

## Product Description

Hollow glass microsphere(HGM) is a kind of micron-sized hollow sphere with smooth surface. The main chemical composition is soda lime borosilicate glass. Under the observation of microscope, it is a hollow transparent sphere. HGS has a variety of properties including low density, high compressive strength, low thermal conductivity, electrical insulation, high temperature resistance, acid and alkali resistance, etc., with good fluidity and chemical stability, which is a new kind of versatile frontier material.

HGM applications are of great significance for the performance promotion and optimization of various materials, and also for the lightweight of materials as well as the strategy of energy saving and emission reduction.

### Properties of Hollow Glass Microspheres

Appearance: white powder, good fluidity

Under the Microscope: transparent, hollow, spherical

True Density: 0.12~1.60 g/cm<sup>3</sup>

Bulk Density: 0.10~0.62 g/cm<sup>3</sup>

Particle Size: 1~130 μm

Thermal Conductivity: 0.038-0.085 W/m.K

Max Compressive Strength: 30000 psi

PH: 8~9.5

### Applications of Hollow glass microsphere

Main Applications: Aerospace, 5G Communication, Military Marine, Lightweight Transportation, Building Energy Conservation, Oilfield Cementing, Rubber Plastic Elastomer, Industrial Anti-corrosion, Cosmetics, Sealants and Adhesives, etc.

### Application of Hollow glass microsphere in Sealants and Adhesives

Hollow glass microsphere is lightweight, hollow and high-strength glass spheres. With the highest strength/density ratio, it is suitable for silicone, epoxy, acrylic, polyurethane, synthetic rubber adhesives etc., which offers adhesives a series of excellent performance.

1)Microsphere Effect: minimum specific surface area, low oil absorption value, which reduce the usage amount of resin and make the adhesives have low viscosity, better fluidity and processing performance. Isotropic consistency makes the adhesives with no warpage and shrinkage, which will not be effected by inconsistent stress after processing.

2)Glass Material: it will not react with the base material or other substances as a filler, which is suitable for a variety of systems.

3)Hollow sphere: low density can help to reduce the density and volume cost of adhesives; low thermal conductivity can make the adhesive with sound insulation, heat insulation, low thermal conductivity effect.

4)Micron particle size: it can improve the rheological properties of adhesives while improving the thixotropy; The small microspheres fill the gap of the large microspheres, thus increasing the solid content and reducing VOC. Easy to disperse, no agglomeration.

5)Other features, It makes the adhesives have grinding effect, which improve the wear resistance of resin and improve the dielectric properties of the material.

6)White color, better for color compatibility.

### Application of Hollow glass microsphere in Anticorrosive Coatings

Hollow glass microsphere can be widely used in outdoor coatings with characteristics of

weather ability, sun-proof and heat insulation, automotive coatings, vessel antifouling coatings, anti-corrosion coatings, etc, which play the roles as below.

1)Reduce VOC: In the case of high filler amount, the viscosity of coating did not increase greatly, which can reduce the usage amount of each organic component in coating, so as to reduce the discharge of harmful substances in the process of using coating, effectively reduce VOC index. At the same time, the structure of the sphere determines that it has a small specific surface area and low oil absorption rate, which can reduce the amount of resin, as well as other components.

2)High fluidity: ball structure is similar to ball bearings, which has lubrication effect in paint, thus reducing the viscosity of paint, increase fluidity.

3)Low oxygen/water penetration: Since the size of hollow spheres are widely distributed, it can improve stacking performance, reduce voidage, in this way it slows down the penetration rate, block the circuit channels, isolate H<sub>2</sub>O and O<sub>2</sub> to fail to produce electrolytes, which delay rusting attack time and get good stable long term protection. The particle size of Hollow glass microsphere are micron sized, which prevent the collapse of the coating after drying and improve the dry film thickness, in this way, it delays the arrival of H<sub>2</sub>O and O<sub>2</sub> to the surface of the steel plate.

4)Reduce shrinkage and cracking: spheroid, anisotropic consistency, which reduce the warping and shrinkage of coating film caused by inconsistent stress.

5)Barrier effect and inhibition effect: The dispersion and barrier effect of zinc powder can be improved by adding Hollow glass microsphere inside. Trapping chloride ions, which inhibit and prevent corrosive particles from penetrating down to the surface of the base materials.

#### **Application of Hollow glass microsphere in Building Energy Conservation**

Hollow glass microspheres are widely used in reflective thermal insulation coatings, giving them special functions. The reflective thermal insulation coating becomes a new type of cooling coating, which has the functions of reflection, radiation and thermal insulation. The coating can efficiently reflect the sunlight in the range of 400nm-2500nm, prevent the sun's heat from accumulating on the surface of the object, and can radiate heat and cool down, and radiate the heat of the surface of the object into the air to reduce the temperature of the object. At present, this kind of reflective thermal insulation coating is not only used in military and aerospace equipment, but also widely used in oil pipelines, oil storage tanks, industrial plants, large grain storage silos and other industries.

