E-SPHERES®
Hollow Ceramic Microspheres
Welcome to the Big World of Small Spheres

E-SPHERES® - An advanced ceramic substance, designed to enhance the performance and reduce weight of engineered materials. Reshaping our world through spherical ingenuity.
Key properties that make E-SPHERES® unique:

**Unparalleled temperature resistance**
Melting point above 1700 °C
The highest of any hollow ceramic microspheres in the market.

**White colour**
E-SPHERES® SL Series are distinctly whiter than any other hollow ceramic microspheres in the market thanks to their special chemistry.

**Highest compressive strength**
Isostatic pressure tests show over 70% rate of particle survival at 4800 psi (33 MPa). This is more than 30% the compressive strength of other hollow ceramic microspheres of similar density and 20 times higher than expanded glass fillers.

E-SPHERES® hollow ceramic microspheres (HCM) - an advanced functional additive, where each individual particle of almost perfect spherical shape, contributes to enhance key properties in formulated and engineered materials.
An easy solution for demanding performance

**Functional low density**
Bulk density 0.3 - 0.4 g/cc

**Low thermal conductivity**
0.1 W/m°C

**Safe to use**
Non dangerous goods status

**Chemically inert**

**Low rate of oil absorption**
7g/100g*

**Free flowing form improves rheological properties**

**Neutral pH7**

**Acoustic insulation due to vacuum core**

**Hardness**
6 Mohs scale

**GEOMETRY**
A sphere has the minimum surface area to volume ratio of any geometric shape. This maximises the filling properties (volume) and minimises area of contact.

It results in less resin to wet the surface, which is an advantage over most ground and expanded glass and mineral fillers.

* grams of oil per 100g of microspheres
** of the emulsion in water
## Typical chemical composition
### E-SPHERES® SL Series

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon Dioxide SiO₂ (Silica)</td>
<td>55 – 60%</td>
</tr>
<tr>
<td>Aluminium Oxide Al₂O₃ (Alumina)</td>
<td>35 – 40%</td>
</tr>
<tr>
<td>Iron Oxide Fe₂O₃ (Hematite)</td>
<td>0.4 – 0.6%</td>
</tr>
<tr>
<td>Titanium Dioxide TiO₂ (Rutile)</td>
<td>1.4 – 1.6%</td>
</tr>
</tbody>
</table>

*These figures are for general representation only, not for specification purposes*
Did you know that E-SPHERES® typically deliver these benefits in formulated and engineered materials/products?

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>VALUE IN USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density and weight reduction</td>
<td>Volume displacement by low density functional filling material</td>
</tr>
<tr>
<td>Increased stiffness</td>
<td>Due to high compressive strength and optimum filling of interspacial voids</td>
</tr>
<tr>
<td>Improved impact resistance</td>
<td>Owing to its capacity to absorb and disperse energy within the binder matrix</td>
</tr>
<tr>
<td>Resin extension</td>
<td>Less resin or binder needed due to low surface area and spherical geometry of particles</td>
</tr>
<tr>
<td>Reduced shrinkage</td>
<td>Resulting from resin (binder) extension and particle size distribution</td>
</tr>
<tr>
<td>Reduced warpage (dimensional error)</td>
<td>Due to improved dimensional stability, reduced binder and less shrinkage</td>
</tr>
<tr>
<td>Improved thermal insulation</td>
<td>Ceramic composition and hollow structure enhances low thermal conductivity</td>
</tr>
<tr>
<td>High temperature resistance</td>
<td>High melting point, non-combustible nature and stability at high temperatures</td>
</tr>
<tr>
<td>Optimised pigmentation</td>
<td>Reduces white pigments costs and also formulation weight</td>
</tr>
<tr>
<td>Friendly water based formulas</td>
<td>Neutral pH, resulting in less or no need for coated pigments and neutralisers</td>
</tr>
<tr>
<td>Improved durability</td>
<td>Enhanced corrosion resistance and UV stability</td>
</tr>
<tr>
<td>Environmentally friendly</td>
<td>Eco-friendly alternative to polymer based spheres / beads</td>
</tr>
<tr>
<td>Easy formulation</td>
<td>Simple dispersion and incorporation into existing or new formulas</td>
</tr>
</tbody>
</table>

Adding value throughout the life cycle of end products

- Lower formulation costs: Through resin extension and lower weight products
- Transport and packaging costs: Lighter final product weight & less expensive packaging materials needed
- Lower labour and installation costs: Easier handling of materials during production and faster and lighter to install components

