

3M Advanced Materials

3M™ Glass Bubbles K Series, S Series, iM Series

Introduction

3M™ Glass Bubbles are engineered hollow glass microspheres that are alternatives to conventional fillers and additives such as silicas, calcium carbonate, talc, clay, etc., for many demanding applications. These low-density particles are used in a wide range of industries to help customers reduce part weight, replace other fillers such as talc or CaCO₃ and enhance product properties.

The unique spherical shape of 3M™ Glass Bubbles offers a number of important benefits, including: higher filler loading, lower viscosity/improved flow and reduced shrinkage and warpage. It also helps the 3M™ Glass Bubbles blend readily into compounds and makes them adaptable to a variety of production processes including spraying, casting and molding.

The chemically stable soda-lime borosilicate glass composition of 3M™ Glass Bubbles provides excellent water resistance to create more stable suspensions. They are also non-combustible and nonporous, so they do not absorb resin. And, their low alkalinity gives 3M™ Glass Bubbles compatibility with most resins, stable viscosity and long shelf life.

3M™ Glass Bubbles K, S and iM Series are specially formulated for a high strength-to-density ratio.

This allows greater survivability under many demanding processing conditions, such as injection molding. They also produce stable voids, which results in low thermal conductivity and a low dielectric constant. 3M™ Glass Bubbles are available in a variety of sizes and grades to help you meet your product and processing requirements.

Chemical Resistance

In general, the chemical properties of 3M™ Glass Bubbles resemble those of a soda-lime borosilicate glass.

Thermal Conductivity

Conductivity increases with temperature and product density. The thermal conductivity of a composite will depend on the matrix material and volume loading of 3M™ Glass Bubbles.

Thermal Stability

Softening occurs in formulations with 3M™ Glass Bubbles above 1112°F (600°C) depending on temperature and duration of exposure.

Packing Factor

(Ratio of bulk density to true particle density)

Averages about 60%.

Oil Absorption

0.3-0.5 g oil/cc of 3M™ Glass Bubbles.

Volatile Content

Typically 0.3 percent by weight.

Alkalinity

Typically 0.3 milliequivalents per gram.

pH

Because 3M™ Glass Bubbles are a dry powder, pH is not defined. The pH effect will be determined by the alkalinity as indicated above. When 3M™ Glass Bubbles are mixed with deionized water at 5 percent weight loading, the resulting pH of the slurry is typically 9.5, as measured by a pH meter.

Dielectric Constant

Typically ranges from 1.2 to 2.0 at 2.5 GHz, based on the product density. Values were measured according to ASTM D2520.

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Typical Properties* (Not for specification purposes)

Grade of 3M™ Glass Bubbles	True Density	Isostatic Pressure			Minimum Survival	Particle Size (µm)				Thermal Conductivity** W/m•K at 70°F, 21°C
	g/cc	psi	MPa	Bar	(Vol%)	D10	D50	D90	Effective Top Size (D95)	
K11	0.110	200	1.4	14	80%	36	66	105	120	0.045
K1	0.125	250	1.7	17	80%	30	65	100	115	0.047
K15	0.15	300	2.1	21	80%	30	60	95	115	0.055
K15HSN	0.15	600	4.1	41	80%	25	40	65	80	0.055
S15	0.15	300	2.1	21	85%	25	55	90	100	0.055
K20	0.20	500	3.5	35	80%	30	52	85	100	0.070
K20HS	0.20	750	5.2	52	90%	20	50	80	80	0.070
S22	0.22	400	2.8	28	80%	20	35	60	75	0.076
K25	0.25	750	5.2	52	80%	25	55	95	105	0.085
S28HS	0.28	3000	21	210	90%	18	30	50	60	0.095
S32LD	0.29	1500	10	100	80%	20	40	75	85	0.098
S32	0.32	2000	14	140	80%	20	40	75	80	0.108
S32HS	0.32	6000	41	410	90%	14	22	34	45	0.108
S32HSN	0.32	6000	41	410	90%	16	26	40	50	0.108
S35	0.35	3000	21	210	80%	17	37	48	58	0.117
K37	0.37	3000	21	210	80%	20	45	85	95	0.124
S38	0.38	4000	28	280	80%	15	48	75	85	0.127
S38HS	0.38	5500	38	380	80%	17	45	66	83	0.127
S38XHS	0.38	5500	38	380	90%	20	42	67	80	0.127
K42HS	0.42	7500	52	520	90%	11	22	35	41	0.138
S42XHS	0.42	8000	55	550	90%	11	22	35	41	0.138
K46	0.46	6000	41	410	80%	15	40	70	80	0.153
S60	0.60	6000	41	410	90%	15	34	55	65	0.200
iM16K	0.46	16000	110	1100	90%	10	20	33	38	0.153
S60HS	0.60	18000	124	1240	90%	11	25	50	60	0.200
iM30K	0.60	27000	186	1860	90%	9	18	25	29	0.200

