



**Kenospheres®**

**Changing the world,  
one Kenosphere® at a time.**

Brochure



Kenospheres® are alumino-silicate hollow ceramic microspheres that make the impossible to be possible. Imagine a world where cars are lighter, fuel is conserved, and thermal insulation reaches new heights. From advanced construction materials to groundbreaking automotive composites, Kenospheres® deliver performance and innovation like no other.

Picture oil rigs operating more efficiently with reduced environmental impact. Visualize paints and coatings that not only beautify but also insulate, protect, and save energy. These tiny yet mighty spheres are transforming industries and shaping a more sustainable future.

## Redefining What's Possible, Starting Small.

### **Tiny Spheres. Monumental Impact.**

Kenospheres® are crafted from hollow ceramic microspheres derived from coal combustion, embodying nature's efficiency in the simplest form. These free-flowing particles feature thin walls and a high strength-to-density ratio, making them exceptionally lightweight yet durable enough to endure demanding processing conditions. Composed of alumino-silicate ceramics, Kenospheres® are chemically inert, water-resistant, and non-combustible, making them a superior choice compared to irregularly shaped fillers. These microspheres excel in a diverse range of applications. From enhancing the strength and reducing the weight of construction materials like cement and spackling compounds to improving fuel efficiency in automotive plastics, Kenospheres® deliver unparalleled versatility.

They also contribute to advanced solutions in oil and gas operations, such as deep-sea pipe insulation and lightweight drilling fluids, enabling safer and more efficient resource extraction.

Beyond these industrial applications, Kenospheres® elevate products like thermal coatings, soundproofing materials, and even lightweight recreational equipment. Across the globe, Kenospheres® are helping industries increase productivity, tackle new design challenges, and unlock the next generation of sustainable innovations.



# Applications for Kenospheres®



## Construction Materials

- High-performance fillers for paints, coatings, and mastics.
- Additives in preformed concrete, fire-resistant boards, and spackling compounds.
- Essential components in tile backer boards and External Insulation Finishing Systems (EIFS).
- Enhanced thermal insulation in roofing materials and decorative moldings.



## Plastics & Polymers

- Lightweighting in injection molding and extrusion processes.
- Versatile applications in low-density polyethylene, polypropylene, PVC, and nylon.
- Body fillers, adhesives, and polymer/wood composites for robust solutions.
- Improved vibration and soundproofing in automotive and aerospace plastics.



## Energy, Mining, and Oil & Gas

- Buoyancy modules and risers for deepwater applications.
- Syntactic foams for thermal insulation in extreme environments.
- Additives in lightweight cement slurries, drilling fluids, and emulsion explosives.
- Components for deep-sea pipe insulation to enhance operational efficiency.

# The Science of Kenospheres®

The spherical shape of Kenospheres® offers inherent advantages over irregularly shaped mineral fillers or fibers.

## Reduced Binder Demand

Thanks to their minimal surface area relative to volume, Kenospheres® significantly reduce the amount of binder or resin required. This key property results in:

- Reduced raw material expenses.
- Improved flow dynamics during processing.
- Consistent quality in end-use applications.

