Application note

Mixing masterbatches - guidelines for mixing a barium sulfate masterbatch into a silicone product

Silicone elastomers are commonly utilized for their highly compressible and permeability characteristics. Due to their unique chemistry which results in a large amount of free volume within the polymer/filler matrix, silicones are ideal candidates for incorporating additional fillers or additives. These additives can ultimately provide a variety of useful benefits which may result in aesthetic, functional or therapeutic effects.

ADDING THE MASTERBATCH

One such method for incorporating a filler into a formulated silicone is via a masterbatch. A masterbatch is a highly filled or concentrated component. The filler is typically compounded into a functional polymer to ensure compatibility with the silicone system to be utilized. The example below uses a barium sulfate masterbatch. The amount of masterbatch to be added can be calculated based on the percentage of barium sulfate ($BaSO_4$) in the master batch and the ultimate desired loading of $BaSO_4$ in the final elastomer formulation. The following equation is applicable to liquid silicone rubbers (LSRs):

$$\text{Desired\% } BaSO_4 = \frac{X}{Y + \left(\frac{1}{\text{(Concentration of Masterbatch)}}\right) X}$$

Where "Y" = the unit amount (in this case, grams) of silicone, "X" = the unit amount of $BaSO_4$ in the master batch.

In this example, a 75% barium sulfate masterbatch will be added to 100 grams of silicone for a 15% $BaSO_4$ loading.

In Step 1, "X" is solved for as 18.75. In Step 2, this value is divided by the percentage of $BaSO_4$ in the master batch (75%) to yield the amount of $BaSO_4$ needed to produce the desired formulation of 15% $BaSO_4$ per 100 grams of silicone:

Mixing Masterbatches

Weighing out small amounts of material allows for more control of component concentrations. Excessive mixing may generate too much heat, potentially resulting in a loss of inhibitor and reductions in work time or other properties. In some cases, unused mixed silicone can be frozen and reused within a certain time of mixing. Reference the Standard Material Certification for "Work Time" or other pot life parameters to determine time between mixing and application. For instructions on mixing and de-airing silicone masterbatch products, see NuSil's Mixing and De-airing Addition Cure Silicones Application Note.

Step 1.

$$0.15 = \frac{X}{100 + \left(\frac{1}{0.75}\right) X}$$

$$0.15 = \frac{X}{100 + 1.33X}$$

$15 + 0.2X = X$ (0.1995X Rounded up to 0.2X)

$15 = 0.8X$ or $X = 18.75$

Step 2.

$$\frac{18.75}{0.75} = 25$$

To achieve 15% barium sulfate loading, add 25 grams of masterbach to every 100 grams of elastomer.

24523-GM-KK

0320 Lit. No. 931040W