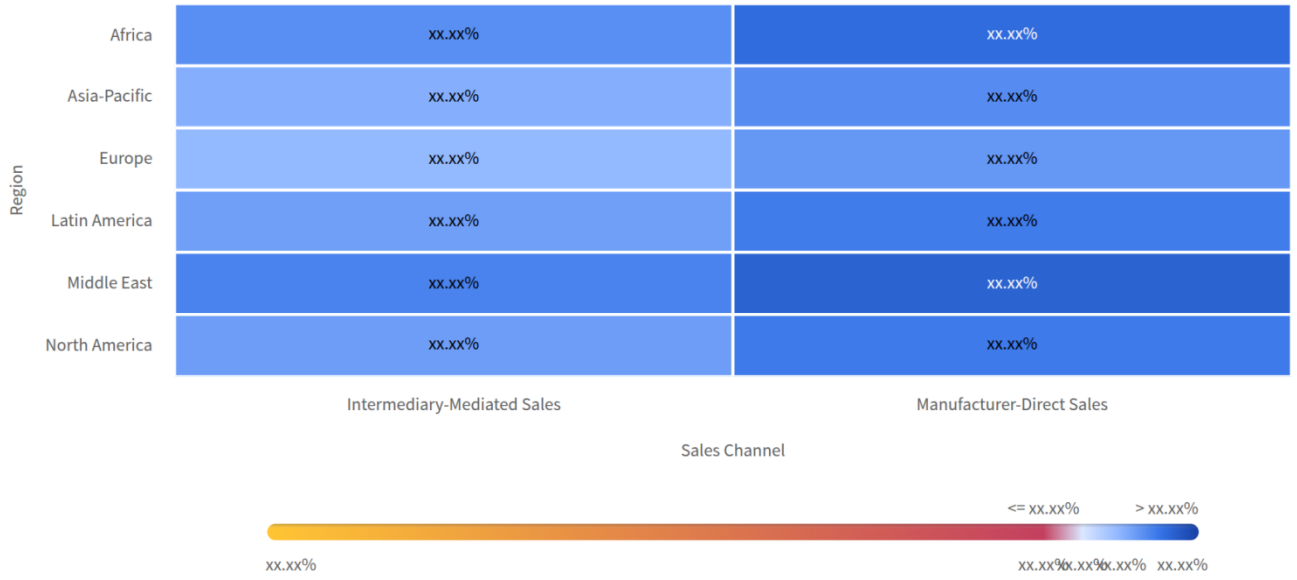


Table 84. Global Thermally Conductive Spherical Alumina Powder Market, by Region growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 85. Global Thermally Conductive Spherical Alumina Powder Market Size, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Asia-Pacific	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Europe	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latin America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Middle East	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North America	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. REACH explained - European Commission
   - EU substance-market responsibilities can make a European supply route different from routes in other regions.

2. Trends in electric cars | Global EV Outlook 2026 | IEA
   - Electric-car conditions differ across major and emerging markets; they are a downstream context rather than direct powder-sales evidence.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
3. Introduction | Bestry
   - Bestry describes a Chinese producer and sales-center relationship relevant to the Asia-Pacific supply-chain interpretation.
4. Momentive Technologies Acquires Spherical Alumina and Spherical Silica Business From Sibelco
   - The completed South Korean business acquisition supplies a concrete example of cross-border Asia-Pacific powder assets.
5. Energy demand from AI - Energy and AI | IEA
   - The IEA describes differing regional data-center development, including the United States, China, Europe, and Southeast Asia.
6. ASEAN Investment Report 2025: FDI as a Key Catalyst for Advancing Regional Supply Chains | ASEAN
   - ASEAN's account of member supply-chain development supports treating Southeast Asian electronics relationships as varied rather than uniform.
7. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
8. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
9. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

10. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
11. Denka FY2024 Third-Quarter Results Presentation - Q&A
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
12. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
    - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
    - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
    - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
    - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
13. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
14. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.

15. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
16. WSTS - Full-Year 2025 Global Semiconductor Market Results
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
17. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.

18. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
19. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.

14.1. Asia-Pacific

Table 86. Asia-Pacific Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Indonesia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Malaysia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Philippines	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Singapore	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Taiwan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thailand	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Unallocated / remaining scope	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 87. Asia-Pacific Thermally Conductive Spherical Alumina Powder Market Size, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Indonesia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Malaysia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Philippines	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Singapore	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Taiwan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thailand	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 88. Asia-Pacific Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 89. Asia-Pacific Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 90. Asia-Pacific Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 91. Asia-Pacific Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 92. Asia-Pacific Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 93. Asia-Pacific Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 94. Asia-Pacific Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. WSTS - Full-Year 2025 Global Semiconductor Market Results
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific and China remained central to semiconductor demand, advanced logic, memory, and data-center supply chains, supporting the region's dominant thermal-filler allocation.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.

12. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Asia-Pacific contains the largest EV market and manufacturing hub, with China producing nearly three-quarters of electric cars in 2025.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
13. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
14. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the Asia-Pacific allocation.

15. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

16. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

17. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
18. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

19. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
20. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
21. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

14.2. North America

Table 95. North America Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 96. North America Thermally Conductive Spherical Alumina Powder Market Size, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 97. North America Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 98. North America Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 99. North America Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 100. North America Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 101. North America Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 102. North America Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 103. North America Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. WSTS - Full-Year 2025 Global Semiconductor Market Results
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The 2025 semiconductor market showed especially strong growth in Asia-Pacific and the Americas, with more moderate European growth; this anchors the electronics-demand component of the regional allocation and its forward momentum.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.

12. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: North American allocation incorporates the large US EV and automotive thermal-management market, tempered by slower 2025 US EV growth.
13. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
14. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: UNIDO national-accounts manufacturing-value-added data provide the common industrial-scale input used to adjust country economic size for material-intensive production.
15. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

16. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

17. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

18. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
19. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

20. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
21. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
22. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

14.3. Europe

Table 104. Europe Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Austria	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Belgium	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Denmark	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Finland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Netherlands	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Norway	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Poland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Portugal	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Sweden	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Switzerland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Unallocated / remaining scope	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 105. Europe Thermally Conductive Spherical Alumina Powder Market Size, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Austria	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Belgium	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Denmark	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Finland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Netherlands	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Norway	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Poland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Portugal	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Sweden	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Switzerland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 106. Europe Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 107. Europe Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 108. Europe Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 109. Europe Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 110. Europe Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 111. Europe Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 112. Europe Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. WSTS - Full-Year 2025 Global Semiconductor Market Results
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor growth was materially slower than the Americas and Asia-Pacific in 2025, constraining the region's modeled global share.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
12. International Energy Agency - Global EV Outlook 2026 Executive Summary
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Europe recorded more than xx.xx% electric-car sales growth in 2025 and remains a major thermal-management demand center.
13. OICA - World Motor Vehicle Production by Country and Region, 2025
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
14. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added provides a cross-country industrial-demand control for the European allocation.

15. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act

- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: European semiconductor investment and production-capacity policy support continued regional thermal-material growth, though not enough to match faster global growth in the modeled forecast.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Austria supports a modest forecast share increase.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

16. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

17. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

18. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
19. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

20. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
21. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
22. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

14.4. Latin America

Table 113. Latin America Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Argentina	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Chile	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Colombia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Peru	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Unallocated / remaining scope	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 114. Latin America Thermally Conductive Spherical Alumina Powder Market Size, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Argentina	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Chile	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Colombia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Peru	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 115. Latin America Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 116. Latin America Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 117. Latin America Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 118. Latin America Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 119. Latin America Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 120. Latin America Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 121. Latin America Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. International Energy Agency - Global EV Outlook 2026 Executive Summary
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Latin American EV sales grew rapidly in 2025, led by Brazil and Mexico, supporting a rising regional forecast share.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
12. OICA - World Motor Vehicle Production by Country and Region, 2025
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.

13. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

14. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

15. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
16. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

17. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
18. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
19. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
20. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

14.5. Middle East

Table 122. Middle East Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Israel	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Qatar	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Saudi Arabia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Turkey	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Unallocated / remaining scope	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Arab Emirates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 123. Middle East Thermally Conductive Spherical Alumina Powder Market Size, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Israel	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Qatar	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Saudi Arabia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Turkey	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Arab Emirates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 124. Middle East Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 125. Middle East Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 126. Middle East Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 127. Middle East Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 128. Middle East Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 129. Middle East Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 130. Middle East Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. International Energy Agency - Global EV Outlook 2026 Executive Summary
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: EV adoption and imports increased across the Middle East, supporting a higher forecast allocation from a small base.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The United Arab Emirates was the Middle East's largest electric-car market, supporting its above-GDP market-intensity adjustment.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The United Arab Emirates was the Middle East's largest electric-car market, supporting its above-GDP market-intensity adjustment.
12. OICA - World Motor Vehicle Production by Country and Region, 2025
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Turkey's substantial 2025 vehicle production supports its large conditional Middle Eastern allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Turkey's substantial 2025 vehicle production supports its large conditional Middle Eastern allocation.

13. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

14. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

15. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
16. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

17. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
18. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
19. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
20. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

14.6. Africa

Table 131. Africa Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Egypt	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Kenya	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Nigeria	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Unallocated / remaining scope	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 132. Africa Thermally Conductive Spherical Alumina Powder Market Size, by Region, 2017-2040 (USD Million)

Region	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Egypt	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Kenya	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Nigeria	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 133. Africa Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 134. Africa Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 135. Africa Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 136. Africa Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 137. Africa Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 138. Africa Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 139. Africa Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. OICA - World Motor Vehicle Production by Country and Region, 2025
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: South Africa was the largest cataloged African vehicle producer, supporting its leading share among the four mandatory African countries.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: South Africa was the largest cataloged African vehicle producer, supporting its leading share among the four mandatory African countries.
12. UNIDO Statistics Portal - National Accounts and Manufacturing Value Added Data
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Manufacturing value added constrains the relative scale assigned to emerging Latin American, Middle Eastern, and African markets.

13. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

14. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

15. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
16. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

17. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
18. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
19. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
20. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

15. Thermally Conductive Spherical Alumina Powder Market, by Group

Geographic groups offer different commercial mechanisms within the global market. ■■■ ■■■■■■■■ ■■■■■ ■■■■■■■■ ■ ■■■■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■■ ■■■■ ■■■■■■■■■■■■■■■■ ■■■■■■■■■■■■■■■■ ■■■■ ■■■ ■■■■■■ ■■ ■■■■■■■■■ ■■■■■■ ■■■■■■■ ■■■■■■■■■■■■■■ ■■■■■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■■ ■■■■■■ ■■■■■■ ■■■■■■■■■ ■■■■■■ ■■ ■■■■■■■■■■■■ ■■■■■■ ■■■■■■ ■■■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■ ■■■ ■■■■■■■ ■■ ■■■ ■■■■ ■■■■■■■■■ ■■■■■■■■■■ ■■■■■■ Neither group initiative guarantees selection of spherical alumina.

The GCC's customs framework is relevant to route design, while BRICS and G7 are better treated as forums spanning substantially different national supply and demand conditions, not as unified powder markets. ■■■■■■ ■■■ ■■■■■■■■■■■ ■■■■■ ■■■ ■■■■■■■■■ ■■■■■■ ■■■■■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■■■■■■■ ■■■■■■■■■■ ■■■■■ ■■■■■■ ■■■■■■■ ■■■■■■■ ■■■ ■■■■ ■■■■■■■■ ■■■■■ ■■■■■■■■ ■■ ■■■■■■■■■■■■■■ Exporters should identify the actual importing jurisdiction, buyer, and qualified grade before using a group affiliation to guide investment.