* Not for specification purposes

** Calculated thermal conductivity values listed in the table are for individual 3M™ Glass Bubbles particles only and are suitable for calculations to predict thermal conductivity of formulations.

Appearance

Off-white, powdery.

Flow

3M™ Glass Bubbles will remain free-flowing for at least two years from the date of manufacture when stored in the original, unopened container following the recommended storage conditions. For bulk deliveries, the material will remain free-flowing for at least one year from the date of manufacture when stored under recommended relative humidity conditions.

Labeling

3M™ Glass Bubbles will be packaged in suitable containers to help prevent damage during normal handling and shipping. Each container will be labeled with:

1. Name of manufacturer
2. Grade of 3M™ Glass Bubbles
3. Lot number
4. Quantity in pounds/kilograms

Storage and Handling

To help ensure ease of storage and handling while maintaining free flowing properties, 3M™ Glass Bubbles have been made from a chemically stable glass and are packaged in a heavy-duty polyethylene bag within a cardboard container.

Minimum storage conditions should be unopened cartons in an unheated warehouse.

Under high humidity conditions with an ambient temperature cycling over a wide range, moisture can be drawn into the bag as the temperature drops

and the air contracts. The result may be moisture condensation within the bag. Extended exposure to these conditions may result in “caking” of the 3M™ Glass Bubbles to various degrees. To minimize the potential for “caking” and prolong the storage life, the following suggestions are made:

1. Carefully re-tie open bags after use.
2. If the polyethylene bag is punctured during shipping or handling, use this bag as soon as possible, patch the hole, or insert the contents into an undamaged bag.
3. During humid summer months, store in the driest, coolest space available.
4. If good storage conditions are unavailable, carry a minimum inventory, and process on a first in/first out basis.

3M™ Glass Bubbles breakage may occur if the product is improperly processed. To minimize breakage, avoid high shear processes such as high speed Cowles™ Dissolvers, point contacts hear such as gear pumps or 3-roll mills, and processing pressures above the strength test pressure for each product.

Health and Safety Information

Dusting problems may occur while handling and processing. For worker protection, please consider the following:

1. Safety glasses with side shields are recommended. An exposure assessment may be needed to decide if a respirator is required.
2. Use with appropriate local exhaust ventilation/dust collection in the work area.
3. Pneumatic conveyor systems have been used successfully to transport 3M™ Glass Bubbles without dusting from shipping containers to batch mixing equipment. Static eliminators should be used to help prevent static charges.
4. Diaphragm pumps have been used to successfully convey 3M™ Glass Bubbles. Vendors should be consulted for specific recommendations.

Refer to the 3M™ Glass Bubbles Safety Data Sheet for additional safety information.

Additional Information

3M™ Glass Bubbles 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 continuing attention to product development, performance, safety and environmental issues.

For additional technical information on 3M™ Glass Bubbles in the United States, visit our web site at: www.3M.com/glassbubbles.

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