## Comparative Surface Area of Fillers

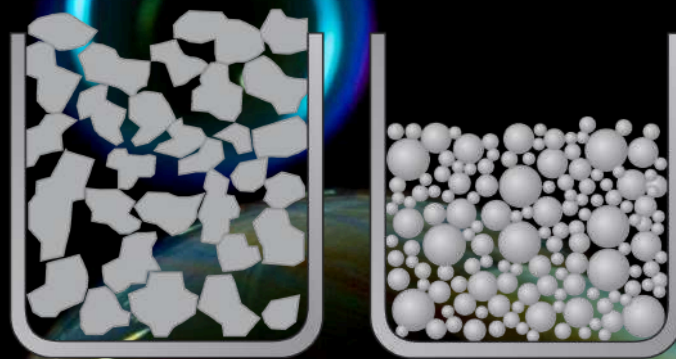
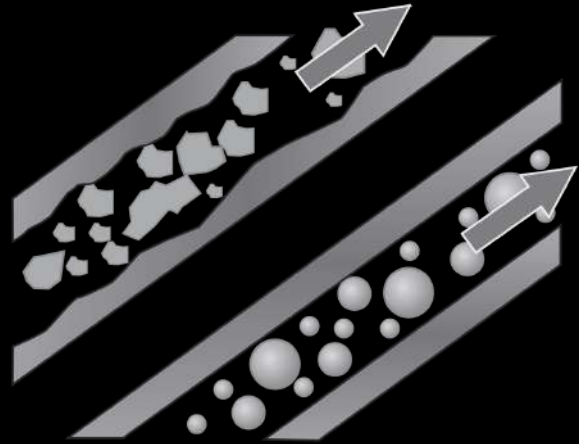
| Filler Product    | Surface Area (m <sup>2</sup> /g) |
|-------------------|----------------------------------|
| Kenospheres®      | 2.0-3.5                          |
| Talc              | 3.2-14.0                         |
| Clay              | 7.0-21.0                         |
| CaCO <sub>3</sub> | 1.0-10.5                         |

## Improved Flow

Due to their spherical structure, Kenospheres® behave like tiny ball bearings, rolling smoothly against one another.

This feature:

- Enhances material flow in production processes.
- Facilitates forming complex geometries in final products.
- Reduces wear on processing equipment.



## Higher Volume Loading

Kenospheres® allow for higher filler loading while maintaining low viscosity.

This leads to:

- Reduced solvent requirements for workable viscosity.
- Minimized shrinkage in applications.
- Significant weight reduction.

## Cost Effectiveness

The lightweight nature of Kenospheres® means they occupy substantially more volume compared to equivalent weights of traditional fillers.

This makes them a cost-effective solution when assessed on a per-volume basis, offering:

- Lower transportation and material costs.
- Enhanced product performance at competitive pricing.

## Densities of Common Fillers

|                     |                         |
|---------------------|-------------------------|
| Barium Sulfate      | 4.50 g/cc               |
| Titanium Dioxide    | 4.17 g/cc               |
| Wollastonite        | 2.99 g/cc               |
| Talc                | 2.80 g/cc               |
| Calcium Carbonate   | 2.71 g/cc               |
| Feldspar            | 2.65 g/cc               |
| Sand                | 2.6 g/cc                |
| Alumina Trihydrate  | 2.42 g/cc               |
| Clay                | 2.20 g/cc               |
| Fumed Silica        | 2.10 g/cc               |
| <b>Kenospheres.</b> | <b>0.75 - 0.92 g/cc</b> |
| Perlite             | 0.15 g/cc               |

# Performance Enhancements

## Performance and Versatility Beyond Lightweighting

Kenospheres® deliver exceptional performance and processing advantages that extend far beyond lightweighting. Their hollow ceramic structure provides a wide range of enhancements tailored to meet the most demanding industrial needs. These microspheres enable innovative solutions that align with specific design goals while offering flexibility across diverse applications.

Kenospheres® contribute to improved material flow, dimensional stability, and thermal properties, ensuring consistent quality and enhanced usability in finished products. By reducing resin demand and facilitating higher filler loading, they not only minimize raw material costs but also enable environmentally sustainable practices. Their versatility ensures that they excel in applications ranging from high-performance coatings to advanced syntactic foams for extreme environments.

Kenospheres® allow manufacturers to explore new possibilities in product design, achieving unparalleled results without compromising on efficiency or functionality.





## Sustainability

Kenospheres® are a byproduct of coal combustion, promoting sustainability by repurposing industrial waste into high-performance materials. Their lightweight nature reduces transportation costs and carbon emissions. Additionally, Kenospheres® are chemically inert, making them compatible with recyclable systems.

## Productivity & Cycle Time

In manufacturing processes like injection molding and extrusion, the low density of Kenospheres® reduces the energy required for heating or cooling. This results in faster cooling times and increased production rates while meeting weight reduction and performance goals.

## Weight Reduction

Kenospheres® are designed to replace heavier fillers in formulations, enabling a significant reduction in the overall weight of products. With a specific gravity ranging between 0.75 and 0.92 g/cm<sup>3</sup>, they help create lightweight components across plastics, coatings, and structural materials. These weight reductions enhance ease of application, transportation, and handling, making Kenospheres® ideal for industries like automotive and construction.