Figure 25. Global Thermally Conductive Spherical Alumina Powder Market Size, by Group, 2025 vs 2026 vs 2032

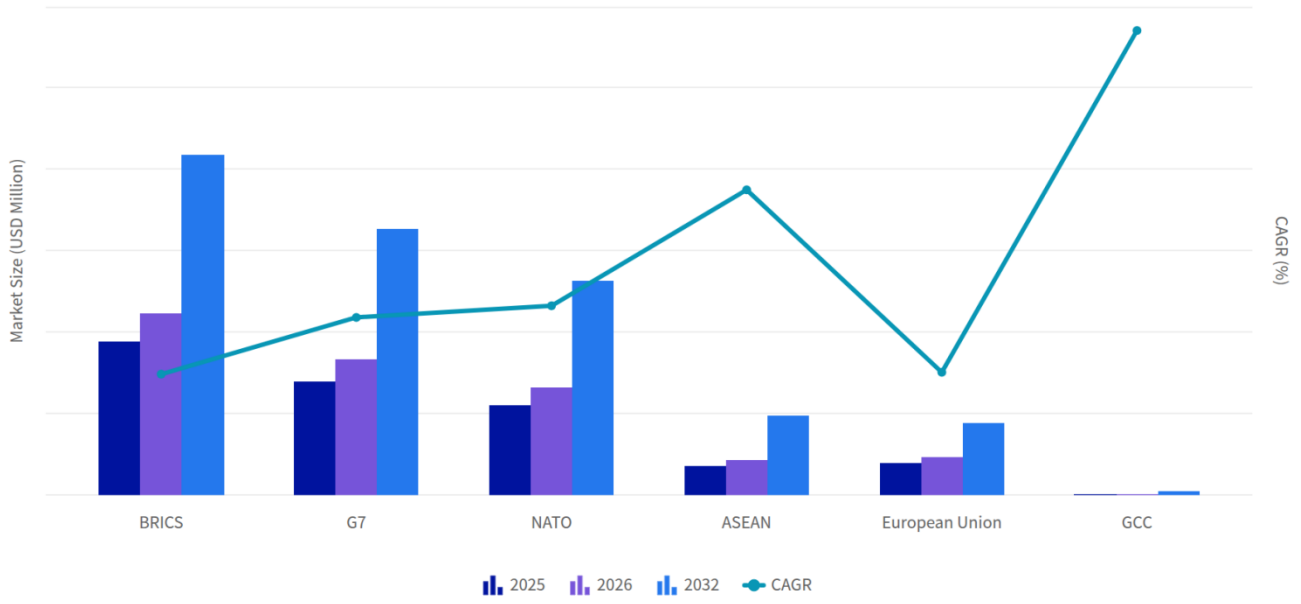


Table 140. Global Thermally Conductive Spherical Alumina Powder Market Size, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
ASEAN	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
BRICS	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
European Union	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
G7	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
GCC	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
NATO	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Sources & Evidence

1. REACH explained - European Commission
   - The European Commission describes REACH responsibilities for manufacturers and importers of substances, subject to applicable conditions and exemptions.
2. ASEAN Investment Report 2025: FDI as a Key Catalyst for Advancing Regional Supply Chains | ASEAN
   - ASEAN describes interconnected semiconductor and automotive supply chains and differing infrastructure, logistics, and skills challenges among members.
3. European Chips Act | European Commission
   - The European Chips Act establishes an EU framework supporting semiconductor manufacturing and advanced packaging; this is an equipment-industry pathway, not a powder order.
4. The Economic Agreement Between the GCC States | GCC Secretariat
   - The GCC economic agreement provides a common customs framework for trade among its member states; it does not establish common powder specifications or customers.
5. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
6. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
7. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

8. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
9. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
10. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
    - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
    - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
    - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
    - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
11. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
    - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
    - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

12. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
13. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
14. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

15.1. BRICS

Table 141. BRICS Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 142. BRICS Thermally Conductive Spherical Alumina Powder Market Size, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Africa	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 143. BRICS Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 144. BRICS Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 145. BRICS Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 146. BRICS Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 147. BRICS Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 148. BRICS Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 149. BRICS Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. WSTS - Full-Year 2025 Global Semiconductor Market Results
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.

12. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
13. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: South Africa was the largest cataloged African vehicle producer, supporting its leading share among the four mandatory African countries.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: South Africa was the largest cataloged African vehicle producer, supporting its leading share among the four mandatory African countries.

14. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

15. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

16. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
17. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

18. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
19. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
20. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

15.2. G7

Table 150. G7 Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 151. G7 Thermally Conductive Spherical Alumina Powder Market Size, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 152. G7 Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 153. G7 Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 154. G7 Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 155. G7 Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 156. G7 Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 157. G7 Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 158. G7 Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. WSTS - Full-Year 2025 Global Semiconductor Market Results
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
12. OICA - World Motor Vehicle Production by Country and Region, 2025
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
13. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

14. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

15. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

16. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

17. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
18. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

19. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
20. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
21. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

15.3. NATO

Table 159. NATO Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Albania	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Belgium	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Bulgaria	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Croatia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 159 - continued

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Czech Republic	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Denmark	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Estonia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Finland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Greece	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Hungary	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Iceland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latvia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Lithuania	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Luxembourg	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Montenegro	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Netherlands	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North Macedonia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Norway	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Poland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Portugal	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Romania	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Slovakia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Slovenia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Sweden	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Turkey	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 160. NATO Thermally Conductive Spherical Alumina Powder Market Size, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Albania	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Belgium	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Bulgaria	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Croatia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Czech Republic	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Denmark	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Estonia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Finland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Greece	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Hungary	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Iceland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latvia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 160 - continued

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Lithuania	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Luxembourg	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Montenegro	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Netherlands	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
North Macedonia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Norway	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Poland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Portugal	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Romania	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Slovakia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Slovenia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Sweden	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Turkey	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 161. NATO Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 162. NATO Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 163. NATO Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 164. NATO Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 165. NATO Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 166. NATO Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 166 - continued

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 167. NATO Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. WSTS - Full-Year 2025 Global Semiconductor Market Results
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
12. OICA - World Motor Vehicle Production by Country and Region, 2025
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Czech vehicle output was large relative to economic size, supporting an above-GDP market-intensity adjustment.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Czech vehicle output was large relative to economic size, supporting an above-GDP market-intensity adjustment.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Turkey's substantial 2025 vehicle production supports its large conditional Middle Eastern allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Turkey's substantial 2025 vehicle production supports its large conditional Middle Eastern allocation.
13. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

14. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

15. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

16. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

17. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
18. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

19. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
20. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
21. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

15.4. European Union

Table 168. European Union Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Austria	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Belgium	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Bulgaria	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Croatia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Cyprus	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Czech Republic	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Denmark	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Estonia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Finland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Greece	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Hungary	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Ireland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latvia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Lithuania	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Luxembourg	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Malta	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Netherlands	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Poland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Portugal	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Romania	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Slovakia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Slovenia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Sweden	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 169. European Union Thermally Conductive Spherical Alumina Powder Market Size, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Austria	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Belgium	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Bulgaria	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Croatia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Cyprus	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Czech Republic	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Denmark	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Estonia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Finland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Greece	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Hungary	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Ireland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Latvia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Lithuania	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Luxembourg	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Malta	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Netherlands	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Poland	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Portugal	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Romania	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Slovakia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Slovenia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Sweden	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 170. European Union Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 171. European Union Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 172. European Union Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 173. European Union Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 174. European Union Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 175. European Union Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 176. European Union Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. OICA - World Motor Vehicle Production by Country and Region, 2025
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Czech vehicle output was large relative to economic size, supporting an above-GDP market-intensity adjustment.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Czech vehicle output was large relative to economic size, supporting an above-GDP market-intensity adjustment.
12. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Austria supports a modest forecast share increase.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

13. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

14. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

15. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
16. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

17. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
18. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
19. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
20. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

15.5. ASEAN

Table 177. ASEAN Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Brunei	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Cambodia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Indonesia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Lao People's Democratic Republic	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Malaysia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Myanmar	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Philippines	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Singapore	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thailand	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Vietnam	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 178. ASEAN Thermally Conductive Spherical Alumina Powder Market Size, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Brunei	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Cambodia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Indonesia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Lao People's Democratic Republic	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Malaysia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Myanmar	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Philippines	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Singapore	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thailand	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Vietnam	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 179. ASEAN Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 180. ASEAN Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 181. ASEAN Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 182. ASEAN Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 183. ASEAN Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 184. ASEAN Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 185. ASEAN Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Viet Nam led Southeast Asian EV demand expansion, supporting a material increase in its forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Viet Nam led Southeast Asian EV demand expansion, supporting a material increase in its forecast share.

12. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

13. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

14. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
15. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

16. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
17. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
18. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
19. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

15.6. GCC

Table 186. GCC Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Bahrain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Kuwait	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Oman	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Qatar	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Saudi Arabia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Arab Emirates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 187. GCC Thermally Conductive Spherical Alumina Powder Market Size, by Group, 2017-2040 (USD Million)

Group	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Bahrain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Kuwait	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Oman	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Qatar	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Saudi Arabia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Arab Emirates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 188. GCC Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 189. GCC Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 190. GCC Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 191. GCC Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 192. GCC Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 193. GCC Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 194. GCC Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The United Arab Emirates was the Middle East's largest electric-car market, supporting its above-GDP market-intensity adjustment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The United Arab Emirates was the Middle East's largest electric-car market, supporting its above-GDP market-intensity adjustment.

12. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

13. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

14. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

16. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
17. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
18. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
19. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16. Thermally Conductive Spherical Alumina Powder Market, by Country

Country comparisons reveal decisions that regional shares conceal. ■■■■■ ■■■■■■■■■■ ■■■■ ■■■■■■■■ ■■■■■■■■ ■■■■■■■■ ■■ ■■■■■■■■■■■■ ■■ ■■■■■ ■■■■■ ■■■■■ ■■■■■■■■ ■■ ■■■■■■■■■■■■ ■■■■■■■■■■■■■■■■■■ ■■■■■■■■ ■■■■■ ■■■■■ ■■■■■■■■■■■■■■■■■■■■ ■■■■■■■■■■■■■■ ■■■■■■■■■■■ ■■■■■■■■■■■■■ ■■■■■■■■■■■■■ ■■■■■ ■■■■ ■■■■ ■■■■■ ■■■■■ ■■■■■■■■■■■■ ■■■■■■■■■■■■ ■■■■ ■■■■■■■ ■ ■■■■■■■■■■■ ■■■■■■■■■■■■■■■■ ■■■■■ ■■ ■■■■■■■■ These country positions are components of the global analysis, not separate definitions of the market.

Outside Asia-Pacific, U.S. data-center development, European semiconductor investment, and differing electric-vehicle conditions in Brazil illustrate why powder opportunities need country-specific qualification and routes to supply. A country's captured share uses its parent region as the denominator, so it must not be compared directly with a regional share. ■■■■■■■■■■ ■■■■■■■ ■■■■ ■■■■ ■■■■■■■■■■■■ ■■■■■■■■■ ■■■■■■■ ■■■■■■■■ ■■■■ ■■■■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■■■■■■■■ ■■ ■■■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■ ■■■■■■■■ ■■■■■■■ ■■■■■■■■■■■■ ■■■■■■■ ■■■■■■■■■■ ■■■■■■ ■■■■■■■■■■■■■■■

Figure 26. Global Thermally Conductive Spherical Alumina Powder Market Size, by Country, 2025 vs 2032 (%)

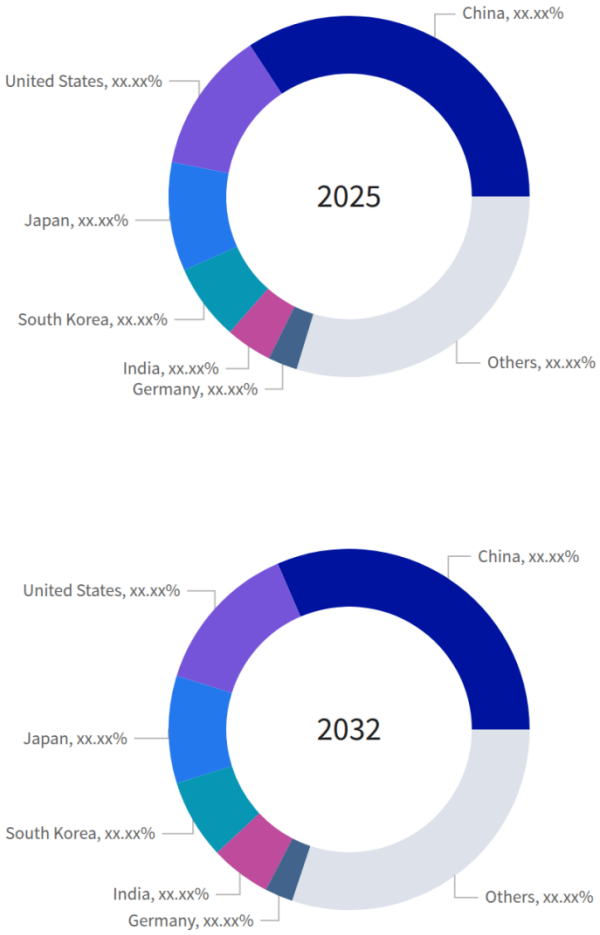


Figure 27. Global Thermally Conductive Spherical Alumina Powder Market Size, by Country, 2025 vs 2026 vs 2032

