Global support for your business

When you work with 3M, you'll have access to new and unique materials solutions, knowledgeable technical and applications support, and a reliable global supply chain. 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.

For more information, including formulation assistance, optimization of material handling or questions about a specific application, contact your 3M technical representative. Users benefit from 3M's broad technology base and continuing attention to product development, performance, safety and environmental issues.

Visit us online to download technical papers, read application profiles, watch videos and more!

3M.com/AutoGlassBubbles

We've got technical service down to a science.

3M wants to help you succeed in leveraging 3M Glass Bubbles in automotive applications. Our application engineers are available to consult at every step in the automotive value chain to help optimize your process.

We offer:

- Application consultation and product grade selection
- Formulation assistance
- Processing and handling optimization

Customer Service

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Potential applications

4 Injection molded thermoplastics

5 Sheet/bulk molding composites (SMC/BMC)

6 Seam sealants and underbody coatings

7 Emerging applications in 5G & Electrical Connectors

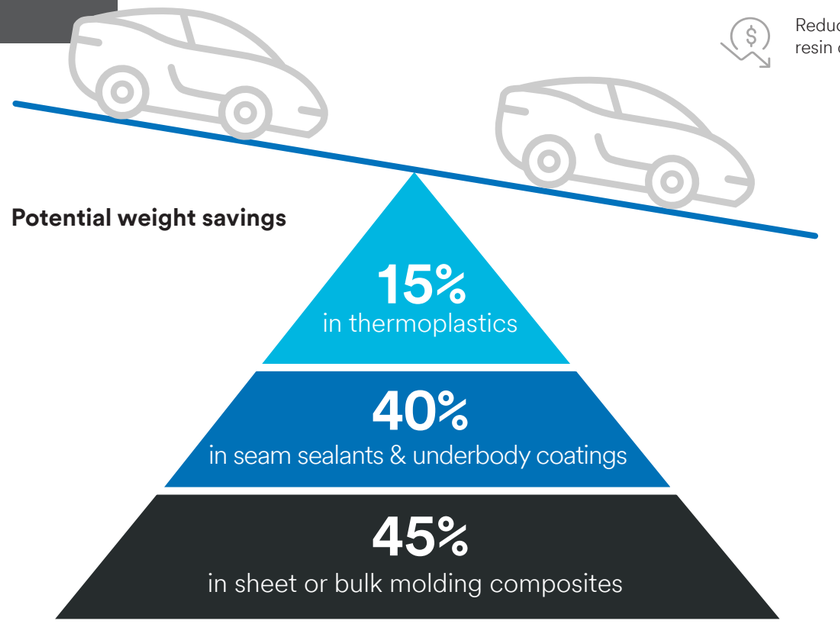
Lower weight. Higher performance.

In the transportation industry, reducing weight is an important design requirement. That's why more and more suppliers of components used in vehicle manufacturing are taking advantage of the lightweighting and performance enhancing capabilities of 3M™ Glass Bubbles.

These high-strength, low-density hollow glass microspheres enable weight reductions in many automotive applications – including injection molded plastics, composites, SMCs/BMCs, plastisols and more. 3M Glass Bubbles can improve dimensional stability; acoustic and electrical insulation; thermal conductivity; and the ability to deliver a Class A surface finish. 3M Glass Bubbles also deliver during production. They can help you reduce cost by displacing costly resins. Unlike irregularly shaped mineral fillers, they help you reduce equipment wear when plastisols are applied to the vehicle.

Benefits 3M Glass Bubbles can bring to OEM Engineers & Material processors include:

- Lightweighting and sustainability
- Dimensional stability improvement
- Thermal management
- Cycle time reduction
- Noise and vibration management
- Dielectric property improvement
- Aesthetic Class A surface finish
- Reduced resin costs



The use of 3M Glass Bubble-filled plastics can shed pounds or kilograms per vehicle, to help OEMs achieve fuel economy and emissions reduction targets.

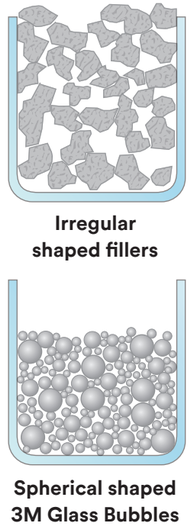
3M™ Glass Bubbles for Automotive Applications

The science of the spheres

3M™ Glass Bubbles are finely dispersed, free-flowing powders consisting of thin-walled hollow glass microspheres. Made of soda-lime-borosilicate glass, 3M Glass Bubbles are chemically inert, nonflammable and water resistant.

