

Science.
Applied to Life.™

▶ 3M™ Glass Bubbles

The start to a better finish

Taking your construction material formulations from good to great

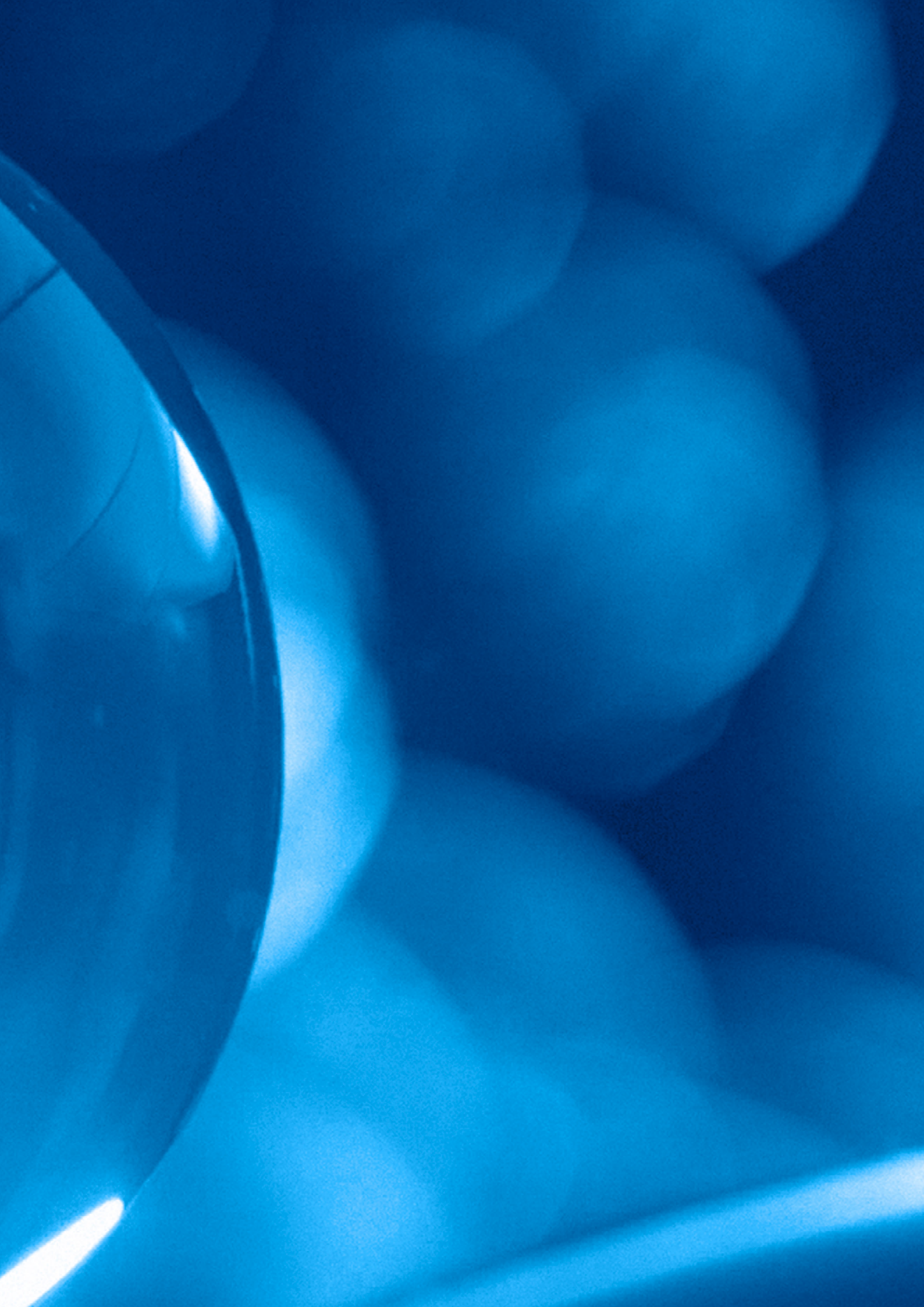
Tiny bubbles. Big impact. No extra effort.

