

# Mixing Masterbatches

Guidelines for mixing a barium sulfate masterbatch into a silicone product

## Application Note

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 ( $\text{BaSO}_4$ ) in the master batch and the ultimate desired loading of  $\text{BaSO}_4$  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  $\text{BaSO}_4$  in the master batch.

In this example, a 75% barium sulfate masterbatch will be added to 100 grams of silicone for a 15%  $\text{BaSO}_4$  loading.

In Step 1, "X" is solved for as 18.75. In Step 2, this value is divided by the percentage of  $\text{BaSO}_4$  in the master batch (75%) to yield the amount of  $\text{BaSO}_4$  needed to produce the desired formulation of 15%  $\text{BaSO}_4$  per 100 grams of silicone:

Step 1.

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

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

$$15 + 0.2X = X \quad (0.1995X \text{ Rounded up to } 0.2X)$$

$$15 = 0.8X \quad \text{or } X = 18.75$$

Step 2.

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

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

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](#).

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