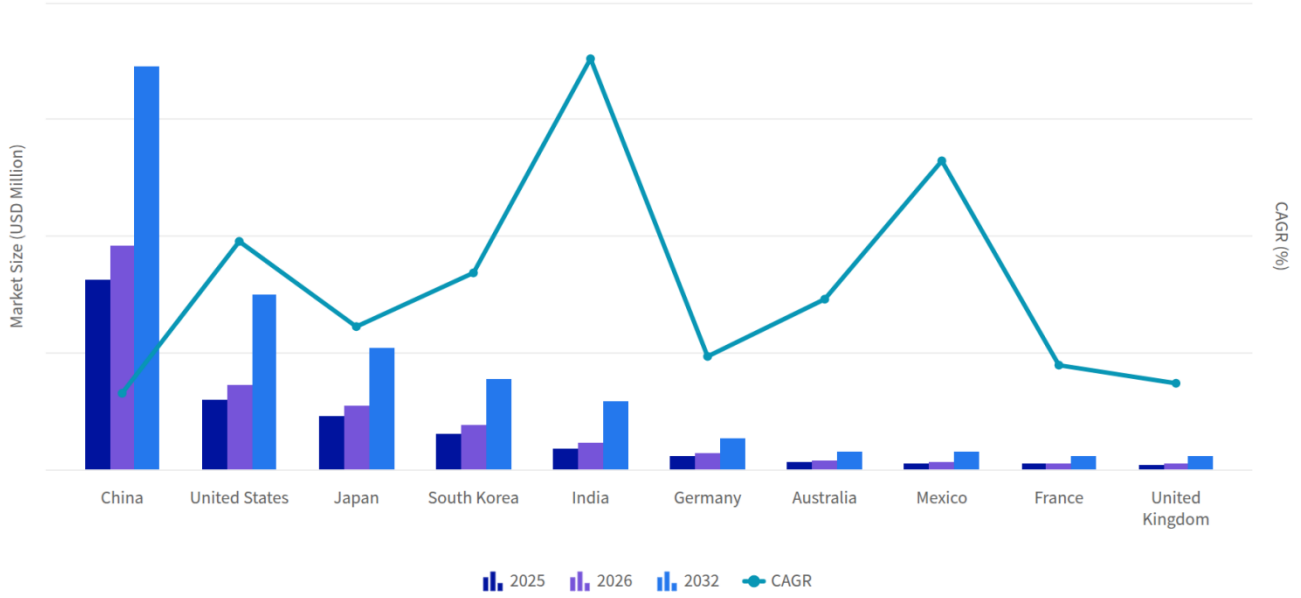


Table 195. Global Thermally Conductive Spherical Alumina Powder Market, by Country growth contribution, 2025-2032

Category	2025 value (USD Million)	2032 value (USD Million)	Added value (USD Million)	2025 share (%)	2032 share (%)	Change (pp)	Growth share (%)	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Unallocated / remaining scope	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Scope total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 196. Global Thermally Conductive Spherical Alumina Powder Market Size, by Country, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Brazil	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Canada	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
China	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
France	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Germany	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
India	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Italy	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Mexico	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Russia	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
South Korea	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Spain	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United Kingdom	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Others	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. REACH explained - European Commission
   - Country-level route planning within the EU must account for applicable importer and manufacturer responsibilities.
2. Trends in electric cars | Global EV Outlook 2026 | IEA
   - The IEA documents country differences in electric-car markets, including Brazil and China.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
3. PRODUCTS | Product List / Alumina | Admatechs
   - Admatechs identifies a Japanese spherical-alumina offering for thermal compounds.

4. Silica/Alumina Spherical Particle | NIPPON STEEL Chemical & Material
   · The company's Japanese high-performance fillers business provides a producer example for country-level interpretation.
5. Energy demand from AI - Energy and AI | IEA
   · The IEA identifies Singapore and southern Malaysia as a Southeast Asian data-center hub and separately discusses U.S., Chinese, and Japanese developments.
6. European Chips Act | European Commission
   · The EU semiconductor framework supports assessing European electronic-material opportunities by customer program.
7. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   · Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   · Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   · Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   · Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
8. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   · Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   · Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
9. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   · Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
10. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
    · Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
11. Denka FY2024 Third-Quarter Results Presentation - Q&A
    · Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

12. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
    - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
    - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
    - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
    - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
13. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
    - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
    - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
14. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
    - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
    - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
15. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

16. WSTS - Full-Year 2025 Global Semiconductor Market Results
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
17. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.

18. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
19. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
20. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

16.1. China

Table 197. China Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
China	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 198. China Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 199. China Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 200. China Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 201. China Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 202. China Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 203. China Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 204. China Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. WSTS - Full-Year 2025 Global Semiconductor Market Results
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China's semiconductor market growth and advanced-computing demand support its dominant Asia-Pacific allocation, while diversification assumptions moderate its forecast share.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
12. International Energy Agency - Global EV Outlook 2026 Executive Summary
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China sold more than xx.xx electric cars in 2025 and remained the largest EV market, supporting its high thermal-material demand weight.
13. OICA - World Motor Vehicle Production by Country and Region, 2025
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: China, Japan, India, Korea, Thailand, Malaysia, and Indonesia account for major shares of Asia-Oceania vehicle output and anchor the automotive portion of country weights.

14. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

15. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

16. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
17. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

18. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
19. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
20. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.2. United States

Table 205. United States Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
United States	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 206. United States Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 207. United States Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 208. United States Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 209. United States Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 210. United States Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 211. United States Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 212. United States Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
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2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
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   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. WSTS - Full-Year 2025 Global Semiconductor Market Results
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong Americas semiconductor growth supports the United States' dominant North American allocation and continued AI-infrastructure demand.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
12. U.S. Bureau of Economic Analysis - GDP by State with Industry Detail
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: State GDP with industry detail supplies the economic and industry-scale control for the United States state allocation.

13. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

14. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

15. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
16. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

17. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
18. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
19. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.3. Japan

Table 213. Japan Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Japan	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

Table 214. Japan Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 215. Japan Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 216. Japan Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 217. Japan Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 218. Japan Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 219. Japan Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 220. Japan Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. WSTS - Full-Year 2025 Global Semiconductor Market Results
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Japan remained a major semiconductor region despite a 2025 cyclical decline, supporting a large specialty-material demand share.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.

12. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

13. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

14. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
15. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

16. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
17. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
18. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.4. South Korea

Table 221. South Korea Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
South Korea	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 222. South Korea Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 223. South Korea Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 224. South Korea Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 225. South Korea Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 226. South Korea Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 227. South Korea Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 228. South Korea Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.
4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.

6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.
8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.

9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

11. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
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- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
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- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
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- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
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- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
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    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
14. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

15. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
16. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
17. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
18. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.5. India

Table 229. India Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
India	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 230. India Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 231. India Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 232. India Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 233. India Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 234. India Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 235. India Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 236. India Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: India and Southeast Asian markets are modeled to gain share as electrification broadens beyond China, Europe, and the United States.

12. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

13. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

14. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
15. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

16. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
17. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
18. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
19. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.6. Germany

Table 237. Germany Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Germany	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 238. Germany Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 239. Germany Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 240. Germany Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 241. Germany Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 242. Germany Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 243. Germany Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 244. Germany Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Germany remained Europe's largest vehicle producer, supporting its elevated thermal-management demand intensity.
12. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production and foundry projects in Germany support a modest increase in its conditional European share.

13. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

14. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

15. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
16. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

17. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
18. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
19. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
20. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.7. Australia

Table 245. Australia Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Australia	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 246. Australia Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 247. Australia Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 248. Australia Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 249. Australia Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 250. Australia Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 251. Australia Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 252. Australia Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

11. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

12. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

13. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
14. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

15. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
16. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
17. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
18. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.8. France

Table 253. France Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
France	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 254. France Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 255. France Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 256. France Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 257. France Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 258. France Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 259. France Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 260. France Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

11. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

12. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

13. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
14. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

15. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
16. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
17. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
18. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.9. Mexico

Table 261. Mexico Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Mexico	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 262. Mexico Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 263. Mexico Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 264. Mexico Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 265. Mexico Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 266. Mexico Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 267. Mexico Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 268. Mexico Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: 2025 vehicle-production data for Canada, Mexico, and the United States support the automotive component of their North American demand weights.

12. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

13. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

14. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
15. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

16. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
17. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
18. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
19. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.10. United Kingdom

Table 269. United Kingdom Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
United Kingdom	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 270. United Kingdom Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 271. United Kingdom Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 272. United Kingdom Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 273. United Kingdom Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 274. United Kingdom Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 275. United Kingdom Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 276. United Kingdom Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

11. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
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    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
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    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

12. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
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13. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
14. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

15. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
16. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
17. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
18. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.11. Italy

Table 277. Italy Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Italy	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 278. Italy Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 279. Italy Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 280. Italy Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 281. Italy Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 282. Italy Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 283. Italy Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 284. Italy Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. European Commission - Decisions Strengthening Semiconductor Manufacturing Capacity under the Chips Act
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Integrated production investment in Italy partly offsets slower automotive output in its forecast allocation.

12. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

13. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

14. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

16. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
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    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
17. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
18. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
19. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.12. Canada

Table 285. Canada Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Canada	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 286. Canada Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 287. Canada Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 288. Canada Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 289. Canada Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 290. Canada Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 291. Canada Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 292. Canada Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

11. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

12. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

13. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
14. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

15. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
16. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
17. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
18. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.13. Russia

Table 293. Russia Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Russia	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 294. Russia Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 295. Russia Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 296. Russia Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 297. Russia Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 298. Russia Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 299. Russia Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 300. Russia Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

11. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

12. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

13. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
14. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

15. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
16. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
17. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
18. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.14. Brazil

Table 301. Brazil Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Brazil	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 302. Brazil Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 303. Brazil Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 304. Brazil Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 305. Brazil Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 306. Brazil Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 307. Brazil Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 308. Brazil Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.
11. International Energy Agency - Global EV Outlook 2026 Executive Summary
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil led rapid Latin American EV growth, supporting its dominant conditional regional share.
12. OICA - World Motor Vehicle Production by Country and Region, 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Brazil produced substantially more vehicles than other cataloged South American countries, supporting its dominant Latin American allocation.

13. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

14. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

15. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
16. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

17. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
18. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
19. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
20. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

16.15. Spain

Table 309. Spain Thermally Conductive Spherical Alumina Powder Market Size, 2017-2040 (USD Million)

Country	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Spain	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 310. Spain Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size, 2017-2040 (USD Million)

Particle Size	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Coarse Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Fine Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medium Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Submicron Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 311. Spain Thermally Conductive Spherical Alumina Powder Market Size, by Particle Size Distribution, 2017-2040 (USD Million)

Particle Size Distribution	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Individual Size Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Multimodal Blend Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 312. Spain Thermally Conductive Spherical Alumina Powder Market Size, by Surface Treatment, 2017-2040 (USD Million)

Surface Treatment	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Standard Surface Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Surface-Treated Powder	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 313. Spain Thermally Conductive Spherical Alumina Powder Market Size, by Ionic Purity Grade, 2017-2040 (USD Million)

Ionic Purity Grade	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Low-Ionic-Impurity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Standard Ionic-Purity Grades	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 314. Spain Thermally Conductive Spherical Alumina Powder Market Size, by Application, 2017-2040 (USD Million)

Application	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Encapsulation & Potting Compounds	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Coatings	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Heat-Dissipating Substrates	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermal Interface Materials	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Thermally Conductive Plastics	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 315. Spain Thermally Conductive Spherical Alumina Powder Market Size, by End-Use Industry, 2017-2040 (USD Million)

End-Use Industry	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Consumer Electronics & Appliances	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Data Center & Telecommunications Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Industrial & Energy Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Medical Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Transportation Equipment	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Table 316. Spain Thermally Conductive Spherical Alumina Powder Market Size, by Sales Channel, 2017-2040 (USD Million)

Sales Channel	2017	2024	2025	2026	2027	2032	2040	CAGR (%)
Intermediary-Mediated Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Manufacturer-Direct Sales	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx
Total	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**	**xx.xx**

Sources & Evidence

1. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The filing reports spherical-alumina revenue of CNY xx.xx in 2022, CNY xx.xx in 2023, CNY xx.xx in 2024, and CNY xx.xx for the first half of 2025; these are direct supplier-sales anchors for the modeled global series.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2023, supporting the modeled volume-and-price bridge.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The filing reports xx.xx tonnes sold at CNY xx.xx per tonne in 2024, directly anchoring one major Chinese producer's revenue and realized price.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: First-half 2025 sales of xx.xx tonnes and revenue of CNY xx.xx support an annualized 2025 supplier-sales estimate, while the lower realized price constrains market-value growth relative to volume growth.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing describes commercial mixing of different particle sizes to achieve high filling, supporting multimodal-grade value and future adoption assumptions.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies surface-modification capability for compatibility, filling, conductivity, and reliability requirements, supporting the treated-powder forecast.
   - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
   - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The filing identifies thermal-material and semiconductor-packaging uses as the principal spherical-alumina demand areas.
2. Denka FY2018 Second-Quarter Summary - Automotive Growth Strategy
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Denka's disclosed spherical-alumina sales plan of JPY xx.xx for fiscal 2020 provides an early-period revenue-scale constraint for the leading supplier.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The JPY xx.xx fiscal-2025 sales plan provides a supplier-level planning reference rather than an observed 2025 result.
3. Denka - Full-scale Operation of New Production Line of Spherical Alumina in Singapore
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Denka reported that its Singapore line expanded spherical-alumina capacity to about five times fiscal-2018 capacity and described an approximately xx.xx% global share at the 2022 expansion point; this constrains the historical supplier concentration and volume model.