From family homes to large industrial plants, paints and coatings as well as cement applications like facade 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 hollow glass microspheres are used as density-reducing additives, helping lower formulation weight and viscosity. They contribute a variety of functional benefits ranging from scratch resistance to solar reflectivity.

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

- Environmental impact
- Success stories
- Applications
- Benefits



Reduce emissions and increase energy efficiency in buildings to achieve climate targets

Only one percent of the building stock in Europe is currently energetically renovated every year, according to the UN environment programme's "2022 Global Status Report for Building and Construction" – too little to achieve the climate protection goals. The European Commission has therefore launched the "Renovation Wave" initiative, with the aim of at least doubling the renovation rate in the next ten years. According to the Building Energy Act, which came into force on November 1, 2020, new buildings must adhere to high standards of thermal insulation and energy efficiency.

Insulation systems are central to achieving these goals



Challenge
Insulation systems are vital in renovation, however, conventional insulation systems present some challenges:

- Recycling
- Fire protection
- Optics and flexibility
- Long term stability
- Algae growth



Solution
A 3M customer has developed a dry mortar facade 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 facade.

- Highly thermal-insulating
- High productivity and low weight
- High stability and strength
- Non-flammable
- As a raw material – opens the possibilities for sustainable solutions
- Ease of application

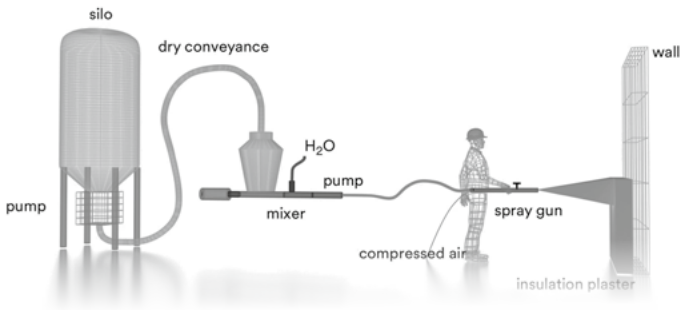
3M is your powerful partner to fight unnecessary energy consumption.

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 to improve insulation values of existing, old, and new buildings

- 100 % mineral based
- Recyclable, saving resources
- Expanded 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, unsided 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	600 °C
Thermal conductivity	0.05 – 0.20 W/m.K (at 20 °C)

Success Story:
Protecting the aesthetics of a historic building

"We had to find an alternative solution to deal with extreme humidity of 60 - 85 % on site and very high exposure to solar irradiation. 3M™ Glass Bubbles offer an optimal, more sustainable, combined solution."

-Roland Weber,
Architect, Bureau DUO Sóller,
Mallorca, Spain

Specialist paints incorporating 3M™ Glass Bubbles have been used to sympathetically renovate a villa set in the protected area of Sóller, Mallorca.

In contrast to new buildings where there are strict requirements around energy efficiency when it comes to renovating existing properties - especially those in protected areas - the focus is on aesthetics.

Apart from these visual aspects of a renovation, protection of the environment and natural resources are also a factor. These days, innovative sustainable solutions are increasingly being requested by discerning clients; for example, to act as a barrier against solar radiation and to reduce condensation, preventing the formation of mold.

For further examples of success stories visit 3m.co.uk/GBinConstruction.



Before



After

Applications

Solar heat reflective paint
- Increase of total solar reflectance
- More comfort and energy saving from AC use
- Prevent damage of EPS based ETICs

Anti-condensation paint
- Retard condensation
- Reduction of moisture build-up and mold growth
- Suitable for use in bathrooms, kitchens, basements, garages

Comfort paint
- Warm-feel/low-effusivity
- Reduction of temperature gradient
- Improved home comfort

Spackle/wall filler
- Airless spraying feasible
- No shrinkage
- Easy to apply
- No cracks even with nails and screws
- Easy to sand