Product Range E-SPHERES® SL Series

<table>
<thead>
<tr>
<th>Group</th>
<th>Product</th>
<th>Grade</th>
<th>Approximate Particle Mean [Microns]</th>
<th>Particle Size Range [Microns]</th>
<th>Particle Distribution [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coarse</td>
<td>E-SPHERES® SL Series</td>
<td>SL 500</td>
<td>300</td>
<td>Above 500 180 - 500 Below 180</td>
<td>0 - 20 70 - 100 0 - 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SL 350</td>
<td>300</td>
<td>Above 500 150 - 500 Below 150</td>
<td>0 - 5 75 - 100 0 - 20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SL 300</td>
<td>150</td>
<td>Above 300 150 - 300 Below 150</td>
<td>0 - 1 54 - 100 0 - 45</td>
</tr>
<tr>
<td>Medium</td>
<td>E-SPHERES® SL Series</td>
<td>SLG</td>
<td>130</td>
<td>Above 300 106 - 300 Below 106</td>
<td>0 - 1 64 - 100 0 - 35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SL150</td>
<td>100</td>
<td>Above 150 75 - 150 Below 75</td>
<td>0 - 2 78 - 100 0 - 20</td>
</tr>
<tr>
<td>Fine</td>
<td>E-SPHERES® SL Series</td>
<td>SL125</td>
<td>80</td>
<td>Above 125 38 - 125 Below 38</td>
<td>0 - 2 88 - 100 0 - 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SL75</td>
<td>45</td>
<td>Above 75 Below 75</td>
<td>0 - 2 98 - 100</td>
</tr>
</tbody>
</table>
Adhesives

Transportation and automotive

Insulation / high temperature resistance coatings

Lightweight cementitious and construction products

Refractory, foundry and metallurgical

Sealants, caulks, stucco and fillers

Hand wash cleaners and exfoliating soap
Friction materials
Abrasives
Insulation panels
Composites components and syntactic foam
Electronics
Fibre reinforced plastics
Explosives
Typical Applications by Industry/segment

Composites and Fibre Reinforced Plastics (FRP)

Spray / Hand lay-up:
- Swimming pools
- Bath tubs and spa baths
- Tanks
- Motor vehicle canopies
- Engineered laminates: Campers and RV’s roofs, boats, go-karts
- Signs and artwork

Dough moulding compounds (DMC)
- SMC and BMC compounds
- Motor vehicle components
- Panels and cabinets
- Electrical boxes and cases
- Plastic pallets
- Water management tanks
- Low pressure injection / extrusion

Cold / Hot press moulding
- Engineered plastics
- Bathroom fittings
- Machinery housings

Other FRP applications
- Automotive anti-vibration / acoustic mats and sheets
- Shoe sole ceramic reinforced rubber
- PVC floor coverings
- Mannequins, displays, art and miniature models
- Bullet proof panels

Syntactic foam
- Thermoforming plug assist tooling
- Helicopter and airplane components
- Radar transparent materials
- Acoustically attenuating materials
- Cores for sandwich panels (fillings)
- Blast mitigating materials
- Thermal insulating compounds
**Sealants, putties, adhesives and caulks**
Reduces weight, shrinkage and cracking, improves flow and workability, colour, cost reduction, better nail/screw grip.
- Sealants and high temperature sealants
- Waterproof products
- Acrylic caulks for cement and stucco surface
- Automotive and marine body repair fillers and putties
- Spackle / putties for crack repair
- Jointing paste for plaster and fibre cement wall boards
- Wood putties and fillers
- Acrylic latex grouts for tiles
- Adhesives - mastics, tile adhesives
- High temperature gaskets - engine gaskets
- Latex carpet and artificial grass backing

**Epoxies and Polyurethane**
- Epoxy compounds and fillers
- Wear resistant coatings
- Slip resistant flooring coatings
- Trowel screeds and mortars
- Epoxy adhesives
- Self-levelling floors
- Insulation polymeric flooring

**Refractory and Foundry:**
High melting point (1700 °C), high compressive strength, non-flammable, thermal insulation.
- Foundry coatings or refractory coatings
- Insulating slurry coatings
- Refractory bricks and blocks
- Lightweight castables / mouldables
- Kiln furniture - product supports
- Riser sleeves
- Pre-cast refractory shapes
- Ladle covering compounds or hot toppings
- Backfill for moulds
- Feeder head assemblies
- Monolithic refractory materials