4. Denka FY2024 First-Quarter Financial Results Presentation - Q&A
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Denka reported stronger-than-expected spherical-alumina sales in 2024, with robust advanced-semiconductor packaging demand offsetting weaker European xEV demand; this supports the modeled 2024 recovery.
5. Denka FY2024 Third-Quarter Results Presentation - Q&A
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Denka stated that advanced applications, including generative-AI-related demand, represented about one-fifth of combined spherical-silica and spherical-alumina revenue and were growing, while non-AI semiconductor and EV demand remained subdued; this supports a balanced 2025 growth assumption.
6. World Semiconductor Trade Statistics - Global Semiconductor Market Q2 2025 Update
   - Evidence informing the 2017 market-value input; displayed series and growth include calculations: Worldwide semiconductor revenue grew xx.xx% in 2017, supporting strong electronics thermal-management demand in the historical bridge.
   - Evidence informing the 2019 market-value input; displayed series and growth include calculations: The semiconductor cycle contracted in 2019, moderating the powder-market growth assumption despite continuing thermal-management adoption.
   - Evidence informing the 2020 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2020, supporting electronics resilience during the pandemic-related automotive disruption.
   - Evidence informing the 2021 market-value input; displayed series and growth include calculations: Worldwide semiconductor sales grew xx.xx% in 2021, supporting the modeled post-pandemic acceleration.
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: The semiconductor market grew modestly in 2022 before contracting in 2023, supporting a deceleration rather than a decline in the powder market because EV thermal demand continued expanding.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The 2023 semiconductor downturn supports restrained growth for that year despite continuing EV and localization gains.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The semiconductor market rebounded strongly in 2024, supporting renewed thermal-filler demand in packaging and high-performance electronics.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Strong logic and memory growth associated with AI and data-center infrastructure supports continued 2025 demand expansion.
7. International Energy Agency - Global EV Outlook 2026: Trends in Electric Cars
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2024, rising more than xx.xx%, supporting rapidly expanding automotive thermal-management demand.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: Electric-car sales exceeded xx.xx in 2025 and grew about xx.xx%, providing a current demand anchor for battery-pack, power-electronics, and onboard-electronics thermal materials.
   - Evidence informing the 2030 market-value input; displayed series and growth include calculations: Continued electrification under stated policies supports sustained market growth through 2030, although powder demand is modeled below EV-unit growth because of formulation efficiency and competing fillers.
   - Evidence informing the 2035 market-value input; displayed series and growth include calculations: Long-term electric-vehicle penetration supports demand through 2035, with growth moderated for substitution, loading optimization, and market maturation.

8. World Semiconductor Trade Statistics - Global Semiconductor Market Records Exceptional Growth in Q2 2026
   - Evidence informing the 2026 market-value input; displayed series and growth include calculations: Exceptional 2026 semiconductor expansion driven by AI infrastructure, high-performance computing, and advanced memory supports elevated demand for high-performance thermal fillers; the powder-market estimate is capped by qualification and production-capacity constraints.
   - Evidence informing the 2027 market-value input; displayed series and growth include calculations: Continued above-trend semiconductor growth expected for 2027 supports another strong powder-market year before the modeled growth rate begins to normalize.
9. Federal Reserve - Chinese Yuan Renminbi to U.S. Dollar Annual Spot Exchange Rate
   - Evidence informing the 2022 market-value input; displayed series and growth include calculations: Federal Reserve annual exchange rates provide the 2022-2025 CNY-per-USD conversions applied to the disclosed Chinese supplier revenue anchors.
   - Evidence informing the 2023 market-value input; displayed series and growth include calculations: The annual CNY-per-USD rate supports consistent conversion of the 2023 supplier observation.
   - Evidence informing the 2024 market-value input; displayed series and growth include calculations: The 2024 annual average of CNY xx.xx per USD supports conversion of the disclosed 2024 supplier revenue.
   - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of CNY xx.xx per USD supports conversion and annualization of the first-half 2025 supplier result.
10. Federal Reserve - Japanese Yen to U.S. Dollar Annual Spot Exchange Rate
    - Evidence informing the 2025 market-value input; displayed series and growth include calculations: The 2025 annual average of JPY xx.xx per USD supports conversion of Denka's yen-denominated fiscal-2025 planning reference into a USD supplier-scale constraint.

11. DENKA SPHERICAL ALUMINA | Denka Company Limited

- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer publishes spherical-alumina grades spanning submicron through approximately xx.xx micrometers; this anchors the complete size spectrum and relative specialty positioning used in the value-weight model.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Published standard and low-sodium grade tables include fine-powder D50 values and support the modeled migration toward finer grades.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The grade tables include a broad range of medium-powder products used as the central volume-weight category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Multiple grades have D50 values above xx.xx micrometers, supporting a substantial but declining coarse-powder allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer states that various surface treatments are possible, supporting separate standard and treated commercial categories and forecast treatment adoption.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The availability of supplier-applied surface treatments supports a distinct value-bearing treated-powder category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer separately publishes standard-type grades, supporting the standard ionic-purity category.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A separate low-sodium product family supports the low-ionic-impurity category and its modeled premium.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer identifies thermal-interface pads, sheets, and pastes as major uses.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Epoxy molding compounds for semiconductor packages are expressly identified, supporting the encapsulation allocation.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal plastics are listed as a commercial filler use.
- Evidence informing base-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.
- Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Heat-dissipating paint is identified as a commercial use, supporting a small coatings allocation.

12. Resonac Thermal Filler Brochure
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer's spherical-alumina grade table spans D50 values from approximately xx.xx to xx.xx micrometers and documents both sharp and broad distributions, supporting the size and individual-grade mix assumptions.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The brochure identifies supplier-sold blends of different particle sizes and states that bimodal grades improve filling, supporting multimodal blend adoption.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer states that its portfolio includes surface-treated material, supporting the treated-powder category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The manufacturer directs customers to its own sales offices, supporting a substantial manufacturer-direct route.

13. Spherical Alumina | Momentive Technologies
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes distinct regular-soda spherical-alumina grades, supporting the standard ionic-purity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The supplier publishes a separate low-soda family, supporting a value-bearing low-ionic-impurity category.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermal interface materials, including pads, tapes, and epoxies, are identified as powder applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Thermally conductive plastics are identified as an established application.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Printed-circuit-board and other base materials are identified as heat-dissipation applications.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Automotive and aerospace parts are named destinations for powder-filled thermal plastics, supporting transportation demand.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electrical and electronic hardware applications support the consumer-electronics allocation.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Healthcare equipment is expressly identified as an application destination, supporting a small medical-equipment allocation.
14. Denka Company Limited - FY2025 Results Presentation
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports strong AI-related demand for spherical alumina in thermal-conductive molding compounds, supporting above-market encapsulation growth through the forecast.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The producer reports gradual recovery in thermal-interface demand, supporting continued growth but a modest forecast share decline relative to faster packaging uses.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: High-speed-memory and multilayer-package adoption supports increased heat-dissipating substrate and packaging demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: AI-related spherical-alumina sales growth supports the forecast increase for data-center equipment.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The presentation distinguishes sluggish European xEV demand from stronger AI applications, supporting transportation growth below the total market rate.

15. World Semiconductor Trade Statistics - Global Semiconductor Market Grows 26% in 2025
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Global semiconductor sales grew xx.xx% in 2025, with computer applications increasing by more than xx.xx% because of data-center and AI investment; this is a demand-growth input rather than a direct powder share.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Strong logic and high-bandwidth-memory demand supports the modeled shift toward advanced semiconductor encapsulation.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Advanced computing growth supports the forecast increase in heat-dissipating substrate demand.
16. International Energy Agency - Global EV Outlook 2026: Outlook for Electric Mobility
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The IEA reports more than xx.xx electric-car sales in 2025 and projects continued large-scale fleet expansion through 2035, supporting sustained transportation thermal-management demand.
17. A View From Henkel North America: Chanhassen
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: A major downstream formulator defines the thermal-interface function and identifies production of interface materials, supporting the application's leading position.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Electric-vehicle battery modules are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Data-center transceivers and 5G base stations are identified as thermal-management destinations.
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: Industrial factory equipment and power-generation and conversion technologies are identified as thermal-management destinations.
18. Aluminium Oxide | Sibelco
    - Evidence informing base-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.
    - Evidence informing forecast-year allocation inputs; displayed values and growth are calculated: The company states that it distributes another manufacturer's spherical alumina for European thermal-interface applications, establishing an intermediary route without adding producer output.

17. Competitive Landscape

17.1. Market Share Analysis, 2025

[redacted] These are captured company positions, not shares of finished thermal materials or country markets. They identify suppliers warranting close attention in global competitive comparisons.

The known named-company share total is xx.xx%; the unallocated xx.xx% can include further named-company business as well as unnamed firms. [redacted] Nor does a product listing or an intermediary relationship establish an additional share of original powder supply.

For buyers, the leading positions justify examining supplier dependency, but a global share does not establish which alternative grade is qualified for a particular formulation. Producers should compare their application access and continuing customer acceptance with those of the identified leaders. [redacted]

Figure 28. Global Thermally Conductive Spherical Alumina Powder Market Share, by Key Player, 2025

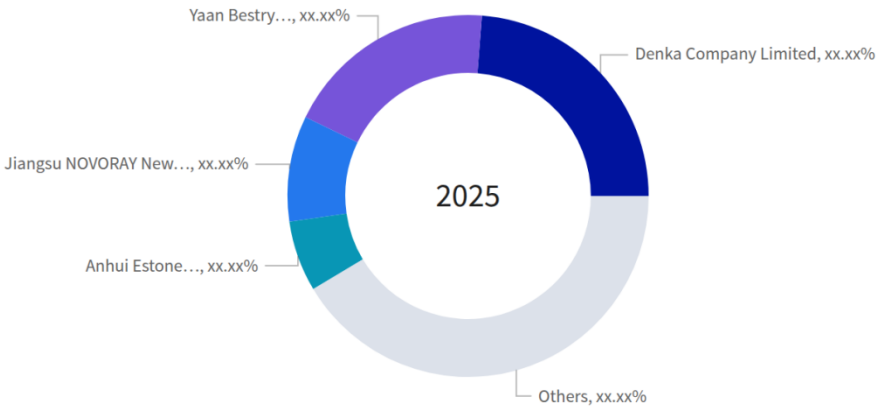


Table 317. Global Thermally Conductive Spherical Alumina Powder Market Share, by Key Player, 2025

Key Player	Share (%)
AdValue Technology	xx.xx
Akros Trading Malaysia Sdn. Bhd.	xx.xx
Anhui Estone Materials Technology Co., Ltd.	xx.xx
AppliChem Technology Co., Ltd.	xx.xx
ASPP Co., Ltd.	xx.xx
Chalco Qingdao International Trading Co., Ltd.	xx.xx
Denka Company Limited	xx.xx
GNPGraystar Specialty Materials	xx.xx
Heeger Materials Inc.	xx.xx
HighChem Company Limited	xx.xx
Jiangsu NOVORAY New Material Co., Ltd.	xx.xx
Krayden	xx.xx
PMAT Co., Ltd.	xx.xx
Sanyo Corporation of America	xx.xx
Sibelco	xx.xx
Stanford Advanced Materials	xx.xx
Tomoe Engineering Co., Ltd.	xx.xx
Topco Technologies Corporation	xx.xx
Yaan Bestry Performance Materials Corporation	xx.xx
Others	xx.xx

Sources & Evidence

1. Denka FY2018 Second-Quarter Financial Results Presentation
   - Evidence informing base-year company-share estimates: The producer disclosed a JPY xx.xx fiscal-2025 spherical-alumina sales plan. Converted using the staged annual exchange-rate input, it provides the numerator scale for the modeled 2025 share.
2. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Evidence informing base-year company-share estimates: The issuer filing reports first-half 2025 spherical-alumina revenue of CNY xx.xx and xx.xx tonnes sold. Annualizing the disclosed revenue and applying the staged exchange-rate input supplies the modeled numerator.
3. Yaan Bestry High-Tech Materials Co., Ltd. Prospectus
   - Evidence informing base-year company-share estimates: The official filing reports 2025 spherical-alumina revenue of CNY xx.xx. Conversion using the staged annual exchange-rate input supplies the attributable numerator.
4. Aluminium Oxide - Sibelco
   - Evidence informing base-year company-share estimates: The company states that it only distributes Momentive spherical-alumina products in Europe under a distribution agreement. Under the manufacturer first-sale denominator, this establishes no independently attributable producer value for the channel entity.