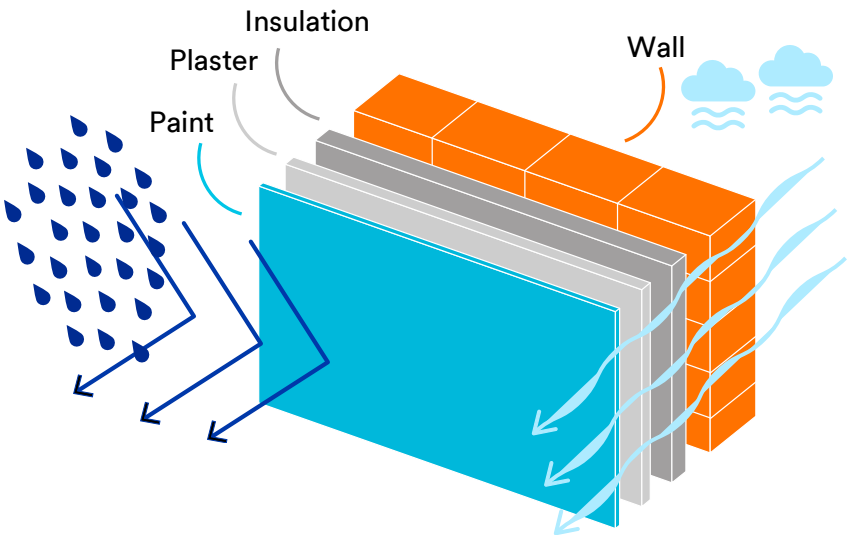
Thermal protective coating
- Reduce surface temperature
- Personal burn protection
- Prevent corrosion under insulation

Caulks/Sealant
- Low shrinkage
- Easy to apply

Insulation mortar
- Interior and exterior
- Thermally insulating
- Incombustible
- Good water vapor transmission
- High yield

Tile adhesives ready-mix/dry mortar
- Improved performance
- Easy to carry and apply
- Prevents musculoskeletal problems

High build facade paints and plaster
- Increased dry thickness
- Less cracks
- Increased 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 greenhouse, exterior walls, roof coatings, outdoor storage, or refrigerated tanks.

Thermal insulation

The addition of 3M Glass Bubbles to a material system can decrease the thermal conductivity, depending on the grade and amount of microspheres used. By using large filler loads of 3M Glass Bubbles, highly insulating materials with unique properties can be manufactured.

Weight reduction

3M Glass Bubbles are used to reduce the density of materials – improving handling, applying 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.

Productivity increase

3M™ Glass Bubbles may help to improve the application process and therefore improve productivity, reduce cost, and decrease the physical strain of workers.

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 not lead to 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, ...)

Glass Bubbles

Specific surface area

Filler Product	Surface Area (m^2/g)
3M™ Glass Bubbles	1.9 – 2.7
Talc	3.2 – 14
Clay	7.0 – 21
$CaCO_3$	1.0 – 10.5

The low surface area properties of 3M Glass Bubbles aid 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 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 to help reduce binder demand in a variety of applications – for 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/cm³	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 facade paints and plaster	–	–	–	✓	✓	✓	✓	✓	✓	✓	✓	✓
Thermal productive coating	✓	✓	✓	✓	✓	✓	✓	–	–	–	–	–
Spackle/ wall filler (interior)	✓	✓	✓	–	✓	✓	–	–	–	–	–	–
Spackle/wall filler (airless spraying)	–	–	–	–	–	–	✓	✓	–	–	✓	✓
Insulation mortar	✓	✓	–	–	✓	✓	–	–	–	–	–	–
Tile adhesives (ready-mix/dry mortar)	✓	✓	–	✓	✓	✓	–	–	–	–	–	–
Caulks/sealant	–	✓	✓	✓	✓	–	–	–	–	–	–	–

For further examples of white papers, case studies, and success stories of applications of 3M™ Glass Bubbles in the construction segment visit our education portal.

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General recommendations on health and safety in processing, on work hygiene and on measures to be taken in the event of accident are detailed in our "safety data sheets (SDS)."

The present edition replaces all previous versions. Please make sure and inquire if in doubt whether you have the latest edition.

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