

3M Science.
Applied to Life.™

► 3M™ Glass Bubbles

The start to a better finish

Taking your construction material formulations
from good to great

Tiny bubbles. Big impact. No extra effort.

From family homes to large industrial plants, paints and coatings as well as cement applications like façade plaster or mortar are the first line of protection for the buildings that shelter our businesses and lives. Weathering the elements year after year – while keeping down initial and long-term costs – requires the right materials.

3M™ Glass Bubbles provide a high performance alternative to conventional fillers in a variety of paints and specialty coatings. These glass microspheres are helping you lower your formulation weight and viscosity. They contribute to a variety of benefits for your formulations ranging from improved performance to solar reflectivity and thermal insulation.

Easy to apply, they can be utilized across the construction market segment. Continue reading to find out more about:

- ▶ Environmental impact
- ▶ Applications
- ▶ Benefits

Reduce CO2 emissions and increase energy efficiency in buildings with better insulation systems.



Challenge

Insulation systems are vital in renovations as well as new building structures, however, conventional insulation systems present some challenges:

- ▶ Recycling
- ▶ Fire protection
- ▶ Aesthetics and interior/exterior use
- ▶ Long term stability
- ▶ Algae growth



Solution

A 3M customer has developed a dry mortar façade insulation system containing the microscopic and highly heat-insulating 3M™ Glass Bubbles. These tiny hollow glass spheres, used in your own specific formulation, can result in a purely mineral, resource saving material, that can be sprayed onto the façade.

- ▶ Highly thermal-insulating
- ▶ High productivity and low weight
- ▶ High stability and strength
- ▶ Non-flammable
- ▶ Ease of application

3M is your powerful partner to fight unnecessary energy consumption.

3M™ Glass Bubbles can enable environmentally relevant processes and technologies depending on the formulation of customer specific finished products:

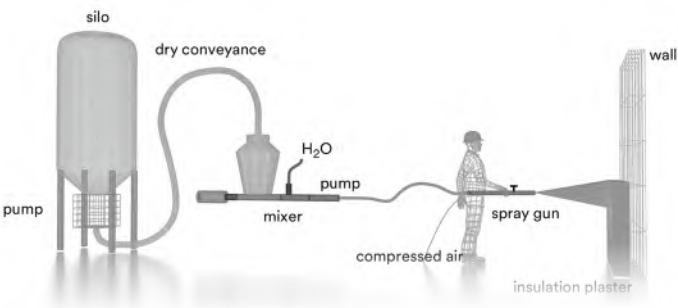
Innovative and sprayable insulation technologies

3M™ Glass Bubbles can help improve insulation values of existing, old, and new buildings.

- ▶ 100% mineral based
- ▶ Recyclable, saving resources
- ▶ Extended lifetime
- ▶ Lightweight
- ▶ Improving healthy living by enabling water vapor permeability of an insulated house
- ▶ Easy handling for improved working conditions on construction site

Simplify End of Life (EOL) management

Disposing of insulation material when it reaches its EOL can be challenging and costly. 3M™ Glass Bubbles do not contain any environmentally harmful substances and can provide a fully mineral solution in insulation concepts. Using 3M™ Glass Bubbles as a filler in material systems such as insulation plaster would not require the incorporation of organic materials, making it easily disposable at EOL.



Typical physical properties of 3M™ Glass Bubbles

Property	3M™ Glass Bubbles
Shape	Hollow spheres with thin walls
Composition	Soda-lime-borosilicate glass
Color, unaided eye	Off-white, powdery
Crush strength (90 % survival)	250 – 27,000 psi/17 – 1,880 bar
True density	0.125 – 0.60 g/cm³
Median particle size	18 – 65 microns
Softening temperature	F: 600 C / 1112 F
Thermal conductivity	0.05 – 0.20 W/m.K (at F: 20C / 68 F)

Typical Applications



Solar heat reflective paint

- ▶ Helps increase total solar reflectance
- ▶ More comfort and potential energy savings from AC use
- ▶ Helps prevent damage of EPS base ETICs



Anti-condensation paint

- ▶ Helps repel condensation
- ▶ Helps reduce moisture build-up and mold growth
- ▶ For use in bathrooms, kitchens, basements, garages