5. Spherical Alumina - HighChem Company Limited
   · Evidence informing base-year company-share estimates: The product page identifies Bengbu Zhongheng as the spherical-alumina manufacturer and HighChem as the sales contact. Manufacturer-level value is therefore attributed to the named producer rather than the sales agent.
6. Spherical Alumina - Topco Technologies Corporation
   · Evidence informing base-year company-share estimates: The catalog places the offered SJA spherical-alumina grade under Estone products. The manufacturer-level denominator attributes the powder value to Estone rather than Topco's distribution activity.
7. About Us - Sanyo Corporation of America
   · Evidence informing base-year company-share estimates: The company identifies itself as the US subsidiary of an international trading company and as an importer of specialty materials. Its spherical-alumina channel activity is excluded from the manufacturer-level numerator.
8. PUREGuard 5170P - Krayden
   · Evidence informing base-year company-share estimates: The distributor's product listing attributes the offered PUREGuard alumina family to Polar. The underlying producer value is assigned to Polar, leaving no independent manufacturer-first-sale numerator for Krayden.
9. Anhui Estone Materials Technology Co., Ltd. - Response to Review Inquiry
   · Evidence informing base-year company-share estimates: The issuer disclosure reports CNY xx.xx of thermally conductive spherical-alumina revenue for the first quarter of 2022, providing the observed company-specific numerator anchor used in the 2025 market-index model.
10. Anhui Estone Materials Technology Co., Ltd. - 2025 Annual Report
    · Evidence informing base-year company-share estimates: The audited 2025 report continues to identify spherical alumina among the company's inorganic functional powders and reports CNY xx.xx of total inorganic functional-powder revenue, providing a reasonableness ceiling for the modeled product numerator.
11. Products - ASPP Co., Ltd.
    · Evidence informing base-year company-share estimates: The company classifies spherical alumina under imported products and describes its business as matching international supply and demand, supporting exclusion of its resale activity from the manufacturer first-sale numerator.
12. About GNPGraystar Specialty Materials
    · Evidence informing base-year company-share estimates: The company describes itself as a raw-material supplier using worldwide sourcing and stocking facilities; no independent spherical-alumina manufacturing operation is identified for the listed entity.
13. Materials We Handle - PMAT Co., Ltd.
    · Evidence informing base-year company-share estimates: The company identifies itself as a materials trading and development partner that sources and supplies advanced materials, supporting a zero independent manufacturer-first-sale numerator for its spherical-alumina listing.
14. About Us - Chalco Qingdao International Trading Co., Ltd.
    · Evidence informing base-year company-share estimates: The listed entity identifies itself as Chinalco's exclusive import-export trading channel and separately identifies other group production bases, so the powder's manufacturer-level value is not independently attributable to the trading company.
15. Spherical Alumina Powders - AdValue Technology
    · Evidence informing base-year company-share estimates: The company's materials page states that it supplies spherical-alumina powders, while its business description identifies a specialty-material supply role rather than an in-scope powder-manufacturing operation.
16. About Us - Heeger Materials Inc.
    · Evidence informing base-year company-share estimates: The company describes itself as a specialized materials supplier and catalog vendor; no independent spherical-alumina production operation is identified for the listed entity.
17. About Us - Stanford Advanced Materials
    · Evidence informing base-year company-share estimates: The company identifies itself as a global supplier that works with vetted manufacturing partners, supporting attribution of manufacturer first-sale value to upstream producers rather than the catalog supplier.

18. Thermally Conductive Fillers - Tomoe Engineering Co., Ltd.
    · Evidence informing base-year company-share estimates: The company's thermal-filler sheet expressly identifies the offered spherical-alumina grade as manufactured by HPF, establishing Tomoe's channel role rather than an independent powder-manufacturer numerator.
19. About - AppliChem Technology Co., Ltd.
    · Evidence informing base-year company-share estimates: The company states that its principal business is agency sales of electronic specialty chemicals and materials, supporting exclusion of reseller value from the manufacturer first-sale numerator.
20. Denka Spherical Alumina - Akros Trading Malaysia Sdn. Bhd.
    · Evidence informing base-year company-share estimates: The trading company identifies the listed product as Denka spherical alumina and describes its own role as trade business, so the underlying manufacturer value belongs with Denka rather than Akros.

17.2. Market Concentration Analysis, 2025

[redacted] That combination points to meaningful rivalry among established powder suppliers without making every listed manufacturer or intermediary a comparable competitor for the same qualified formulation. Company positions describe the base year, not a subsequent shift in control.

Customer qualification can protect an incumbent grade when a formulator depends on its characteristics and continuing supply. [redacted] Momentive's completed acquisition of South Korean spherical-powder businesses illustrates consolidation of relevant capabilities, but the transaction alone establishes neither a change in global share nor a reduction in buyers' choices.

[redacted] A distributor listing can broaden access without creating another manufacturing source. Buyers should verify grade origin and continuity; suppliers considering expansion should monitor competing qualifications and durable customer use before interpreting a broad company roster as easy market entry.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka's differentiated grade offering supports the application-specific qualification and rivalry discussion, without establishing another firm's share.
2. Momentive Technologies Acquires Spherical Alumina and Spherical Silica Business From Sibelco
   · The completed South Korean spherical-powder business acquisition is an observed example of capability consolidation, not evidence that buyer alternatives or global shares changed by a specified amount.

17.3. Recent Developments & Impact Analysis, 2025

Momentive reported completing its acquisition of Sibelco's South Korean spherical alumina and spherical silica businesses on September xx.xx 2024. [redacted]

[redacted] Competing suppliers should monitor customer qualifications and repeat use before committing resources on the assumption that this application will expand uniformly.

Sources & Evidence

1. Momentive Technologies Acquires Spherical Alumina and Spherical Silica Business From Sibelco
   · Momentive reported completing its acquisition of Sibelco's South Korean spherical alumina and spherical silica businesses on September xx.xx 2024; the announcement does not quantify a global powder-market share change.
2. Results Presentation of FY2025 | Denka
   · Denka's May xx.xx 2026 presentation reports decided adoption for new multilayer high-speed-memory package projects and separately describes continuing evaluation of next-generation memory grades; these are company-reported developments, not market-wide adoption figures.

17.4. Product Portfolio Analysis, 2025

Competition spans different ways of serving a thermal-material formulation. Denka offers particle-distribution, surface-treatment, and low-ionic-impurity options; NOVORAY describes narrow and multimodal distributions; and Bestry lists surface-treated alumina families. [redacted]

Resonac positions Alunabeads for thermally conductive sheets and resin or rubber fillers, while Momentive's Boratherm offering addresses interfaces and conductive plastics. An Estone spherical-alumina series is also listed through Topco, illustrating that access to a producer's grade may come through an intermediary. [redacted]

[redacted] Producers should extend adjacent grades only after identifying the formulation constraint and a path to continuing qualification. Bundled application support may improve retention, but breadth and service consume resources if customers do not adopt the resulting grade.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka describes spherical alumina options spanning particle distributions, surface treatment, and low ionic impurity for thermal-material applications.
2. Spherical Alumina | Momentive Technologies
   · Momentive identifies Boratherm spherical alumina for thermal-interface materials and thermally conductive plastics.

3. Spherical aluminum oxide powder | Jiangsu NOVORAY New Material Co., Ltd
   · NOVORAY describes spherical aluminum oxide powder with adjustable particle distributions, including narrow and multimodal options.
4. Alumina | Bestry
   · Bestry lists multiple alumina families, including surface-treated families and one identified for potting products.
5. Alumina Beads / CB | Resonac Europe
   · Resonac identifies Alunabeads CB spherical alumina for thermally conductive sheets and resin and rubber fillers.
6. Spherical Alumina, Estone Products | Topco Technologies
   · Topco lists an Estone SJA spherical-alumina product for thermally conductive filler use in epoxy, rubber, and plastics; the page establishes a product-channel listing, not a separate manufacturing share.

17.5. Benchmarking Analysis, 2025

Benchmark manufacturers against the grade a formulator could actually qualify: distribution control, relevant surface or impurity characteristics, suitability for the finished thermal material, supply continuity, and clarity of product identity. Denka, NOVORAY, Bestry, Resonac, and Momentive disclose different combinations of these attributes. ■■■■■ ■■■■■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■■■■ ■■■ ■ ■■■■■■■■■■■ ■■■■■■■ ■■■■■■■ ■■■■■■■■■■■ ■■■■■■■■■■■■

The appropriate peer set changes with the application. A packaging formulator may place greater weight on a specified impurity characteristic and distribution, while a potting-material buyer may compare treated-grade fit and dependable supply. ■■■■■■■ ■■■■■■■ ■■■■■■■ ■■■■■■■ ■■ ■ ■■■■■■■■■■■■■■ ■■■■■■■■■■■ ■■■ ■■ ■■■■■■■ ■■■ ■■ ■■■■■■■■ ■■ ■ ■■■■■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■■ ■■■■■■■■■ ■■■■■■■■■■■■■ ■■■■■■■■■■■■■

Recorded market position provides context, not a substitute for this buyer-level test. In particular, the captured name for NOVORAY's powder offering differs from the English company name displayed by the securities exchange; buyers should confirm the contracting and producing entity when comparing that offering. ■■■■■■■■■■■■ ■■■■■■ ■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■■■■ ■■■ ■■■■■■■■■■■■■ ■■■■■■■■■■■■■■■■■■ ■■■■■■■ ■■■■■■■■■ ■ ■■■■■■■■ ■ ■■■■■■■■ ■■■■■■■■■■■

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   · Denka's grade range provides a manufacturer comparison point; suitability in a particular customer formulation is not established by the catalog.
2. Spherical Alumina | Momentive Technologies
   · Momentive's published applications and grade characteristics provide manufacturer comparison dimensions, not proof of cross-supplier equivalence.
3. Spherical aluminum oxide powder | Jiangsu NOVORAY New Material Co., Ltd
   · The NOVORAY product page identifies the powder offering and displays the company's product-site English designation.
4. Alumina | Bestry
   · Bestry's listed grade families support application-specific manufacturer benchmarking, without proving results in a buyer's formulation.

5. Alumina Beads / CB | Resonac Europe
   · Resonac's identified thermal-filler applications provide a manufacturer-specific comparison point.
6. Spherical Alumina, Estone Products | Topco Technologies
   · Topco's Estone listing supports distinguishing access to a producer-associated grade from an independent original-powder source.
7. 688300 Company Overview | Shanghai Stock Exchange
   · The Shanghai Stock Exchange displays Novoray Corporation as the issuer's English full name; the powder product website uses the Jiangsu NOVORAY New Material designation, supporting a contracting-entity verification recommendation rather than a new company identity.

18. Company Profiles

18.1. Denka Company Limited

Denka offers spherical alumina for thermal interfaces, semiconductor-package materials, thermally conductive plastics, and heat-dissipating coatings. ▪▪▪ ▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪ ▪▪ ▪▪▪▪▪▪▪▪ ▪▪ ▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪ ▪▪ ▪▪▪▪▪▪▪ ▪▪▪▪▪ ▪▪ ▪▪▪▪▪▪▪▪ ▪▪ ▪▪▪▪▪▪▪▪ Buyers should compare the offered grade with their qualified material and establish supply continuity before relying on portfolio breadth as a sourcing advantage.

Sources & Evidence

1. DENKA SPHERICAL ALUMINA | Denka Company Limited
   - Denka's product page establishes its spherical alumina offerings, grade distinctions, and stated thermal applications.
   - Company verification: Denka identifies its own spherical alumina product and thermally conductive filler uses.
2. Company Overview - Denka Chemicals Holdings Asia Pacific
   - Company verification: Denka's regional company identifies spherical-alumina manufacture by its Singapore operation since 2021; this supports a regional fact for the existing Denka identity, not an additional company.

18.2. Resonac Corporation

Resonac markets Alunabeads CB spherical alumina through its European product organization for thermally conductive sheets and resin or rubber fillers. ▪▪▪ ▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪ ▪▪ ▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪ ▪ ▪▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪ ▪▪▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪ ▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪ ▪▪▪▪ ▪▪ ▪▪▪▪▪▪▪▪▪▪ Buyers should assess the particular grade and regional supply route rather than assume that the European listing establishes equivalent availability or performance in every market.

Sources & Evidence

1. Alumina Beads / CB | Resonac Europe
   - Resonac markets Alunabeads CB spherical alumina through its European site for thermally conductive sheets and resin and rubber filler applications.
   - Company verification: Resonac offers its spherical Alumina Beads / CB for thermally conductive sheets and fillers.

18.3. NIPPON STEEL Chemical & Material Co., Ltd.

NIPPON STEEL Chemical & Material offers spherical alumina particles through its high-performance fillers business, emphasizing particle-size control, thermal conduction, and electrical insulation for thermally conductive resins. ▪▪▪▪ ▪▪▪▪▪▪▪▪▪ ▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪ ▪▪▪▪ ▪▪▪▪▪▪▪▪ ▪ ▪▪▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪ ▪▪▪▪▪▪▪▪▪▪ A buyer assessing its offering should distinguish the alumina grade from

the company's separately described silica fillers and confirm that the selected powder fits the intended resin application.

