Other 3M™ Microspheres for specialty coatings

3M™ Ceramic Microspheres are one in a family of 3M microspheres. They have the broadest applications for paints and powder coatings. 3M Glass Microspheres, however, offer enhancements for specialties such as high-build/low-slump coatings, high-risk coatings,lower thermally conductive finishes, and low density roof coatings.

3M™ Microspheres Product Descriptions

<table>
<thead>
<tr>
<th>Product</th>
<th>Target Crush Strength1</th>
<th>True Density2</th>
<th>Particle Size4</th>
<th>Color5</th>
<th>Comments</th>
<th>Application Ideas</th>
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<tbody>
<tr>
<td>K1</td>
<td>250</td>
<td>0.125</td>
<td>30</td>
<td>65</td>
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<tr>
<td>S15</td>
<td>300</td>
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<td>55</td>
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<tr>
<td>S22</td>
<td>400</td>
<td>0.22</td>
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<td>35</td>
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<td>Smaller, tighter particle size range and higher strength than comparable &quot;K&quot; series</td>
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<tr>
<td>S32</td>
<td>2000</td>
<td>0.32</td>
<td>20</td>
<td>40</td>
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<td>Spray applications</td>
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<tr>
<td>S38</td>
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<td>0.38</td>
<td>15</td>
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<td>15</td>
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<tr>
<td>S60HS</td>
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<td>0.60</td>
<td>11</td>
<td>30</td>
<td>White</td>
<td>Strongest glass microsphere</td>
</tr>
</tbody>
</table>

Resources

3M Microspheres are supported by global sales, technical and customer service resources, with fully-staffed technical service laboratories in the U.S., Europe, Japan, Latin America and Southeast Asia. Users benefit from 3M’s broad technology base and continuous attention to product development, performance, safety and environmental issues.

For additional technical information on 3M microspheres in the United States, call 3M Energy and Advanced Materials Division, 800-367-8905. For other 3M global offices, and information on additional 3M products, visit our web site at: www.3M.com

Other 3M™ Microspheres for specialty coatings

For dispersal, use low shear mixing equipment and add during the late downturn stage. The following is an overview of product characteristics.

- **K1**
  - 250 MPa
  - 0.125 g/cc
  - 30% retention
  - White
  - Most economical
- **S15**
  - 300 MPa
  - 0.15 g/cc
  - 25% retention
  - White
  - Specific, higher particle size range
- **S22**
  - 400 MPa
  - 0.22 g/cc
  - 20% retention
  - White
  - Smaller, tighter particle size range and higher strength than comparable "K" series
- **S32**
  - 2000 MPa
  - 0.32 g/cc
  - 20% retention
  - White
  - Spray applications
- **S38**
  - 4000 MPa
  - 0.38 g/cc
  - 15% retention
  - White
  - Spray applications
- **S60**
  - 10,000 MPa
  - 0.60 g/cc
  - 15% retention
  - White
  - High strength
- **S60HS**
  - 18,000 MPa
  - 0.60 g/cc
  - 11% retention
  - White
  - Strongest glass microsphere

**Notes:**
- 1. 90% survival, psi
- 2. g/cc
- 3. ASTM D12-10
- 4. Microns by volume
- 5. Unaided eye

Important Notice to Purchaser:
The information in this publication is based on tests that we believe are reliable. Your results may vary due to differences in test types and conditions. You must evaluate and determine whether the product is suitable for your intended application. Since conditions of product use are outside of our control and vary widely, the following is made in lieu of all express and implied warranties (including the implied warranties of merchantability and fitness for a particular purpose): Except where prohibited by law, 3M’s only obligation and your only remedy, is replacement or, at 3M’s option, refund of the original purchase price of product that is shown to have been defective when you received it. In no case will 3M be liable for any direct, indirect, special, incidental, or consequential damages (including, without limitation, lost profits, goodwill, and business opportunity) based on breach of warranty, condition or contract, negligence, strict tort, or any other legal or equitable theory.
Eight ways to help you reduce costs while enhancing paint and powder coating performance

1. Lower viscosity and improved flow

Under very many highly filled conditions, 3M ceramic microspheres roll easily over each other, reduce flow resistance, and increase volume loading capacity. Smaller spheres may fill voids between larger ones to enhance packing for higher solids/fewer VOCs, and reduced costs.

2. Higher filler loading to reduce costs

With the lowest excess to volume ratio of any shape, 3M ceramic microspheres require lower resin demand and increase volume loading capacity. Smaller spheres may fill voids between larger ones to enhance packing for higher solids/fewer VOCs, and reduced costs.

3. Barrier effect

A tight particle packing, combined with hardness and wear resistance, creates a durable, low-permeation film barrier against weather, corrosion and chemicals.

4. Gloss control

Many glass ceramic materials can increase gloss, but increasing levels of 3M ceramic microspheres can help inordinately lower gloss without significantly increasing viscosity in many applications.