- High strength-to-density ratio
- Free-flowing nature provides low viscosity build
- High filler loading reduces resin demand and helps you lower raw material cost

Because spheres have the lowest surface area to volume ratio of any shape, 3M Glass Bubbles pack tightly for high filler loading.



Property	3M™ Glass Bubbles
Shape	Hollow spheres with thin walls
Composition	Soda-lime-borosilicate glass
Color, unaided eye	Off-white, powdery
Crush strength*	250–28,000 psi 17–1,930 bar 1.7–193 MPa
True density**	0.125–0.60 g/cc
Median particle size	18–65 microns
Softening temperature	600°C (1112°F)
Thermal conductivity (@20°C)	0.05–0.20 W/(m*K)
Dielectric constant (@100 MHz)	1.2–1.9

*3M internal QCM
**Helium Gas Pycnometer

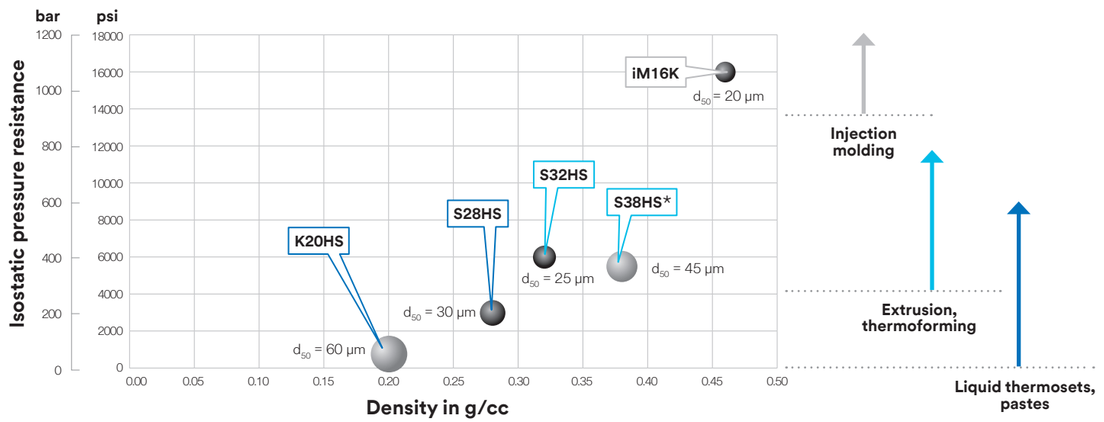
The above values refer to different grades of the product portfolio offering.

Lightweighting in more places than ever

3M Glass Bubbles are offered in a range of high performance grades. So instead of metal or heavy PVC-based underbody coatings, lightweight parts and coatings can now be used in many more areas of the automobile. 3M Glass Bubbles are used in SMCs/BMCs, thermoplastics, sealants and structural foams as well as LFT, RIM, RRIM and lightweight body fillers.

Isostatic pressure resistance vs. density

The bubble size represents the average particle size (d50)



*Measured at 80% survivability. All others at 90%.

3M™ Glass Bubbles for Injection Molded Thermoplastics

Injection molded thermoplastics

3M is one of the only known manufacturers to offer high-strength, low-density hollow glass microspheres that can withstand harsh compounding and injection molding processes. Take 3M™ Glass Bubbles iM16K for example: this grade features a compressive strength of 16,000 psi (1,100 bar) at a density of just 0.46 g/cc and a particle size of 20 µm (diameter D50).