Sources & Evidence

1. Silica/Alumina Spherical Particle | NIPPON STEEL Chemical & Material
   - NIPPON STEEL Chemical & Material describes spherical alumina particles, particle-size control, and thermally conductive resin applications.
2. Nippon Steel Technical Report No. 134 - Development of High-performance Fine Powder Spherical Filler Product Technology
   - Company verification: A 2025 company technical report identifies the Micron Division as the present spherical-filler business, describes commercial spherical-alumina thermal fillers, and identifies the former Micron Co., Ltd. as its predecessor. The former company is not an additional current producer.
3. Silica/Alumina Spherical Particle | NIPPON STEEL Chemical & Material
   - Company verification: NIPPON STEEL Chemical & Material identifies alumina spherical particles and thermally conductive resin applications.

18.4. Admatechs Co., Ltd.

Admatechs markets high-purity spherical alumina in Japan for thermally conductive compounds, including fine-particle offerings with stated impurity-related characteristics. Its differentiated proposition is relevant when a formulator needs close control of a fine filler or has an electrical-reliability requirement. ■■■ ■■■■■■■■■ ■■■■■■■■■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■■■ ■■■■■■■■■■■■ ■■■ ■■■■■■■■■ ■■ ■■■■■■■■ ■■ ■ ■■■■■■■■■■ ■■■■■■■■■ ■■■■■■ ■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■ ■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■ ■■■ ■■■ ■■■■■■■■■ ■■■■■

Sources & Evidence

1. PRODUCTS | Product List / Alumina | Admatechs
   - Admatechs lists high-purity spherical alumina as filler for thermally conductive compounds and identifies fine-particle and impurity-related characteristics.
   - Company verification: Admatechs lists high-purity spherical alumina among its products and identifies thermally conductive compounds as an application.

18.5. Momentive Technologies

Momentive Technologies markets Boratherm spherical alumina for thermal interfaces, adhesives, gap materials, and thermally conductive plastics. ■■■ ■■■■■■■■■ ■■■■■■■■■ ■■■■ ■■■■■■■■■■■ ■■ ■■■■■■■■■ ■■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■■ ■■■■■■ ■■■■■■■■■■ ■■ ■■■■■ ■■■■■ ■■■■■ ■■■■■■■■ ■■■■■■ ■■■■■■ ■■ ■■■ ■■■■■■■■ ■■■■■■■■■■ For buyers, the expanded portfolio can offer another route to application-specific supply, but the acquisition itself does not establish that a particular grade is interchangeable with an existing qualified filler.

Sources & Evidence

1. Spherical Alumina | Momentive Technologies
   - Momentive lists Boratherm spherical alumina for thermal interfaces, adhesives, gap materials, and conductive plastics.
   - Company verification: Momentive Technologies offers Boratherm spherical alumina for thermal management products, including thermal interface materials.

2. Momentive Technologies Acquires Spherical Alumina and Spherical Silica Business From Sibelco
   - Momentive reports completing the acquisition of Sibelco's South Korean spherical alumina and spherical silica businesses in September 2024.
   - Company verification: Momentive Technologies reports completing the acquisition of Sibelco's South Korean spherical-alumina and spherical-silica businesses on September xx.xx 2024.
3. Spherical Alumina - Boratherm - Momentive Technologies
   - Company verification: Momentive currently lists Boratherm spherical alumina powder for thermal-interface materials and thermally conductive plastics.

18.6. Jiangsu NOVORAY New Material Co., Ltd.

Jiangsu NOVORAY New Material offers spherical alumina powder and identifies electronic encapsulation, thermally conductive laminates, and thermal-interface materials as potential uses. Its product information describes adjustable particle distributions, including narrow and multimodal options. [redacted]

Sources & Evidence

1. Spherical aluminum oxide powder | Jiangsu NOVORAY New Material Co., Ltd
   - NOVORAY identifies its spherical alumina offering and describes adjustable distribution characteristics.
2. Electronics and electric appliance | Jiangsu NOVORAY New Material Co., Ltd
   - NOVORAY identifies spherical alumina as a potential filler in electronic encapsulation, thermally conductive laminate, and thermal-interface uses.
3. Novoray Corporation - January 2026 Convertible Bond Listing Announcement
   - Company verification: A January 2026 issuer filing identifies the staged NOVORAY business as Novoray Corporation in English. Its current official filing name differs from the staged title; this is a title issue, not a second producer.
   - Company verification: The issuer's January 2026 filing identifies the legal business by its Chinese name and gives Novoray Corporation as its English name; it is the same NOVORAY producer represented by the protected staged row.
4. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Company verification: The issuer describes existing production and sales of thermally conductive spherical alumina. Planned expansion is distinct from existing output.
5. Spherical aluminum oxide powder | Jiangsu NOVORAY New Material Co., Ltd.
   - Company verification: Jiangsu NOVORAY lists spherical aluminum oxide powder as a company product and identifies thermal conductivity among its characteristics.

18.7. Yaan Bestry Performance Materials Corporation

[redacted] Its Shanghai subsidiary is identified as a sales and development center, giving the company a stated route from production to customer-facing application work. Formulators can compare

its distinct grade families, while verifying the producing grade and repeatability needed for their particular material.

Sources & Evidence

1. Alumina | Bestry
   - Bestry's own product listing establishes its alumina grade families and stated potting-material use.
2. Introduction | Bestry
   - Bestry identifies Yaan as its production business and its Shanghai subsidiary as a development and sales center.
   - Company verification: Yaan Bestry identifies itself as a thermally conductive powder producer and names spherical alumina among its products.
3. Bestry - Corporate Site
   - Company verification: Bestry's current corporate site identifies its spherical-alumina powder business. The Bestry and Chinese Ba(i)tu names refer to the same staged business, rather than an additional participant.

18.8. GNPGraystar Specialty Materials

GNPGraystar lists spherical alumina for thermally conductive sheets and resin, rubber, and plastic fillers. ■■■ ■■■■■ ■■ ■ ■■■■■ ■■■■ ■■ ■■■■■■ ■■ ■■ ■■■■■■■■■■ ■■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■ ■■■ ■■ ■■ ■■■■■■■■■■ ■■■■ ■■■ ■■■■■■■ ■■■■■■■■■■ ■■■■■■■■■■■ ■■■■■■■■■■■■ Buyers should establish the original producer, grade identity, and supply responsibilities when comparing this route with a direct producer relationship; the intermediary sale is not a second source of powder-market demand.

Sources & Evidence

1. Spherical Alumina | GNPGraystar Specialty Materials
   - GNPGraystar lists spherical alumina for thermally conductive sheets and for resin, rubber, and plastic filler uses.
   - Company verification: A current company product page offers spherical alumina powder as filler for thermally conductive sheets, confirming that the earlier product sheet is not the sole evidence of an offering.
2. Spherical Alumina Powders | GNPGraystar Specialty Materials
   - Company verification: GNPGraystar describes its spherical alumina powder offering and use as filler in thermally conductive sheets.

18.9. Topco Technologies Corporation

Topco Technologies lists an Estone spherical alumina series for thermally conductive fillers in epoxy, rubber, and plastics. This illustrates how an intermediary can give formulators access to a producer's identified grade family without becoming a separate powder manufacturer. ■■■■■■ ■■■■■ ■■■■ ■■■■■ ■■■■■■ ■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■■■■ ■■■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■ ■■■■■■■■■ ■■■ ■■■■■■■■■■■■■■ ■■■ ■■■■■■■■■■■■■■ ■■■■■ ■■■■■■■■ ■■■ ■■■■■■■■ ■■■■■ ■■■■ ■■■ ■■■■■■■■■ ■■■ ■■■■■■ ■■ ■■■■■■■ ■■■■■■ ■■■■■■ ■■■■■■■ ■■■■■■■■

Sources & Evidence

1. Estone Products | Topco Technologies Corporation
   - Topco lists an Estone SJA spherical alumina series as a thermally conductive filler for epoxy, rubber, and plastics.

2. Spherical Alumina | TOPCO
   · Company verification: Topco offers Estone SJA-series spherical alumina as a thermally conductive filler through its product catalog.
3. Words from the Founder | Topco Technologies Corporation
   · Company verification: Topco identifies its English corporate name and describes its distributor business.

19. Companies Covered

Table 318. Global Thermally Conductive Spherical Alumina Powder Market, Companies Covered

Company
Admatechs Co., Ltd.
AdValue Technology
Akros Trading Malaysia Sdn. Bhd.
Anhui Estone Materials Technology Co., Ltd.
Anhui Zhengrui New Materials Technology Co., Ltd.
AppliChem Technology Co., Ltd.
ASPP Co., Ltd.
Baikowski SA
Bengbu Zhongheng New Materials Scientific & Technological Co., Ltd.
Chalco Qingdao International Trading Co., Ltd.
Chemazone Inc.
China ChangSha Fine-tech Ceramic Co., LTD
Denka Company Limited
Dongkuk R&S Co., Ltd.
Eport Co., Ltd.
GNPGraystar Specialty Materials
Guangdong Hico New Materials Technology Co., Ltd.
Guangdong Jinge Material Co., Ltd.
Guangdong Leyuan Chemical Materials Technology Co., Ltd.
Hebei Suoyi New Material Technology Co., Ltd.
Heeger Materials Inc.
Henan Tianma New Material Co., Ltd.
HighChem Company Limited
Imerys
Innovative Growth Enterprises
Jiangsu NOVORAY New Material Co., Ltd.
Jiangsu Shengtian New Materials Co., Ltd.
Jiangsu Yoke Technology Co., Ltd.
KCM Corporation
Krayden

Table 318 - continued

Company
Leader (UK) Ltd
Luoyang Zhongchao New Material Co., Ltd.
Mipri GmbH
Momentive Technologies
Nanografi
NIPPON STEEL Chemical & Material Co., Ltd.
PMAT Co., Ltd.
Polar Performance Materials
Resonac Corporation
Sanyo Corporation of America
SAT nano Technology Material Co., Ltd.
Sibelco
Stanford Advanced Materials
Sukgyung AT Co., Ltd.
Sun Rise Powder New Materials Co., Ltd.
Tianjin Zexi New Materials Co., Ltd.
TITANEX CORP.
Tomoe Engineering Co., Ltd.
Topco Technologies Corporation
xtra GmbH
Yaan Bestry Performance Materials Corporation
Zhengzhou Haixu Abrasives Co., Ltd.
东莞东超新材料科技有限公司
中铝郑州有色金属研究院有限公司
兰陵县益新矿业科技有限公司
苏州贝尔德新材料科技有限公司

Sources & Evidence

1. Novoray Corporation - January 2026 Convertible Bond Listing Announcement
   - Company verification: A January 2026 issuer filing identifies the staged NOVORAY business as Novoray Corporation in English. Its current official filing name differs from the staged title; this is a title issue, not a second producer.
   - Company verification: The issuer's January 2026 filing identifies the legal business by its Chinese name and gives Novoray Corporation as its English name; it is the same NOVORAY producer represented by the protected staged row.
2. Jiangsu Novoray New Material Co., Ltd. - Response to Convertible Bond Review Inquiry
   - Company verification: The issuer describes existing production and sales of thermally conductive spherical alumina. Planned expansion is distinct from existing output.
3. Anhui Estone Materials Technology Co., Ltd. - 2024 Annual Report
   - Company verification: The company's 2024 report says its spherical alumina had been introduced in volume to an electric-vehicle customer for thermal-interface applications. It separately describes low-alpha packaging grades as undergoing customer validation, not established bulk sales.
4. Anhui Estone Materials Technology Co., Ltd. - 2025 Annual Report
   - Company verification: The 2025 annual report continues to identify spherical alumina powder among the issuer's products. It does not establish that a proposed project's capacity was already operating.
5. Jiangsu Yoke Technology Co., Ltd. - 2026 Half-Year Report
   - Company verification: The group reports that its Huafei electronic-materials business had achieved stable customer supply of spherical alumina by the first half of 2026. The subsidiary activity belongs with the staged group identity, not an additional independent producer.
6. Nippon Steel Technical Report No. 134 - Development of High-performance Fine Powder Spherical Filler Product Technology
   - Company verification: A 2025 company technical report identifies the Micron Division as the present spherical-filler business, describes commercial spherical-alumina thermal fillers, and identifies the former Micron Co., Ltd. as its predecessor. The former company is not an additional current producer.
7. Spherical Alumina - GNPGraystar Specialty Materials
   - Company verification: A current company product page offers spherical alumina powder as filler for thermally conductive sheets, confirming that the earlier product sheet is not the sole evidence of an offering.
8. Guangdong Hico New Materials Technology Co., Ltd. - Company and Thermal Powders
   - Company verification: The company's current English site expressly includes spherical alumina in its thermal-composite powder offering for electronics and battery thermal-management applications. Its separate specification listing identifies a family of spherical grades.
9. About - ASPP Co., Ltd.
   - Company verification: The company's English business profile identifies ASPP Co., Ltd. and describes its international sourcing and industrial-inorganic-materials business. Its spherical-alumina range is assessed as a channel offering, not attributed to ASPP manufacture.
10. About Us - Sanyo Corporation of America
    - Company verification: Sanyo identifies itself as a US subsidiary of Sanyo Trading. Its staged product offering is a US sales-channel role and does not establish separate manufacture of the Micron-branded powder.
11. Bestry - Corporate Site
    - Company verification: Bestry's current corporate site identifies its spherical-alumina powder business. The Bestry and Chinese Ba(i)tu names refer to the same staged business, rather than an additional participant.
12. Spherical Alumina Powders for Thermal Conductive Fillers - AdValue Technology
    - Company verification: The supplier's current US product page specifies multiple available spherical-alumina grades for thermal-interface and other thermally conductive fillers. It substantiates a distinct specialty-supply role, not in-house manufacture.
    - Company verification: AdValue advertises spherical alumina powders supplied for use as thermally conductive polymer fillers and thermal-interface materials.