5. Barrier effect

Tight particle packing, combined with hardness and wear resistance, creates a durable, low-permeation film barrier against weather, corrosion and chemicals.

6. Inert and free of crystalline silica

Because of their inert composition, 3M Ceramic Microspheres are resistant to a variety of chemicals. Solid ceramic microspheres are also free of crystalline silica (below microspheres are free).

7. Radiation curable coatings

To help improve productivity and add depth of color for UV curable coatings, 3M Ceramic Microspheres are UV-transparent for 250nm. The microspheres absorb cures from the UV energy through the coating. Gray and white 3M ceramic microspheres also improve UV viscosity and flow blending in 6-Bac coating applications.

8. Standard equipment for dispersing

With high compression strength, 3M ceramic microspheres are best added during the grind. For optimum dispersion, oversize, ball, and roll mills are preferred. Equipment wear has been reported to be less than many irregularly shaped mineral fillers of equal or lower hardness.

<table>
<thead>
<tr>
<th>Ceramic Microspheres Product Descriptions</th>
<th>Product</th>
<th>Target Strength</th>
<th>Flakiness</th>
<th>Inertness</th>
<th>Scrubability</th>
<th>Abrasion</th>
<th>Uniformity of sheen</th>
<th>Flexibility</th>
<th>Scrubability</th>
<th>Durability</th>
<th>Cost reduction</th>
<th>High viscosity</th>
<th>Application Notes</th>
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</tbody>
</table>

- **Cost reduction**
- **Scrubability**
- **Durability**
- **Flexibility**
- **Uniformity of sheen**
- **Cost reduction**
- **Improved hardness with low viscosity**
- **Improved gloss**
- **Improved flow**
- **Consumption resistance**
- **Improved corrosion resistance**
- **Reduced film permeability**
- **Inertness**
- **Reduced film permeability**
- **Improved burnish resistance**
- **Improved hardness**
- **Improved gloss**
Eight ways to help you reduce costs while enhancing paint and powder coating performance

1. Lower viscosity and improved flow
   - Unlike many irregularly shaped fillers, 3M ceramic microspheres roll easily over one another, creating less backflow. This helps to lower viscosity, better flow, and improved processability.

2. Higher filler loading to reduce costs
   - With the lowest surface area to volume ratio of any shape, 3M ceramic microspheres reduce make demand and increase volume loading capacity. Smaller spheres may fill voids better between larger ones to increase packing for higher solids lowers VOCs, and reduced costs.

3. Borkenhagen resistance and hardness
   - Mix 2 hardness and spherical shape contribute to increased burn-in resistance and hardness of the finished surface. Spherical clay rolls easier to save the time and cost of touch-ups or repeating 3M ordinary fillers, and is perfect for journals in the surface otherwise break or wear away.

4. Gloss control
   - Many glass ceramic materials can increase viscosity. But increasing the higher levels of 3M ceramic microspheres can help increase glass without significantly increasing viscosity in most applications.

5. Barrier effect
   - Paints and coatings containing lower VOCs, high solids, and low corrosion resistance. A variety of other regular metal oxides make a physical barrier against harsh environments.

6. Inert and free of crystalline silica
   - Because of their inert composition, 3M Ceramic Microspheres are resistant to a variety of chemicals. Silica ceramic microspheres are also free of crystalline silica (hollow microspheres are not).

7. Radiation curable coatings
   - To help improve profitability and cost savings, use 3M Ceramic Microspheres on UV-curable coatings. With 3M Ceramic Microspheres, 3M is the largest UV-curable coating application. 3M ceramic microspheres also improve UV energy and flow bending in 6-Bian coatings applications.

8. Standard equipment for dispersing
   - With high compatibility strength, 3M ceramic microspheres are best added during the grind. For optimum dispersion, sand, ball and roll mills are preferred. With high compression strength, 3M ceramic microspheres are the best added during the grind.

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**Potential application – UV-curable coatings for increased durability**

- Potting compounds
- Primers
- Adhesives
- Overprints
- Coatings
- Wood coatings
- Industrial coatings

---

**Architectural coatings**

- Durability
- Hardness
- Compatibility
- High solids
- Skin hardness
- Improvement in corrosion resistance
- Improved hardness
- Improved gloss reduction
- Improved UV protection

---

**3M™ Ceramic Microspheres Product Descriptions**

<table>
<thead>
<tr>
<th>Product</th>
<th>Target Viscosity</th>
<th>True Density</th>
<th>Applicability</th>
<th>Comments</th>
<th>Application Area</th>
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---

**3M™ Ceramic Microspheres Series “G”**

- Calcium Carbonate
- Wollastonite

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**3M™ Ceramic Microspheres Series “W”**

- White (medium gloss reduction)
- Gray (medium gloss reduction)
- Black (lowest gloss reduction)

---

**3M™ Ceramic Microspheres Target Viscosities**

- 80,000
- 100,000
- 125,000

---

**3M™ Ceramic Microspheres True Densities**

- 1.8
- 2.0
- 2.5
- 3.0

---

**3M™ Ceramic Microspheres Applications**

- Wood coatings
- Industrial coatings
- Adhesives
- Primers
- Overprints

---

**3M™ Ceramic Microspheres Performance Characteristics**

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<th>Color</th>
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<tr>
<td>Black</td>
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---

**3M™ Ceramic Microspheres Particle Size Distribution**

- 1 Micron by volume
- 2 Microns by volume
- 3 Microns by volume
Eight ways to help you reduce costs while enhancing paint and powder coating performance

1. Lower viscosity and improved flow
   Unlike many irregularly shaped fillers, 3M ceramic microspheres roll easily over one another, similar to ball bearings. This contributes to lower viscosity, better flow, and improved sag resistance.