Excellent performance of Hollow glass microsphere in reflective thermal insulation coatings

1) The reflection ratio of Hollow glass microspheres to near-infrared light is much higher than that of ordinary fillers. It can effectively reduce radiation heat transfer and conduction heat transfer to achieve the purpose of heat insulation.

2) The hollow closed sphere and the tightly arranged Hollow glass microspheres contain dilute gas inside, and its excellent thermal conductivity (0.038 ~ 0.085W/m.K) makes the coating have a very good thermal insulation effect.

3) The spherical structure is similar to a ball bearing, which plays a lubricating role in the paint, thereby reducing the viscosity of the paint and increasing the fluidity.

4) It can adsorb nano-scale fillers, help nano-scale fillers to disperse, prevent their agglomeration and deposition, and make them more uniformly dispersed in the resin emulsion.

#### **Application of Hollow glass microsphere in Rubber and Elastomer**

Hollow glass microsphere is micron sized hollow closed sphere, with low density, high strength, low thermal conductivity characteristics, it has been used in elastomers like rubber with heat insulation, weight reduction and increase resilience functions etc.

#### Lightweight Shoes

Hollow glass microsphere can greatly reduce the weight of shoes, which make shoes more comfortable.

#### Industrial Rubber

As a filler in cable, the skin rubber packing layer of communication optical cable, all kinds of rubber sealing ring, Hollow glass microsphere makes these products own the features of weight reduction, flame retardant, tear resistance.

#### Elastomer Material for Household Goods

As a filler in latex pillows, mattresses, sofas and other household items, Hollow glass microsphere can increase the texture of materials and improve resilience.

#### **Application of Hollow glass microsphere in Tooling Boards**

Hollow glass microsphere are used in tooling boards to improve the processing properties and provide excellent quality assurance for the manufacture of furniture parts, car models, shoe molds, tire molds, architectural models, decorations and sculptures.

1) Adding Hollow glass microspheres can adjust the density of the product and make the tooling board more stable.

2) Compared with ordinary mineral powder fillers, Hollow glass microsphere have better fluidity and dispersibility, which can ensure the dimensional stability of the products, reduce shrinkage and warpage, and enhance the impact strength of the products.

#### **Application of Hollow glass microsphere in Oilfield Cementing**

Application of Hollow glass microsphere in Low Density Drilling Fluid and Cementing Slurry

Advantages of low-density drilling fluid prepared with Hollow glass microsphere

1) Hollow glass microsphere is inorganic non-metal material, which is weakly alkaline and very stable. It can be added to various existing mud systems without reacting with various chemical substances in the mud, which can ensure drilling liquid chemical stability;

2) Low density, high compressive strength, easy to deploy low-density drilling fluid, can be widely used in deep wells, to ensure constant and stable drilling fluid density;

3) Spherical shape, excellent fluidity, perfect lubrication function. These characteristics of Hollow glass microsphere can reduce friction during drilling, prolong the service life of equipment such as drill pipes and drill bits, and greatly improve drilling speed and operation efficiency;

4) The particle size state is easy to be used with the existing drilling equipment, no need to add special equipment, and the Hollow glass microsphere in the drilling fluid can be recycled and reused, reducing production costs.

#### **Advantages of cementing slurry prepared with Hollow glass microsphere**

The low-density and high-strength mud system prepared by adding Hollow glass microsphere is one of the main ways to solve the problem of low-pressure, leak-prone cementing cement slurry leakage and low return. Advantages of cementing slurry prepared with Hollow glass microspheres.

1) Excellent fluidity, easy to mix and pump;

2) Inorganic components, high temperature resistance and high pressure resistance make the mud performance stable;

3) The thickening time can be adjusted according to the construction needs, which is convenient for operation;

- 4) Effectively control the water loss rate and prevent pollution;
- 5) The slurry density is low, the compressive strength is high, and the 24h compressive strength can reach more than 15MPa;
- 6) Improve cementing quality and prolong oil well life.

#### **Application of Hollow glass microsphere in Lightweight Transportation**

Plastics play an important role in the lightweight of vehicles, and further lightweighting of plastic products is also an important issue in technology research and development. Although the currently used foaming method and thinning have achieved some effects, the decline in the physical properties of the material limits its large-scale application. The hollow structure, glass material, micron particle size and other characteristics of Hollow glass microspheres make them a functional lightweight filler, and can also be used in SMC\BMC materials. Adding them to plastics can bring the following characteristic.

- 1) reduce the specific gravity;
- 2) Improve the processing performance of materials;
- 3) Reduce shrinkage and warpage and maintain dimensional stability;
- 4) Improve the rigidity of the material;
- 5) Improve the appearance of the product and solve the problem of floating fiber;
- 6) Improve the surface hardness of the material and enhance the scratch resistance;
- 7) Improve thermal insulation and noise reduction performance;
- 8) Reduce the amount of resin and reduce VOC;
- 9) Improve the flame retardancy and reduce the amount of smoke.