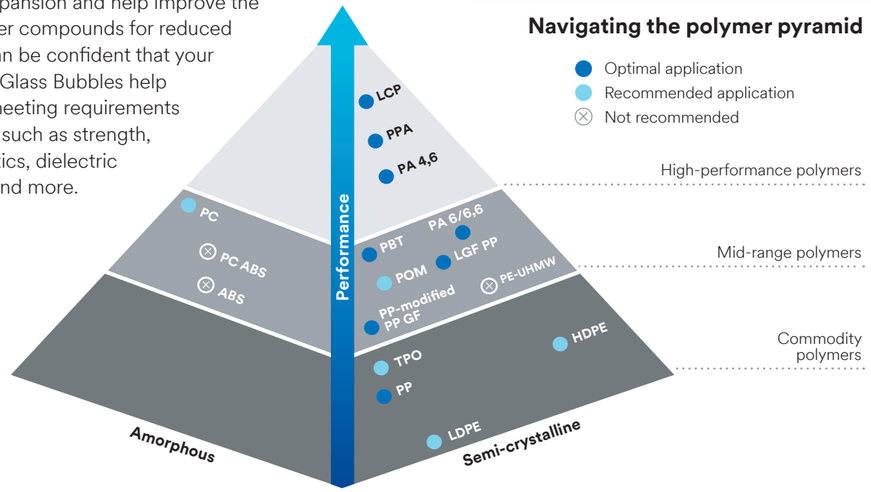
That's just the start. Compared to conventional fillers used in PP, PA, PC/ABS and other thermoplastics, 3M Glass Bubbles allow more flexibility for producing light, dimensionally accurate parts. They enable lower linear thermal expansion and help improve the dimensional stability of polymer compounds for reduced shrinkage and warping. You can be confident that your thermoplastic parts using 3M Glass Bubbles help reduce vehicle weight while meeting requirements for a wide range of properties such as strength, process requirements, aesthetics, dielectric performance, lightweighting and more.

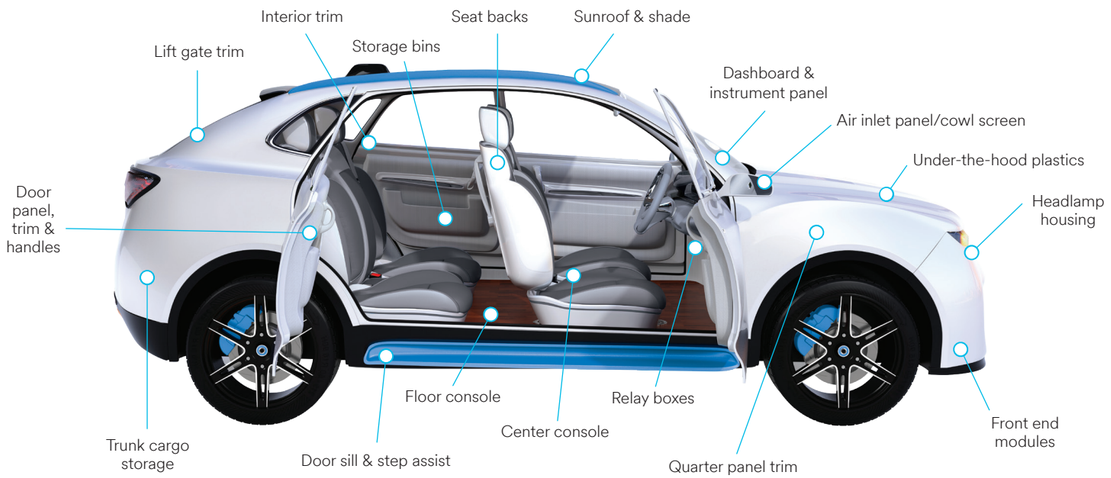
TIP: 3M™ Glass Bubbles lead to greater weight reduction when replacing high-density fillers. When reducing density by displacing resin, they provide a better benefit when used in higher-performing, higher-cost polymers.

Advantages 3M Glass Bubbles may help you achieve:

- Reduce weight by up to 15%
- Increase productivity with 15-25% faster part cooling in the mold
- Reduce shrinkage and warpage
- Improve glossiness and aesthetics
- Improve low-frequency acoustic insulation
- Improve thermal insulation
- Improve signal transfer efficiency

Navigating the polymer pyramid





3M™ Glass Bubbles for SMC/BMC

Sheet molding and bulk composites

A typical automobile has about 300 kg (661 lbs) of composite parts. That's a lot of weight, especially when electric and high efficiency vehicles are becoming more popular. The solution: integrating 3M™ Glass Bubbles. Now, ultralightweight sheet molding and bulk molding composites that contain 3M Glass Bubbles can withstand the compression or injection molding process despite their low density.

Ultralightweight SMC/BMC parts can be up to 45% lighter vs. standard composites – with no reduction in dimensional stability. They can even be more cost effective than aluminum or steel. Best of all, 3M Glass Bubbles can enable Class A paintable surface finishes. So SMCs and BMCs are now suitable for parts such as hoods, trunk lids, body panels, battery enclosures and more.

Emerging Application: SMC Battery Enclosures

To reduce weight of heavy battery packs in electric vehicles, composite materials, like SMC, are being used as the enclosure or cover in place of steel or aluminum. This opens up new opportunities for lightweighting with 3M Glass Bubbles.

