SILICONE RUBBER

WITH EXPANDABLE MICROSPHERES

Make one- and two-component systems light and uniform

OVERVIEW

Product Type
Expanded microspheres
Unexpanded microspheres

Main Benefits
Controlled & uniform pore structure
Low shrinkage
Reduced weight

Applications
Binding building materials
Coatings
Core compounds
Extrusion
Moulds
Seals

Expandable Microspheres

Expandable microspheres can be used in **1-** and **2-component silicone rubber** systems, ones that vulcanise at **room temperature** and ones that vulcanise at **high temperatures**.

Using the microspheres makes it possible to produce silicone rubber at a reduced cost with reduced weight and a uniform, closed-cell structure.

Cost savings can be made by replacing expensive silicone rubber with microspheres. Spheres expanded to a density of 0.025 g/cm3 equate to 40 litres per kilo of spheres, where considerable cost savings can be made at additions of 1% w/w.

Reducing weight to give a very lightweight product is easy to achieve due to the ultra-light density of the microspheres.

The **uniform, closed cell structure** in the final product is a result of the microspheres being distributed throughout the depth of the matrix and their shell remaining intact through processing.

Processing

Curing agents, mixing and density reduction

Sphere Vulcanisation

There are some **limitations** when using expandable microspheres in silicone rubber. The most important is the **discolouration** of the microspheres' thermoplastic shell when **exposed** to **high temperatures** for a **long** period of **time**.

For **high-temperature vulcanisation** (HTV), **dry unexpanded microspheres** are the recommended choice, with grades available in different particle sizes and with different expansion temperatures and durability at high temperatures. In **light colours**, if the microspheres are exposed to high temperatures for a long time, for example, when post-curing the silicone rubber, discoloration may be observed. These spheres can be mixed in silicones that need heat to vulcanise. The **starting temperature** for expansion of the microspheres needs to **match** the **curing temperature** of the curing agent used. The spheres should expand before or at the same time as the curing of the silicone starts.

For **room-temperature vulcanisation**, **dry expanded microspheres**, a free-flowing powder with high compressibility, should be used. Expanded microspheres can be mixed with **1-** or **2-component** systems with no heat needed to obtain weight reduction from the silicone rubber. Free-flowing or paste-like silicone can be mixed with 2-4 phr (parts per hundred of resin, w/w) of dry expanded spheres to give 35–60% v/v, depending on addition level and grade. The maximum addition depends on the initial viscosity of the silicone. A lower initial viscosity allows a higher addition level of the spheres.

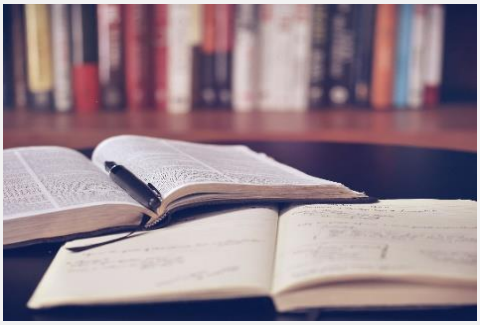
Dicumyl peroxide starts to cure silicone at 165°C, microspheres used must have a higher heat durability after the expansion.

Bis-(2.4 dichlorobensoyl) peroxide starts to cure at 100°C and requires microspheres which start to expand ~90°C. Spheres with a higher starting expansion temperature would be hindered due to the strong cross-linking of the silicone.

Hydrogen functional poly-siloxane with platinum catalyst, or other curing agents that start to cross-link silicones between 100 to 140°C work with spheres with a low starting expansion temperature.

Solid silicones and **microspheres** can be **mixed** using a dough mixer or roll mill, equipped with a cooling system to keep mixing temperature below 50°C. In **coating applications** with a drying process, adding a solvent as a softener makes mixing easier.

Density reduction in high molecular weight, high temperature vulcanising, silicones can be achieved but is limited in light colours due to discolouration, dark colours are unaffected. In HTV silicones, density reductions of **up to 70%** with a 4 phr addition of unexpanded microspheres.



What's Next?

Further Reading

Our **Technical Guide – Expandable Microspheres** takes an in depth look at the properties of expandable microspheres. A great introduction if you are new to the world of expandable microspheres.

Find out about using expandable microspheres in extrusion and injection moulding in our **Application Guide – Thermoplastics with Expandable Microspheres**.

You can also discover how unexpanded microspheres are use in our **Application Guide –Rubber with Expandable Microspheres**.

Do you need help **choosing the right grade** for your application, **more information** or a **sample** to try?

We are always happy to help and answer any questions you may have. Please do not hesitate to contact us:

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