### **Machinability and Sandability**

Kenospheres® enhance the ease of machining and sanding in tooling and composite applications. They improve surface definition, reduce gouging during finishing, and deliver sharp contours and corners in molded or extruded products.

### **Low Permeability and Anti-blocking**

When added to films and coatings, Kenospheres® act as anti-blocking agents, reducing adhesion between layers and improving workability. Their non-absorbent nature minimizes the permeability of materials to gases and liquids, making them ideal for barrier applications

### **Dimensional Stability**

The hollow ceramic structure of Kenospheres® reduces shrinkage and warpage in materials such as spackling compounds, polymer composites, and concretes. Their high filler loading capabilities improve stiffness and dimensional consistency, preventing sink marks and ensuring uniform stress distribution.

### **Water Resistance**

Kenospheres® are inherently water-resistant, maintaining structural integrity in high-moisture or submerged environments. This makes them suitable for applications like marine coatings, underwater adhesives, and water-resistant construction materials.

### **Buoyancy and Marine Applications**

With their low density and high strength, Kenospheres® are ideal for syntactic foams used in buoyancy modules and deep-sea applications. These foams prevent collapse under high-pressure conditions and contribute to net buoyancy in marine equipment and submersibles.





## Thermal Insulation

Kenospheres® offer low thermal conductivity, making them valuable in applications requiring insulation, such as syntactic foams for deep-sea operations or fire-resistant building materials. They also provide a “cool-touch” effect for automotive interiors and improve condensation resistance in paints used in moist environments.

## Surface Appearance

Kenospheres® contribute to a uniform, smooth surface finish in coatings and composites. Their hollow ceramic nature enhances light scattering, producing clean, white surfaces while reducing the need for additional pigments like titanium dioxide (TiO<sub>2</sub>). This property makes them ideal for aesthetic applications in appliances, electronics, and decorative coatings

## Solar Reflectivity

The spherical shape and unique composition of Kenospheres® reflect light effectively in multiple directions. This makes them suitable for applications in reflective coatings, solar diffusing panels, and thermal barriers. Potential uses include greenhouses, roofing materials, and paints designed to minimize heat absorption and maximize energy efficiency

## Noise and Vibration Dampening

Kenospheres® reduce noise and vibration, improving harmonics in products such as automotive components and industrial equipment. This property enhances the acoustic and mechanical performance of materials filled with Kenospheres®.

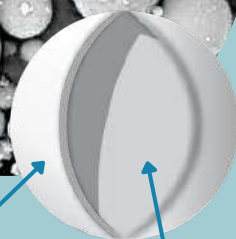
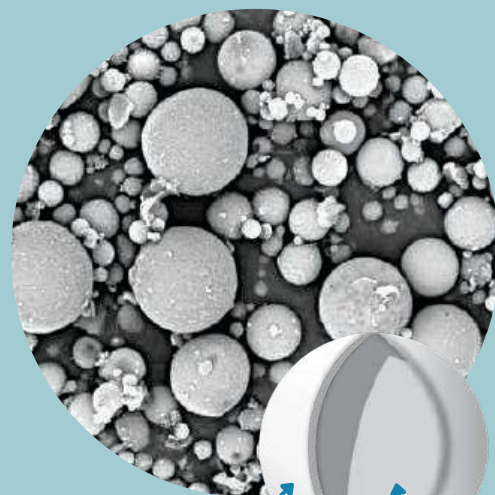
## Dielectric Properties

Thanks to their hollow structure, Kenospheres® exhibit low dielectric constants, making them suitable for applications requiring specific electrical properties. These include printed circuit boards, radomes, and lightweight, insulating packaging materials