Advantages 3M Glass Bubbles may help you achieve:

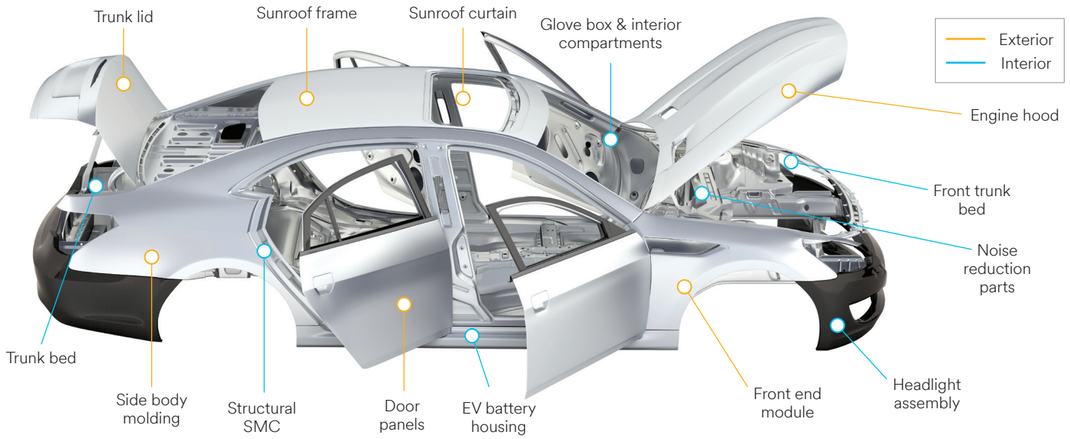
- Reduce weight by up to 45%
- Enable Class A paintable surface finish

Lightweight with 3M™ Glass Bubbles **1.8 kg / 4.0 lbs**

Standard density **2.5 kg / 5.5 lbs**

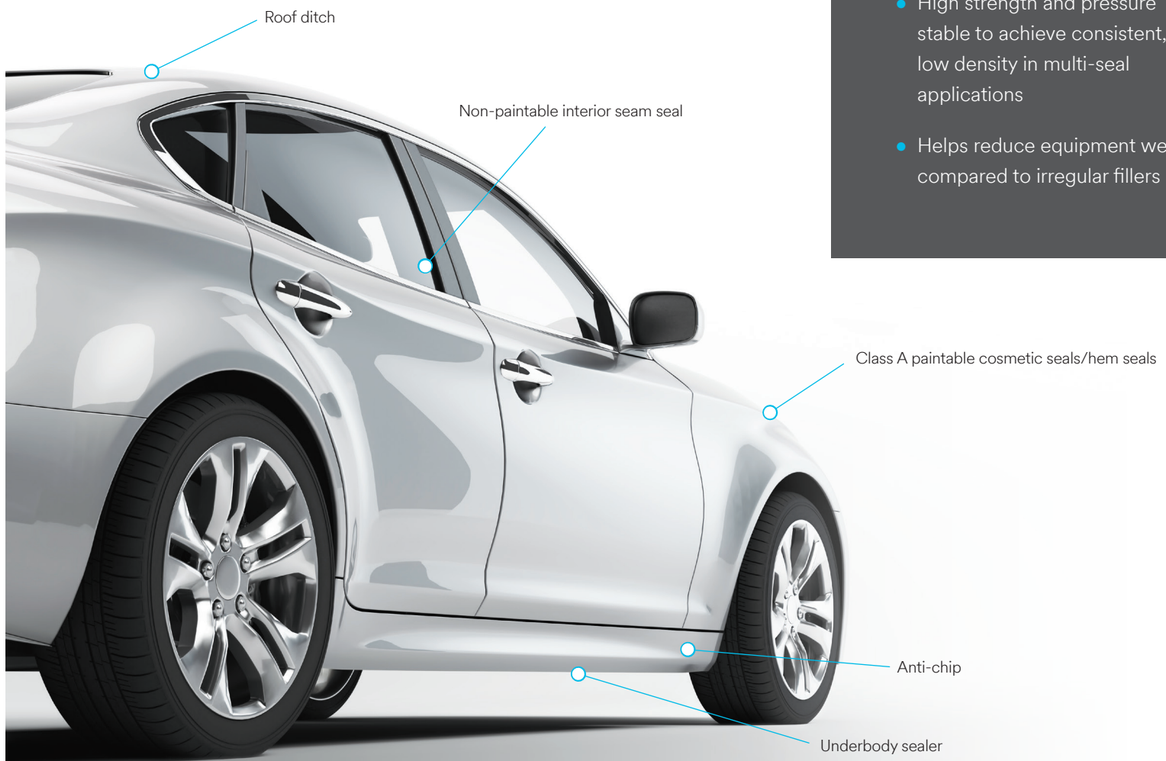
Taking weight reduction to the next level