2. Higher filler loading to reduce costs
   With the lowest surface area to volume ratio of any shape, 3M ceramic microspheres reduce resin demand and increase volume loading capacity. Smaller spheres may fill voids between larger ones to enhance packing for higher solids/lower VOCs and reduced costs.

3. Burr-free resistance and hardness
   Unlike many irregularly shaped fillers, 3M ceramic microspheres roll easily over one another, similar to ball bearings. This contributes to lower viscosity, better flow, and improved sag resistance. (Image)

4. Gloss control
   Many glass-based materials can increase viscosity, but increasingly higher levels of 3M ceramic microspheres can help increase gloss without significantly increasing viscosity in many applications. (Image)

5. Barrier effect
   Tight particle packing, combined with hardness and wear-resistance, creates a durable, low-penetration film barrier against weather, corrosion and chemicals.

6. Inert and free of crystalline silica
   Because of their inert composition, 3M™ Ceramic Microspheres are resistant to a variety of chemicals. Solid ceramic microspheres are also free of crystalline silica (hollow microspheres are not). Because of their inert composition, 3M™ Ceramic Microspheres are resistant to a variety of chemicals. Solid ceramic microspheres are also free of crystalline silica (hollow microspheres are not).

7. Radiation curable coatings
   To help improve productivity and density of cure for UV-curable coatings, 3M ceramic microspheres are used in low as 250nm. The microspheres allow transmission of the UV energy through the coating. They can also be used in E-beam coating applications.

8. Standard equipment for dispensing
   With higher compression strength, 3M ceramic microspheres are best suited during the grind. For optimum dispersion, screw, ball and roll mills are preferred.

---

### 3M Microspheres Product Descriptions

<table>
<thead>
<tr>
<th>Product</th>
<th>Target Strength</th>
<th>True Density</th>
<th>Uniformity of Sheen</th>
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<th>Corrosion Resistance</th>
<th>Humidity Resistance</th>
<th>Weatherability</th>
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### Microspheres

- **Gloss**
  - Nai
  - Moda

- **Spherical**
  - Basic
  - Expect

- **Mastic**
  - Light-colored, industrial and house paints, most thin film coatings

- **Adhesives**
  - Mastics, grouts and powder coatings

- **Sprayable**
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Other 3M™ Microspheres for specialty coatings

3M™ Ceramic Microspheres are one in a family of 3M microspheres. They have been developed for specialty applications in paints and powder coatings. 3M Glass Microspheres, however, offer enhancements for specialties such as high-build/low-slump coatings, intumescent fire coatings, lower thermally conductive finishes, and low density roof coatings.

3M™ Microspheres Product Descriptions

<table>
<thead>
<tr>
<th>Product</th>
<th>Target Crush 1</th>
<th>True Density 2</th>
<th>Particle Size 4</th>
<th>Color 5</th>
<th>Comments</th>
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<tr>
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<td>300</td>
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<td>Caulks, sealants</td>
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<tr>
<td>S22</td>
<td>400</td>
<td>0.22</td>
<td>20</td>
<td>White</td>
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<tr>
<td>S32</td>
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<td>White</td>
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<tr>
<td>S38</td>
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<td>White</td>
<td>High strength</td>
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<tr>
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Resources

3M Microspheres are supported by global sales, technical and customer service resources, with fully-staffed technical service laboratories in the U.S., Europe, Japan, Latin America and Southeast Asia. Users benefit from 3M’s broad technology base and are continuing efforts to product development, performance, safety and environmental issues.

For additional technical information on 3M microspheres in the United States, call 3M Energy and Advanced Materials Division, 800-367-8905.

For other 3M global offices, and information on additional 3M products, visit our web site at: www.3M.com
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<tr>
<th>Product</th>
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<th>Crush Strength1</th>
<th>True Density2</th>
<th>Particle Size4</th>
<th>Color5</th>
<th>Comments</th>
<th>Application Ideas</th>
</tr>
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<tbody>
<tr>
<td>K1</td>
<td>250</td>
<td>0.125</td>
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</tr>
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<tr>
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For dispersal, use low shear mixing equipment and add during the late-stage of product characteristics.

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### China

3M Hong Kong Limited
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### Korea

3M Korea Limited
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### Japan

Sumitomo 3M Limited
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