## Typical Physical Properties

(Not for specification purposes)

| Property                        | Kenospheres®                                       |
|---------------------------------|--|
| Shape                           | Hollow spheres with thin walls                     |
| Composition                     | Alumino-Silicate Ceramic                           |
| Color, unaided eye              | White or Off - White                               |
| Crush strength (90% survival)   | Up to 5000 psi                                     |
| True density                    | 0.70 – 0.90 g/cm <sup>3</sup>                      |
| Median particle size            | 60 – 400 microns                                   |
| Softening temperature           | ~1200°C (~2192°F)                                  |
| Melting Point                   | ~1550°C (~2822°F)                                  |
| pH Range                        | 7.0 – 9.9  |
| Thermal conductivity            | ~0.1–0.2 W·m <sup>-1</sup> ·K <sup>-1</sup> @ 20°C |
| Dielectric constant (@ 100 MHz) | ~2.0   |



Kenospheres® Base Form

Surface Strength  
up to 5000 psi

Nitrogen or Carbon Dioxide  
negative pressurized

| Product   | Average Diameter (µm) | Particle Size (microns, by volume) |       |                    |
|-----------|-----------------------|------------------------------------|-------|--------------------|
|           |                       | 50th%                              | 90th% | Effective Top Size |
| LGS75     | 34                    | 30                                 | 55    | 100                |
| WS 100    | 73                    | 75                                 | 95    | 125                |
| WS 125    | 85                    | 80                                 | 120   | 150                |
| LGS150    | 85                    | 80                                 | 140   | 300                |
| WS 150    | 95                    | 90                                 | 140   | 250                |
| WS 150UF  | 115                   | 110                                | 140   | 300                |
| LGS 300   | 155                   | 140                                | 280   | 500                |
| WS 300    | 165                   | 150                                | 280   | 500                |
| WS 500    | 175                   | 160                                | 320   | 720                |
| LGS 300UF | 200                   | 190                                | 280   | 500                |
| WCS 300   | 210                   | 200                                | 290   | 500                |
| WS 300UF  | 230                   | 230                                | 310   | 500                |
| LGS-500UF | 370                   | 350                                | 480   | 750                |
| WCS 500   | 340                   | 320                                | 480   | 710                |
| WS 500UF  | 350                   | 340                                | 480   | 720                |
| CS 1200   | 620                   | 580                                | 950   | 1200               |

## Typical Chemical Composition

(Not for specification purposes)

|                                |             |
|--------------------------------|-------------|
| SiO <sub>2</sub>               | 54% - 60%   |
| Al <sub>2</sub> O <sub>3</sub> | 32% - 38%   |
| Fe <sub>2</sub> O <sub>3</sub> | 1.5% - 3.5% |
| TiO <sub>2</sub>               | 0.8% - 2.0% |
| CaO                            | 0.8–2.0%    |
| MgO                            | 0.5–1.0%    |
| MnO                            | 0.1–0.5%    |
| Na <sub>2</sub> O              | 0.3–1.0%    |

## Contact Us for Help.

Not sure which Kenospheres® grade best suits your product or process? Contact us for personalized recommendations. We'll help you select the optimal Kenospheres® to achieve your performance goals.

For more information, visit our website at <https://nanovisionchemicals.com> or reach out to our customer service team via email at [sales@nanovisionchemicals.com](mailto:sales@nanovisionchemicals.com).

## Core Series (CS)

Ideal for broad industrial applications, the Core Series provides a foundational level of quality and performance. These standard-grade microspheres are designed for less demanding conditions, offering a balance of performance and cost-efficiency.

## White Series (WS)

Experience the future with our exclusive White Series Kenospheres®. These pristine white microspheres bring exceptional lightness and durability to a variety of applications, enhancing products with their superior properties and performance.

## White Calcined Series (WCS)

Discover superior performance with our White Calcined Series Kenospheres®. These microspheres, treated for enhanced thermal stability and strength, offer exceptional durability and efficiency. Ideal for high-demand applications, they improve products with superior thermal insulation, buoyancy, and chemical resistance.

## Ultra Fine Series (UFS)

Precision and finesse define our Ultra Fine Series. These microspheres are engineered for specialized applications, offering unparalleled refinement in grain size for high-performance needs.

## Light Grey Series (LGS)

Discover the robust and versatile Light Grey Series. Off-white in color, these microspheres are tailored for industries requiring high-quality, resilient materials that provide consistency and reliability in every use.