**Electronics:**
- Printed circuit boards
- Electrical and thermal insulators
Advanced Construction Materials

Roof Related Materials
- Roof pointing compounds - ridge-cap grout for tiled roofs
- Roof thermal insulating coatings
- Roof waterproof membranes
- Roof tiles
- Elastomeric roof coatings

Wall Rendering and Finish
- Render compounds
- Texture coatings
- Patching mortar

Flooring
- Grouts
- Self levelling mortar
- Non-Slip coatings - pigmented or clear
- Epoxy screeds and mortars
- Stencil / patterned concrete residential driveways
- Tile adhesives

Architectural moulding, facades and cladding
- Cornices, mouldings, profiles, ceiling, architraves
- Roses, balustrades, pier caps, parapets
- Modular lightweight polymeric facades
- Lightweight concrete - modular concrete facades, fencing, benches, walls, blocks
- Polymer concrete
- Glass reinforced concrete (GRC) panels, planter boxes, flower pots, fountains
- Pour / fill decorative wall cladding (artificial stone panels).

Thermal Insulating and Fire Rated Building Products
- Fire-rated wall and ceiling boards
- Fire-rated door panels
- Insulating infill (sandwich boards)
- Thermal cement based coatings and slurries for refractory
Coatings and Plasters:
Colour, reduces cost, reduces weight, improves rheology, reduces sag/shrinkage, improves thermal insulation and impact resistance, chemically inert and non-absorbent.

- Thermal insulating coatings
- Non-slip coatings
- Epoxy flooring systems
- Chemical resistance coatings
- Intumescent coatings
- Industrial protective coatings
- Elastomeric roof coatings
- Automotive underbody coatings
- Asphaltic surface coatings
- Architectural texture coatings and special effects
- Waterproofing membranes

Cementitious Products:
Reduces weight, slump/shrinkage control, increases thermal insulation and improves flow and pumpability.

- Cement based mortars
- Lightweight concrete pipes and pipe linings
- Repair / patching compounds
- Cement / acrylic grouts
- Joint fillers for fibre cement and plaster walls
- Tile adhesives
- Polymarble and artificial stone
- Cultured marble: Shower bases and vanities
- Casting (poured): artificial granite, kitchen solid surfaces

Friction, Abrasives and Specialty Ceramic Materials
- Brakes blocks for trams and trains
- Brakes pads for motorcycles and automotive
- Motor vehicle, agricultural and construction machinery clutches
- Grinding media and grinding wheels
- Cutting discs
- Sanding (coated abrasives)
- Grinding cups and inserts
- Advanced high temperature ceramics

Cosmetics
- Skin care / exfoliating products
- Soap bars
- Industrial hand wash emulsions and cleansers
# E-SPHERES® SL Series

## Typical Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Form</td>
<td>Free flowing powder</td>
</tr>
<tr>
<td>Individual Particle Shape</td>
<td>Hollow spheres</td>
</tr>
<tr>
<td>Colour</td>
<td>White</td>
</tr>
<tr>
<td>Particle Size</td>
<td>20 – 500 microns</td>
</tr>
<tr>
<td>Relative Density</td>
<td>0.65 – 0.85 g/cc</td>
</tr>
<tr>
<td>Bulk Density</td>
<td>0.3 – 0.4 g/cc</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>4,800 psi (33 MPa)</td>
</tr>
<tr>
<td>Oil Absorption</td>
<td>~ 7g / 100g</td>
</tr>
<tr>
<td>pH of Water Dispersion</td>
<td>7 ±1</td>
</tr>
<tr>
<td>Thermal Conductivity</td>
<td>0.1 W/m/°C</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion</td>
<td>d= 8 x 10^-6</td>
</tr>
<tr>
<td>Melting Point</td>
<td>1600 °C – 1800 °C</td>
</tr>
<tr>
<td>Hardness</td>
<td>6 Mohs scale</td>
</tr>
<tr>
<td>Refractive Index</td>
<td>1.53</td>
</tr>
<tr>
<td>Electrical Resistance</td>
<td>10^-15 ohm</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>0.1% (maximum)</td>
</tr>
<tr>
<td>Floaters by Volume</td>
<td>94% (minimum)</td>
</tr>
</tbody>
</table>

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Please contact Envirospheres or its authorised distributors for more information, technical service and starting point formulas.
Envirospheres is an Australian company focused entirely on the manufacture and supply of the highest quality ceramic microspheres. The company has supplied to domestic and international markets since 1997, and is recognised as a global leader in its field.
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