With the addition of our newest grades of 3M Glass Bubbles, molders, compounders and automotive OEM manufacturers now have more options to tailor the composite weight for specific requirements – down to **less than 1.0 g/cc.** That's equivalent to a weight saving of up to **45%!**



Sealants and underbody coatings

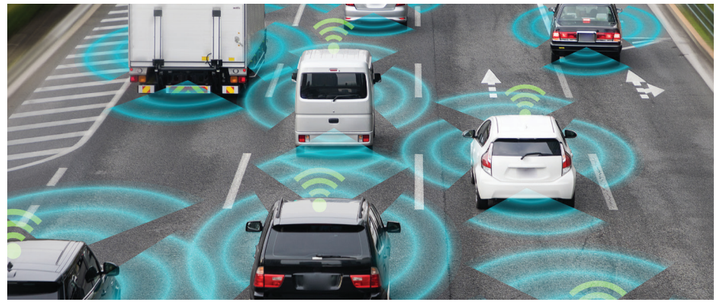
Developed specifically for plastisol production today and tomorrow, 3M™ Glass Bubbles can reduce the weight of plastisols used in seam sealants and underbody coatings by up to 40% – even higher if the coatings are applied using precision automated equipment. This contributes to lower overall vehicle weight, helps OEMs and automotive designers meet increasingly-stringent industry and government standards and helps them improve battery range and life in electric and hybrid vehicles. Best of all, 3M Glass Bubbles can enable durable, lightweight coatings with a Class A paintable finish.



Advantages 3M Glass Bubbles may help you achieve:

- Reduces plastisol weight up to 40%
- Allows increased volume loading while maintaining desired viscosity
- Low aspect ratio enables faster wettability and dispersion
- Produces surfaces that are easily skived (trimmed to desired thickness)
- Can reduce sag on vertical applications
- High strength and pressure stable to achieve consistent, low density in multi-seal applications
- Helps reduce equipment wear compared to irregular fillers

5G connected electronics

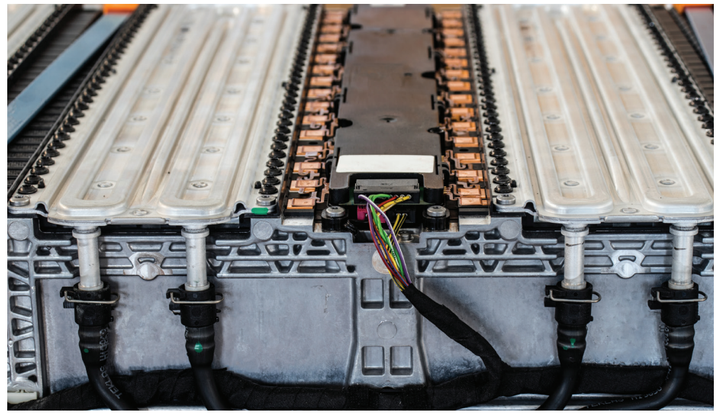


More and more, our vehicles are connected, increasing the number of signals sent and received. Low-loss plastics and composite materials can help you optimize the signal. 3M™ Glass Bubbles deliver excellent dielectric properties in a variety of resin systems and applications, enabling a higher signal transfer in 5G Components.

Advantages 3M Glass Bubbles may help you achieve:

- Improved dielectric properties
- Improved sensor performance
- Enhanced signal strength
- Weight reduction
- Thermal management

Battery potting resins



3M Glass Bubbles are an easy way to bring thermal insulation properties to battery thermal management solutions and can help cut resin costs, all while reducing part weight by 15% to 40%. Used in battery potting resins, their low viscosity build is excellent for consistent fills even at high loadings.

Advantages 3M Glass Bubbles may help you achieve:

- Formulate for excellent thermal management components in EV battery applications
- Fill small crevices even at high loadings for potting resins around cylindrical EV battery cells
- Weight reduction