#### **Application of Hollow glass microsphere in Solid Buoyancy Materials**

Equipment in the marine need to provide power to ensure that they work statically or dynamically in the water, and power is very valuable under water. Unpowered buoyancy technology is a relatively effective way to save power and ensure longer-term effective work. a means. The key to the non-dynamic buoyancy technology lies in the solid buoyancy material, which requires low density and stable performance. The density of the buoyant material remains unchanged for every 100 meters of depth in the water. Sustained effectiveness. Hollow glass microspheres have the advantages of low density, high strength, good corrosion resistance and high filling rate, which are very suitable for the preparation of solid buoyancy materials.

Main advantages of Hollow glass microspheres as a lightweight filler for solid buoyancy materials

- 1) Low density, Hollow glass microspheres are one of the lightest fillers;
- 2) High strength, glass ball wall, can be used in deep sea to withstand deep water static pressure;
- 3) Good stability, Hollow glass microspheres are inorganic powders, with stable chemical properties, acid and alkali resistance, high and low temperature resistance and other characteristics;
- 4) The spherical shape reduces the internal stress of the product, so that the product is not easily deformed and has good dimensional stability;
- 5) Smooth surface, smaller specific surface area, low oil absorption rate, higher filling amount in resin.

#### **Application of Hollow glass microsphere in 5G Communication**

5G communication uses millimeter waves, with short wavelengths, poor diffraction ability, and large attenuation during propagation. Therefore, it is necessary to reduce the dielectric constant and dielectric loss of materials to improve signal transmission speed and efficiency,

and reduce delay and loss. Hollow glass microspheres have low dielectric constant and dielectric loss due to their hollow structure, and can be added to the substrate as a low dielectric filler to improve the dielectric properties of the product. It can be widely used in 5G base station and radome, 5G mobile phone middle frame and backplane, Internet of Things equipment and other materials.

Main dielectric properties of Hollow glass microspheres:

- (1) Dielectric constant: 1.2~1.8
- (2) Dielectric loss: 0.003~0.006
- (3) Typical value of particle size D90: 10 $\mu$ m~40 $\mu$ m
- (4) Strength: 16000psi~30000psi

Application Characteristics of Hollow glass microspheres in Aerospace

- 1) low density;
- 2) Low dielectric constant;
- 3) Insulation;
- 4) Prevent material from cracking;

## Specification of Hollow Glass Microspheres

| Product | True Density<br>(g/cm <sup>3</sup> ) | Bulk Density<br>(g/cm <sup>3</sup> ) | Compressive<br>Strength<br>(MPa/psi) | Particle Size<br>( $\mu$ m) |     |
|---------|--------------------------------------|--------------------------------------|--------------------------------------|-----------------------------|-----|
|         |                                      |                                      |                                      | D50                         | D90 |
| OLH20   | 0.20~0.22                            | 0.10~0.12                            | 4/500                                | 65                          | 110 |
| OLH25   | 0.24~0.27                            | 0.13~0.15                            | 5/750                                | 65                          | 100 |
| OLH28   | 0.27~0.30                            | 0.14~0.17                            | 10/1500                              | 55                          | 85  |
| OLH30   | 0.29~0.32                            | 0.15~0.18                            | 10/1500                              | 55                          | 85  |
| OLH32   | 0.31~0.33                            | 0.17~0.19                            | 14/2000                              | 45                          | 80  |
| OLH35   | 0.33~0.37                            | 0.18~0.21                            | 21/3000                              | 40                          | 70  |
| OLH38   | 0.37~0.39                            | 0.19~0.22                            | 38/5500                              | 40                          | 65  |
| OLH40   | 0.39~0.42                            | 0.19~0.23                            | 28/4000                              | 40                          | 70  |
| OLH42   | 0.41~0.44                            | 0.21~0.24                            | 55/8000                              | 40                          | 60  |
| OLH46   | 0.44~0.48                            | 0.23~0.26                            | 41/6000                              | 40                          | 70  |
| OLH50   | 0.48~0.52                            | 0.25~0.27                            | 55/8000                              | 40                          | 60  |
| OLH60   | 0.58~0.62                            | 0.29~0.34                            | 70/10000                             | 40                          | 65  |
| OLH60   | 0.58~0.62                            | 0.29~0.34                            | 83/12000                             | 40                          | 65  |
| OLH60S  | 0.58~0.63                            | 0.30~0.34                            | 125/18000                            | 35                          | 55  |
| OLHS20  | 0.20~0.22                            | 0.10~0.12                            | 7/1000                               | 60                          | 90  |
| OLHS22  | 0.21~0.24                            | 0.11~0.13                            | 8/1200                               | 45                          | 70  |
| OLHS38  | 0.37~0.39                            | 0.19~0.22                            | 38/5500                              | 30                          | 50  |
| OLHS42  | 0.40~0.44                            | 0.21~0.24                            | 55/8000                              | 25                          | 40  |
| OLHS46  | 0.44~0.48                            | 0.22~0.25                            | 110/16000                            | 20                          | 30  |
| OLHS60  | 0.58~0.62                            | 0.29~0.33                            | 193/28000                            | 16                          | 25  |
| OLHS65  | 0.63~0.67                            | 0.31~0.35                            | 207/30000                            | 13                          | 20  |
| OLHS70  | 0.68~0.72                            | 0.33~0.37                            | 207/30000                            | 10                          | 15  |