Comfort paint

- ▶ Warm-feel/low-effusivity
- ▶ Helps reduce temperature gradient



Spackle/wall filler

- ▶ Airless spraying
- ▶ No shrinkage
- ▶ Easy to apply
- ▶ No cracks even with nails and screws
- ▶ Easy to sand



Thermal protective coating

- ▶ Helps reduce surface temperature
- ▶ Assist in corrosion prevention under insulation



Caulks/Sealant

- ▶ Low shrinkage
- ▶ Easy to apply



Insulation mortar

- ▶ Interior and exterior
- ▶ Thermally insulating
- ▶ Nonflammable
- ▶ Good water vapor transmission
- ▶ High yield



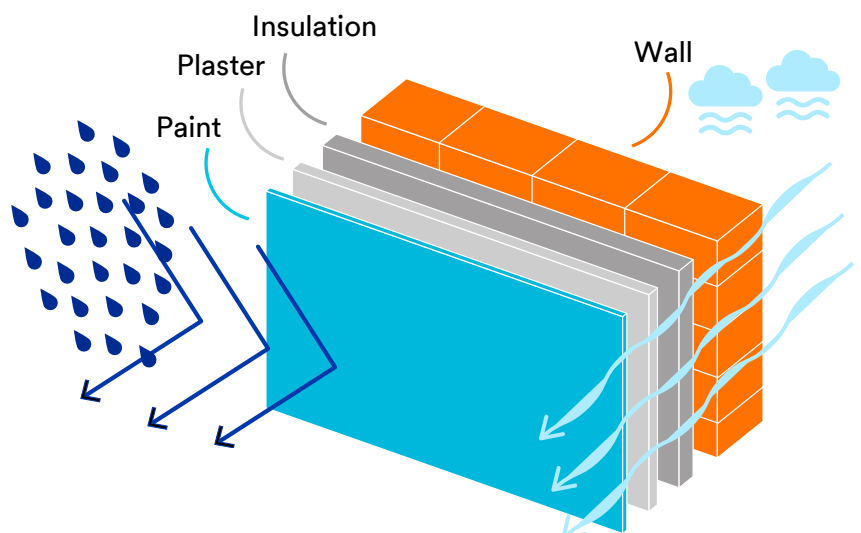
Tile adhesives ready-mix/dry mortar

- ▶ Helps improve performance
- ▶ Easy to carry and apply
- ▶ Helps with musculoskeletal issues



High build façade paints and plaster

- ▶ Helps increase dry thickness
- ▶ Less cracks
- ▶ Helps increase water vapor transmission



Tiny bubbles. Big impact.

Potential benefits of 3M™ Glass Bubbles in construction materials.



Solar heat reflectivity

The spherical shape of 3M™ Glass Bubbles reflects light effectively in all directions. Their unique optical properties make 3M™ Glass Bubbles useful for solar reflective films, building materials, paints and coatings. Potential applications include greenhouses, exterior walls, roof coatings, outdoor storage, or refrigerated tanks.



Thermal insulation

The addition of 3M™ Glass Bubbles to formulations can decrease thermal conductivity, depending on the grade and amount of microspheres used. By using 3M™ Glass bubbles as a high volume filler, highly insulating materials with unique properties can be manufactured.



Weight reduction

3M™ Glass Bubbles are used to reduce the density of materials – improving handling, application process, and properties.



Condensation/mold reduction

The use of 3M™ Glass Bubbles allows formulators to make low density and highly thermally insulating paints below the critical pigment volume concentration, which in turn helps produce durable paints with longer condensation times.



Dimensional stability

3M™ Glass Bubbles decrease the shrinkage of materials, reducing rework, and the number of working cycles. Due to their low density, compounds filled with 3M™ Glass Bubbles are less prone to sagging.



Sandability

Eased sandability with less gouging and clogging of tools is seen in wall-fillers or similar materials filled with 3M™ Glass Bubbles compared to materials filled with conventional fillers.



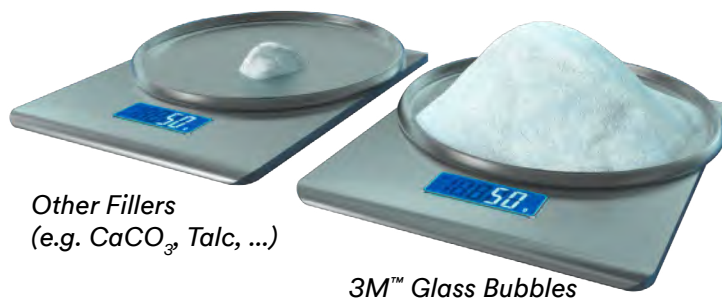
Nail and screw acceptance

Driving screws or nails into materials filled with 3M™ Glass Bubbles will lead to virtually no cracks.