13. DENKA SPHERICAL ALUMINA | Denka Company Limited
    - Company verification: Denka identifies its own spherical alumina product and thermally conductive filler uses.
14. Alumina Beads / CB | Resonac Europe
    - Company verification: Resonac offers its spherical Alumina Beads / CB for thermally conductive sheets and fillers.
15. Silica/Alumina Spherical Particle | NIPPON STEEL Chemical & Material
    - Company verification: NIPPON STEEL Chemical & Material identifies alumina spherical particles and thermally conductive resin applications.
16. Product List / Alumina | Admatechs
    - Company verification: Admatechs lists high-purity spherical alumina among its products and identifies thermally conductive compounds as an application.
17. Spherical Alumina | Momentive Technologies
    - Company verification: Momentive Technologies offers Boratherm spherical alumina for thermal management products, including thermal interface materials.
18. Spherical aluminum oxide powder | Jiangsu NOVORAY New Material Co., Ltd.
    - Company verification: Jiangsu NOVORAY lists spherical aluminum oxide powder as a company product and identifies thermal conductivity among its characteristics.
19. Introduction | Yaan Bestry Performance Materials Corporation
    - Company verification: Yaan Bestry identifies itself as a thermally conductive powder producer and names spherical alumina among its products.
20. Spherical Alumina | Sukgyung AT
    - Company verification: Sukgyung AT displays its spherical alumina range as heat-dissipation material.
21. Spherical Alumina | Dongkuk R&S
    - Company verification: Dongkuk R&S lists spherical alumina grades for thermal-interface fillers and thermally conductive resins.
22. Anhui Estone Materials Technology Co., Ltd. Prospectus
    - Company verification: The issuer identifies its English corporate name and describes spherical alumina it produces for thermal-interface materials.
23. Jiangsu Yoke Technology Co., Ltd. 2025 Annual Report
    - Company verification: Jiangsu Yoke's annual report gives its English corporate name and reports development and scale-up of spherical alumina powder for thermal pads and packaging applications; commercial sales of these grades need separate confirmation.
24. Spherical Alumina | HighChem
    - Company verification: HighChem offers spherical alumina for heat-dissipation sheets and identifies Bengbu Zhongheng as its manufacturer; the manufacturer's own current offering remains unconfirmed.
    - Company verification: HighChem lists its own spherical-alumina sales offering and the manufacturer from which it sources the product.
25. Aluminium Oxide | Sibelco
    - Company verification: Sibelco states that it distributes Momentive spherical alumina for thermal-interface applications in Europe.
    - Company verification: Sibelco markets BORATHERM SA spherical alumina for heat dissipation in polymer composites.
    - Company verification: Its stated distributorship for Momentive spherical alumina is limited to Europe.
    - Company verification: Sibelco says it distributes Momentive spherical-alumina products for thermal-interface applications in Europe under a distributorship agreement rather than manufacturing that acquired business's powder.
26. Company Profiles | HighChem Company Limited
    - Company verification: HighChem identifies its official English company name and its trading business.

27. Spherical Alumina | ASPP
    · Company verification: ASPP advertises spherical alumina, including high-thermal-conductivity types, through its own product page.
28. Al2O3 / Spherical Alumina Powder | xtra GmbH
    · Company verification: xtra GmbH offers XSA-series spherical alumina powders as thermally conductive ceramic fillers.
29. Spherical Alumina Powders | GNPGraystar Specialty Materials
    · Company verification: GNPGraystar describes its spherical alumina powder offering and use as filler in thermally conductive sheets.
30. Spherical alumina | China ChangSha Fine-tech Ceramic Co., LTD
    · Company verification: China ChangSha Fine-tech Ceramic lists spherical alumina for thermally conductive interface materials and engineering plastics; its precise producer-versus-reseller role needs confirmation.
31. Jinge launches spherical alumina | Guangdong Jinge Material Co., Ltd.
    · Company verification: Guangdong Jinge's dated company announcement describes its introduction of single-size spherical alumina for thermal-material customers; present sales require confirmation.
32. Spherical Alumina | TOPCO
    · Company verification: Topco offers Estone SJA-series spherical alumina as a thermally conductive filler through its product catalog.
33. Words from the Founder | Topco Technologies Corporation
    · Company verification: Topco identifies its English corporate name and describes its distributor business.
34. Ceramic & Thermal Management Materials | PMAT Co., Ltd.
    · Company verification: PMAT lists spherical alumina for thermally conductive composites in a representative materials catalog, while explicitly requiring confirmation of availability.
35. Spherical Alumina | Sanyo Corporation of America
    · Company verification: Sanyo Corporation of America advertises MICRON spherical alumina for resins and thermally conductive sheets; it is a channel rather than a second identified producer.
36. Spherical Alumina | Chalco International
    · Company verification: Chalco Qingdao's site advertises spherical alumina for thermal-interface materials.
37. About Us | Chalco International
    · Company verification: The site's about page identifies the trading company as Chalco Qingdao International Trading Co., Ltd.; manufacture of its advertised spherical grade is not established.
38. Spherical Alumina Products | Zhengzhou Haixu Abrasives
    · Company verification: The company's catalog lists spherical alumina powder offerings specifically described as thermally conductive fillers.
39. Technical Data Sheet | Zhengzhou Haixu Abrasives Co., Ltd.
    · Company verification: A company-issued document states the English name Zhengzhou Haixu Abrasives Co., Ltd.; it does not independently establish the spherical grade.
40. About Us | AdValue Technology
    · Company verification: AdValue identifies itself as a specialty-material supplier based in Tucson, Arizona.
41. Spherical Alumina (Al2O3) Powder, HM Top Cut Series | Heeger Materials
    · Company verification: Heeger Materials Inc. offers an identified spherical alumina powder series for thermal-interface materials and identifies its US business location.
42. Spherical Alumina Powder (Narrow Particle Size Distribution) | Stanford Advanced Materials
    · Company verification: Stanford Advanced Materials lists spherical alumina powder for thermal-interface materials and related thermal fillers.
43. About Us | Stanford Advanced Materials
    · Company verification: Stanford describes itself as a US-based supplier headquartered in California and includes Advanced Ceramic Materials in its portfolio.

44. Polar Performance Materials Begins Shipments from State-of-the-Art Canadian Production Facility
    · Company verification: Polar states that its Ontario production facility began shipping high-purity alumina powder and names thermal-interface materials among applications.
45. PUREGuard Alumina for Semiconductors | Polar Performance Materials
    · Company verification: Polar identifies PUREGuard powder as used by customers to produce thermal-interface materials.
46. High Purity Alumina | Krayden
    · Company verification: Krayden lists named Polar PUREGuard spherical alumina grades; this independently documents Polar's spherical-powder offering.
    · Company verification: Krayden commercially lists spherical alumina grades supplied by Polar and discusses alumina use in thermal-interface materials.
47. About Us | Krayden
    · Company verification: Krayden identifies itself as a technical distributor headquartered in Colorado and documents its Mexican operation.
48. Find the Right Alumina Solution for Your Thermal Interface Materials Applications | Imerys
    · Company verification: An Imerys-branded brochure presents spherical alumina produced in the United States for thermal-interface applications; the brochure also marks one grade under development.
49. Other Products | Nanochemazone
    · Company verification: Nanochemazone's own catalog listing names a high-thermal-conductivity spherical alumina micron-particle product.
50. About Nanochemazone | Nanochemazone
    · Company verification: Nanochemazone identifies a Canadian office; its site identifies Chemazone Inc. in its business notice.
51. Jarinu
    · Company verification: Sibelco identifies Jarinu as a Brazilian location with local customer support.
    · Company verification: The location page lists calcium carbonate and silica as available from Jarinu, not spherical alumina.
52. Spherical Alumina | Mipri GmbH
    · Company verification: Mipri GmbH identifies itself at a German address and presents spherical aluminium oxide as filler for thermally conductive pastes and plastics.
53. CMA-S Controlled Morphology Alumina - Baikowski
    · Company verification: Baikowski lists its CMA-S spherical alumina powder and names thermal management among the grade's applications.
54. Privacy policy - Baikowski
    · Company verification: Baikowski identifies Baikowski SA as the company associated with its website and gives an address in Poisy, France.
55. Leader UK | Industrial Minerals Supplier | London
    · Company verification: Leader (UK) Ltd identifies its registered company number and lists spherical alumina for thermal-interface pads, encapsulants and related applications; the listing says available on order.
56. LEADER (UK) LTD overview - Find and update company information - GOV.UK
    · Company verification: The UK official registry identifies LEADER (UK) LTD, company number xx.xx as an active private limited company at the London address shown on its website.
57. Spherical Alumina Powder (High Thermally Conductive) | Stanford Advanced Materials | UK Supplier
    · Company verification: Stanford Advanced Materials offers spherical alumina powder described for thermal-interface materials and thermally conductive plastics through its UK-facing catalog.
58. About Us - Stanford Advanced Materials (SAM)
    · Company verification: Stanford Advanced Materials identifies its US headquarters, lists UK and German warehouses, and names Oceania International LLC as the website's owner.

59. Momentive Technologies Acquires Spherical Alumina and Spherical Silica Business From Sibelco
    - Company verification: Momentive Technologies reports completing the acquisition of Sibelco's South Korean spherical-alumina and spherical-silica businesses on September xx.xx 2024.
    - Company verification: The announced transfer of Sibelco's South Korean spherical-alumina business explains why its present European role is assessed separately from the producer.
60. Spherical Alumina - Boratherm - Momentive Technologies
    - Company verification: Momentive currently lists Boratherm spherical alumina powder for thermal-interface materials and thermally conductive plastics.
61. Distance Sales Framework Agreement
    - Company verification: The shop's seller terms identify Nanografi as the seller and give an Ankara, Türkiye head-office address.
62. Aluminum Oxide (Al2O3) Nanopowder/Nanoparticles, Alpha, Purity: 99.9+%, Size: 500 nm
    - Company verification: Nanografi lists an aluminum oxide nanopowder for sale; the inspected listing does not specify spherical morphology or thermal-conductive filler use.
63. 球状アルミナ (Al_2O_3)｜製品情報｜共立マテリアル株式会社
    - Company verification: Its product catalog offers spherical alumina for semiconductor and heat-dissipation filler uses.
64. KCM Corporation
    - Company verification: The business uses KCM Corporation as its English display name.
65. 熱伝導性フィラー
    - Company verification: Its industrial-materials sheet presents an HPF-made spherical-alumina grade among thermally conductive fillers.
66. Corporate Profile | TOMOE Engineering Co.,Ltd.
    - Company verification: The company's official English name is Tomoe Engineering Co., Ltd.
67. 中铝郑州有色金属研究院有限公司｜高导热绝缘填料氧化铝
    - Company verification: The named Chinalco research-institute company says it can provide a spherical SP-series alumina powder for thermally conductive insulating composites.
68. 球形导热氧化铝 - 苏州贝尔德新材料科技有限公司
    - Company verification: The company lists a spherical thermally conductive alumina powder for thermal polymer and electronics-related uses.
69. Product Specification Sheet - Guangdong Hico New Materials Technology Co., Ltd
    - Company verification: The company's specification sheet lists spherical-alumina grades under its own English company name.
70. SDA 系列球形氧化铝-乐远化学
    - Company verification: Its product page offers SDA-series spherical alumina powder and identifies thermal-interface materials and other heat-dissipation fillers among applications.
71. Leyuan Chemical Material-Electronic Chemicals-chemical material
    - Company verification: The company's English site identifies the business as Guangdong Leyuan Chemical Materials Technology Co., Ltd.
72. Sun Rise Powder New Material Co., Ltd | Ultrafine spherical alumina powder
    - Company verification: The business's own site lists ultrafine spherical alumina powder for thermally conductive materials and electronic heat-dissipation uses.
73. Sun Rise Powder New Material Co., Ltd
    - Company verification: The English homepage displays the Sun Rise Powder New Materials company name and lists spherical alumina among its products.
74. Spherical Alumina Powder - BY Series - Zhengrui
    - Company verification: The company's BY-series spherical-alumina product page identifies thermal pads, gels, and adhesives as recommended applications.