### Density Range

**For Lightweight Applications:** Use lower-density Kenospheres® to achieve maximum weight reduction and enhanced buoyancy, ideal for applications in marine and aerospace sectors.

**For Enhanced Strength:** Choose higher-density Kenospheres® when structural integrity and robust strength are essential, particularly in demanding construction and automotive settings.

### Thermal Insulation and Buoyancy

**Maximize Insulation:** Incorporate Kenospheres® in materials to improve thermal insulation, effectively reducing energy consumption in buildings and other structures.

**Optimize Buoyancy:** Select Kenospheres® with lower densities to provide crucial buoyancy in marine applications while maintaining stability.

### Particle Size Selection

**For Smooth Applications:** Utilize finer Kenospheres® for coatings and paints to ensure smooth and uniform finishes.

**For Structural Integrity:** Choose larger particle-sized Kenospheres® for enhancing structural composites and concrete where robust performance is needed.

### Surface Finish Considerations

**Achieve Smooth Finishes:** Employ Kenospheres® that contribute to a sleek surface in aesthetic applications, ensuring products are visually appealing.

**Enhance Rugged Textures:** Use Kenospheres® to create rugged surface textures where additional grip and durability are beneficial.

## General Formulating Information

Kenospheres® can be incorporated into a variety of formulations to enhance product performance and reduce costs.

To optimize the benefits of Kenospheres®, follow these general guidelines:

**-Pre-Blending:** For optimal results, Kenospheres® can be pre-blended with other dry components to ensure even distribution in the formulation.

In cases where they are mixed into liquids, they should be introduced gradually to maintain uniform dispersion and avoid clumping.

**-Mixing Speed:** Use moderate mixing speeds to prevent breakage of the hollow spheres. Gentle mixing ensures structural integrity while achieving uniform dispersion.

**-Binder Compatibility:** Kenospheres® are compatible with most resin systems, including epoxy, polyurethane, and polyester resins. Always verify compatibility in small-scale trials.

**-Loading Levels:** Typical loading levels range from 5% to 40% by volume, depending on the application and desired properties.

For additional technical information on Kenospheres®, visit our website <https://nanovisionchemicals.com/> or contact our customer service team. email: [sales@nanovisionchemicals.com](mailto:sales@nanovisionchemicals.com)



Kenospheres®

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**-Moisture Control:** Store Kenospheres® in a dry environment to avoid moisture absorption, which can affect their performance.

**-Processing Techniques:** Injection Molding: Adjust screw speed and back pressure to minimize shear forces.

**-Extrusion:** Maintain consistent feed rates to ensure uniform distribution.

**-Coatings:** Use a high-shear mixer to disperse Kenospheres® thoroughly for smooth finishes.

### Packaging

Kenospheres are available in the following packaging sizes to suit various industrial needs:

**Big bags:** 500 kg with a plastic liner (up 2 bags stacked per pallet).

**Paper bags:** 20 kg net, on pallets.

### Product Storage

Optimal storage conditions for Kenospheres include keeping them in unopened bags within a dry, temperature-controlled environment. Prolonged exposure to high humidity or conditions prone to condensation may result in "caking" of the microspheres. To minimize caking and maximize storage life, consider the following:

-Promptly reseal opened bags after use.

-If the bag is damaged during shipping or handling, seal the hole immediately or transfer the contents to an undamaged bag.

-During hot and/or humid months, store bags in the driest, coolest space available. -If controlled storage conditions are not available, maintain a minimal inventory and operate on a first-in, first-out basis.

### Handling

Due to the lightweight and small particle size of Kenospheres, dusting may occur during handling and processing. To minimize dusting, consider: -Not opening Kenospheres® packages until ready for use. -Using local exhaust ventilation near the opening to capture airborne particles. -Employing a suction "wand" for transferring to a closed mixing tank, or using dust collection equipment if a closed tank is not available. -Utilizing static eliminators to prevent static buildup.

### Safety

For worker protection, consider: -Wearing safety glasses with side shields.

-Using an air-purifying respirator suitable for particulates after conducting an optional exposure assessment.

-Employing local exhaust ventilation/dust collection in the work area.

-Refer to the Kenospheres® Safety Data Sheet for additional safety information.

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