Water and chemical resistance

3M™ Glass Bubbles are made of soda-lime borosilicate glass, which is a true glass with inherently greater water and chemical resistance than other hollow glass microspheres made of sodium silicate glass, also known as water glass.



*Other Fillers
(e.g. CaCO_3 , Talc, ...)*

3M™ Glass Bubbles

Specific surface area

Filler Product	Density	Surface Area (m ² /cc)
3M™ Glass Bubbles K1	0.125 gm/cc	0.24 m ² /cc
Talc	2.7 gm/cc	21.6 m ² /cc
Clay	2.2 gm/cc	37.8 m ² /cc
CaCO ₃	2.7 gm/cc	15.5 m ² /cc

The low surface area properties of 3M™ Glass Bubbles can help in the reduction of resin demand meaning less resin is required to wet the surface.

Improved flow

Because of their spherical shape, 3M™ Glass Bubbles behave like tiny ball bearings, easily rolling over one another. This can help improve the flow of many materials to which 3M™ Glass Bubbles are added.

Higher volume loading

Because they help enable lower resin demand, 3M™ Glass Bubbles can also allow higher filler loading at equivalent viscosities. That can mean less solvent is needed to maintain a workable viscosity, resulting in lower shrinkage and significant weight reduction in certain applications.

For hydrocarbon based solvent systems this may result in a relatively low VOC system.

Reduced binder demand

The sphere offers the least surface area per volume of any shape. That allows 3M™ Glass Bubbles help reduce binder demand in a variety of applications – while also helping lower raw material costs.

Grade selection guide for construction, paints and coatings

Product name	True density	Crush strength		Particle size (by volume) μm			Effective top size
	g/cm^3	psi	bar	d10	d50	d90	d95
K1	0.125	250	17	30	65	110	120
K15	0.15	300	21	30	60	105	115
S15	0.15	300	21	25	55	90	95
S22	0.22	400	28	20	35	60	75
K20	0.20	500	34	30	65	110	120
K20HS	0.20	750	52	25	60	100	110
K25	0.25	750	52	25	55	95	105
S28HS	0.28	3,000	210	20	30	50	55
K37	0.37	3,000	210	20	40	80	85
S38	0.38	4,000	280	15	40	75	85
S38HS	0.38	5,500	385	15	40	75	85
S32HS	0.32	6,000	420	14	25	35	47

Materials	K1	K15	S15	S22	K20	K20HS	K25	S28HS	K37	S38	S38HS	S32HS
Anti-condensation paint	✓	✓	✓	✓	✓	✓	✓	—	—	—	—	—
Comfort paint	✓	✓	✓	✓	✓	✓	—	—	—	—	—	—
Acoustic materials	✓	✓	✓	✓	✓	✓	—	—	—	—	—	—
Solar heat reflective paint	—	—	—	✓	✓	✓	✓	✓	✓	✓	✓	✓
High build façade paints and plaster	—	—	—	✓	✓	✓	✓	✓	✓	✓	✓	✓
Thermal protective coating	✓	✓	✓	✓	✓	✓	✓	—	—	—	—	—
Spackle/wall filler (interior)	✓	✓	✓	—	✓	✓	—	—	—	—	—	—
Spackle/wall filler (airless spraying)	—	—	—	—	—	—	✓	✓	—	—	✓	✓
Insulation mortar	✓	✓	—	—	✓	✓	—	—	—	—	—	—
Tile adhesives (ready-mix/dry mortar)	✓	✓	—	✓	✓	✓	—	—	—	—	—	—
Caulks/sealant	—	✓	✓	✓	✓	—	—	—	—	—	—	—

3M™ Glass bubbles in the application table above are suggested grades and will depend on the specific mixing and application process. Please consult with 3M Application Engineer for the final selection.

For further examples of white papers and case studies of 3M™ Glass bubbles in the Construction, Paints & Coatings segment please visit our website: https://www.3M.com/3M/en_US/paints-coatings-us/glass-bubbles/

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3M Center

St. Paul, MN 55144 USA

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