75. Silica Series, Aluminum Series, Crystalline Silica Powder - Zhengrui
    - Company verification: The company's own site identifies Anhui Zhengrui New Materials Technology Co., Ltd. as the business behind the product pages.
76. 중국 제조업체의 고순도 전자 등급 구형 알루미나 열 전도성 필러 - Jiangsu Shengtian New Materials Co., Ltd.
    - Company verification: Jiangsu Shengtian's own product page advertises a spherical-alumina thermal-conductive filler for electronic packaging and thermal-interface materials.
77. 公开转让说明书（申报稿）
    - Company verification: A company's filed disclosure names Tianjin Zexi New Materials as a supplier from which it purchased spherical alumina.
78. Soft alumina-based thermal interface materials with enhanced thermal properties enabled by the synergistic effect with hexagonal boron nitride and liquid metal
    - Company verification: A peer-reviewed paper identifies Tianjin Zexi New Materials Co., Ltd. as the seller from which its authors purchased spherical alumina particles for thermal-interface-material research.
79. 2025 年山东省新材料领军企业培育库入库名单
    - Company verification: A Shandong government list names Lanling Yixin Mining Technology and spherical alumina as one of its products; the list does not specify a thermal-filler application.
80. 球型氧化鋁 - 品化科技股份有限公司
    - Company verification: The company's own catalog lists spherical alumina for aluminum-based and high-frequency substrates.
81. 關於品化 About - 品化科技股份有限公司
    - Company verification: Its company page identifies AppliChem Technology Co., Ltd. as its English name and describes agency sales of electronic specialty materials.
82. Denka Spherical Alumina - Akros Trading Malaysia Sdn. Bhd.
    - Company verification: The Malaysian trading company's own page offers Denka spherical alumina and identifies thermally conductive resin and rubber filler uses; it does not claim to manufacture the powder.
83. 氧化鋁 - 磐拓國際股份有限公司
    - Company verification: Titanex announced a spherical-alumina powder offer in March 2026; that announcement does not specify a thermal-filler use.
84. 磐拓國際股份有限公司 - 經濟部商工登記公示資料查詢
    - Company verification: Taiwan's official company registry supplies the company's registered Chinese identity and TITANEX CORP. English name.
85. Company Overview - Denka Chemicals Holdings Asia Pacific
    - Company verification: Denka's regional company identifies spherical-alumina manufacture by its Singapore operation since 2021; this supports a regional fact for the existing Denka identity, not an additional company.
86. SEMICON Taiwan 2026 - EPORT CO.,LTD
    - Company verification: The named Korean exhibitor describes sales of spherical alumina as a ceramic filler for thermal-interface materials and distinguishes imported powder from its own development work.
87. Spherical Aluminum Oxide powder - EPORT CO.,LTD | buyKOREA
    - Company verification: Eport's named seller listing offers spherical aluminum oxide powder for electronic heat-dissipation uses.
88. 导热用系列 α-氧化铝 2 - 河南天马新材料股份有限公司
    - Company verification: The company's SW-series spherical alumina page identifies thermal gels, thermal pads and electronic packaging as applications.
89. 河南天马新材料股份有限公司 2025 年半年度报告
    - Company verification: The issuer identifies its high-thermal-conductivity spherical-alumina business and discusses production and sales activity; its filing identifies the corporate entity.

90. Productos de alta conductividad térmica Polvo de alúmina esférica - Suoyi
    · Company verification: The Suoyi catalog offers spherical alumina powder as a thermally conductive filler for electronic materials and thermal-interface applications.
91. Spherical Alumina Supplier - Suoyi
    · Company verification: The supplier's own spherical-alumina page identifies Hebei Suoyi New Material Technology Co., Ltd. as the offering business.
92. Supply spherical alumina powder as filler for heat dissipation substrate - SAT NANO
    · Company verification: The SAT NANO product page offers spherical alumina powder for heat-dissipating fillers and thermally conductive polymer applications.
93. About Us | SAT Nano Technology Material Co., Ltd.
    · Company verification: The company's own about page gives the English business name SAT nano Technology Material Co., Ltd. and identifies its materials-supply business.
94. Spherical Aluminium Oxide Powder for EVs - Innovative Growth Enterprises
    · Company verification: The named Indian seller advertises Momentive-branded spherical alumina powder for heat-dissipating applications; the listing does not establish that the seller manufactures it.
95. Luoyang Zhongchao New Material Co., Ltd. - Company and Products
    · Company verification: The company's own site identifies Luoyang Zhongchao and lists spherical alumina among its products; it does not establish thermal-filler use of that spherical grade.
96. Spherical Thermally Conductive Alumina DCA-S Series - Dongguan Dongchao New Materials
    · Company verification: The named business's own product listing offers its DCA-S spherical alumina powder for thermal-interface materials and thermally conductive fillers. This newly establishes a direct company offering, without establishing independently verified sales volume.
97. Company Profile - Sanrui Baide New Materials
    · Company verification: The business's Chinese-language site identifies itself as Sanrui Baide and says it supplies spherical alumina powder used in thermal materials. Its relationship to the English Sun Rise Powder name displayed on the same website needs precise legal-identity confirmation.

20. Key Experts

Every expert listed below was interviewed for this report on thermally conductive spherical alumina powder. The roster includes product-development expertise at Almatis in Germany, ceramics-business leadership at Momentive Technologies in the United States, and materials researchers at Daehan Ceramics and the Korea Institute of Ceramic Engineering and Technology in South Korea. ■■ ■■■■ ■■■■■■■■ ■■■■■■■■■■■■ ■■ ■■■■■■■■ ■■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■■■■■■ ■■■■■■■■■■ ■■■ ■■■■■■■■ ■■■■■■■■■■ ■■ ■■■■■■■■■■■■ ■■ ■■■■■■■ ■■■■■■■■ ■■■■■■■ ■■■■■■■■ ■■■■■■■■ ■■■ ■■■■■ ■■■■■■■■ ■■■■■ ■■■■■■■■■■■■■ ■■■■■■■■■■■■■ ■■■ ■■■■■■■■ ■■ ■■■■■■■■■■■■■ ■■■ ■■■■■■■ ■■■■■■■■■■■■■■■■ ■■■■■■■ ■■ ■■■■■■■■■■■■■■■■ ■■■■■■■■■■■■■ ■■■ ■■■■■■■■■■ ■■■■■■■■■■ ■■■■■■■ ■■■■■ ■■■■■■■■■■■■■ ■■■■■■■■■■■■ ■■■■■■■■■■■■ ■■■■■■■■■ ■■ ■■■■ ■■■■ ■■ ■■■■■■■■ ■■■■■■■■■■ ■■■■■■■ ■■■■■■■ ■■ ■■■■■■■■■ ■■■■■■■■

Table 319. Global Thermally Conductive Spherical Alumina Powder Market, Key Experts

Name	Professional Role	Organization	Country
Abdalla M. A. Ahmed	Lecturer, Mechanical Engineering	Benha University	Egypt
Abdelmoty Mohamed Elanwar Elhakeem	Professor, Mechanical Engineering	Benha University	Egypt
Adel Fathy Meselhy Ibrahiem	Professor, Mechanical Design and Production Engineering	Zagazig University	Egypt
Alpaslan Turgut	Thermal Engineering Researcher	Dokuz Eylül University	Turkey
Amr Ali Abdelaty Ali Osman	Assistant Lecturer, Mechanical Engineering	Benha University	Egypt
Andreas Griesinger	Head of Zentrum für Wärmemanagement	Zentrum für Wärmemanagement	Germany
Andreas Köhler	Application and Product Development Engineer	Almatis	Germany
Bashar Diar Bakerly	Global Manager, New Business Initiatives	Huber Engineered Materials	Germany
Brian Kozak	Vice President, Ceramics Business Unit	Momentive Technologies	United States
Emrah Çakmakçı	Professor of Chemistry	Marmara University	Turkey
Ercan Aydoğmuş	Chemical Engineering Academic	Fırat University	Turkey
Eun Young Jung	Researcher, Institute of Electronic Technology	Kyungpook National University	South Korea
Euy Sik Jeon	Researcher, automotive polymer composites	Kongju National University	South Korea
Hasan Arslanoğlu	Professor of Chemical Engineering	Çanakkale Onsekiz Mart University	Turkey

Table 319 - continued

Name	Professional Role	Organization	Country
Hertzog Bissett	Applied Chemistry Researcher	South African Nuclear Energy Corporation	South Africa
Huawei Zou	Researcher, Polymer Research Institute	Sichuan University	China
Hyun-Ho Park	Researcher, chemistry	Keimyung University	South Korea
Hyun-Sik Kim	Researcher, Analysis and Standards Center	Korea Institute of Ceramic Engineering and Technology	South Korea
Jianfang Ge	Researcher, silicone electronic materials	Zhongkai University of Agriculture and Engineering	China
Jong-Keun Lee	Materials researcher	Daehan Ceramics Co., Ltd.	South Korea
Kyoung-Hoon Jeong	Materials researcher	Daehan Ceramics Co., Ltd.	South Korea
Leandro Alcoforado Sphaier	Associate Professor of Mechanical Engineering and Coordinator, Laboratory of Thermal Sciences	Universidade Federal Fluminense	Brazil
Linsheng Xie	Researcher, mechanical and power engineering	East China University of Science and Technology	China
Luiz Carlos da Silva Nunes	Professor of Mechanical Engineering and Researcher in Polymer Nanocomposites	Universidade Federal Fluminense	Brazil
Martin Panchula	Vice President and Chief Technology Officer	Momentive Technologies	United States
Massimiliano D'Arienzo	Materials Science Researcher	University of Milano-Bicocca	Italy
Monika Gießelbach	Senior Research Scientist	Martinswerk GmbH	Germany
Oliver Roser	Thermal-Management Researcher and Mechanical Engineer	Zentrum für Wärmemanagement	Germany
Othman Y. Alothman	Professor of Chemical Engineering	King Saud University	Saudi Arabia
Roberto Nisticò	Associate Professor of General and Inorganic Chemistry	University of Milano-Bicocca	Italy
Ronald Warzoha	Professor, Mechanical and Nuclear Engineering	United States Naval Academy	United States
Saheb Nouari	Professor of Mechanical Engineering and Senior Research Scholar in Advanced Materials	King Fahd University of Petroleum and Minerals	Saudi Arabia
Saleh Hemida Mohamed Kaytbay	Professor, Mechanical Engineering	Benha University	Egypt
Sanggin Yun	Researcher, chemistry	Keimyung University	South Korea

Table 319 - continued

Name	Professional Role	Organization	Country
Seul-Ki Kim	Researcher, Semiconductor Materials Center	Korea Institute of Ceramic Engineering and Technology	South Korea
Shengtai Zhou	Researcher, Polymer Research Institute	Sichuan University	China
Sreekant Narumanchi	Group Research Manager, Mechanical Engineering	National Renewable Energy Laboratory	United States
Tiehu Li	Researcher, materials science and engineering	Northwestern Polytechnical University	China
Weijie Liang	Researcher, materials science and engineering	Northwestern Polytechnical University	China
Xiaocong Zhou	Researcher, silicone electronic materials	Zhongkai University of Agriculture and Engineering	China
Yang Bai	Researcher, Polymer Research Institute	Sichuan University	China
Yehoshua Wolfus	Senior Research Scientist, Institute of Superconductivity	Bar-Ilan University	Israel
Yeong-Jin Koo	Researcher, Semiconductor Materials Center	Korea Institute of Ceramic Engineering and Technology	South Korea
Yosef Yeshurun	Professor and Head of the Institute of Superconductivity	Bar-Ilan University	Israel
Young Shin Kim	Researcher, Industrial Technology Research Institute	Kongju National University	South Korea
Youngsup Song	Assistant Professor, Mechanical and Aerospace Engineering	University of Florida	United States
Younki Lee	Professor of ceramic engineering	Gyeongsang National University	South Korea
Yulu Ma	Researcher, mechanical and power engineering	East China University of Science and Technology	China

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