Increasing silicone's resistance to thermal degradation

BACKGROUND

Silicones can withstand high temperatures for extended periods of time; however, thermal degradation remains a concern. Depending on the application and requirements of the end user, thermal degradation may be combated by the incorporation of phenyl into the polymer structure or the addition of a thermal stability additive (filler). The incorporation of both phenyl and fillers will provide the best resistance to thermal degradation; however, fillers would not be an option for transparent material. As an alternative, increasing phenyl content would then be necessary in transparent materials to provide resistance to thermal degradation.

METHOD

The effects of both filler addition and phenyl incorporation were studied by analyzing physical properties of silicones before and after a heat treatment of 6 hours at 260° C on material typically used for liquid injection molding. All samples evaluated in this study were two-part platinum systems reinforced with silica and had varying levels of phenyl and the inclusion of filler or no filler (See Table 1 below).

Materials Tested

Material designation	Phenyl content	Thermal stability additive
Sample A (control)	None	None
Sample B	Low	None
Sample C	High	None
Sample D	None	Yes
Sample E	Low	Yes
Sample F	High	Yes

FIGURES 1-4: Below show the percent change in physical properties tested prior to and following heat treatment (6 hours @ 260° C), for each combination of phenyl content and filler.

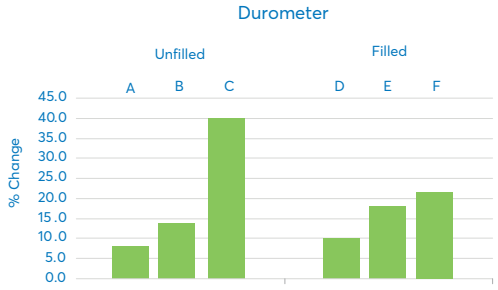

FIGURE 1: Change in durometer

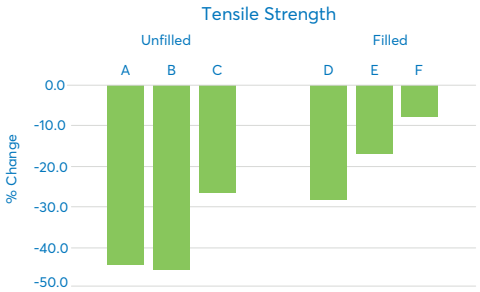

FIGURE 2: Change in tensile strength

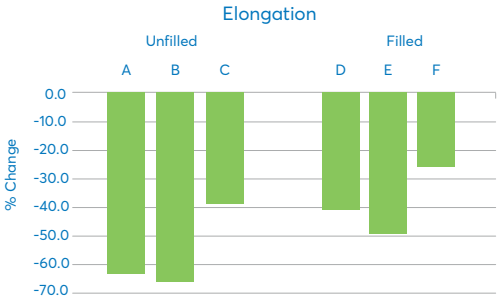

FIGURE 3: Change in elongation

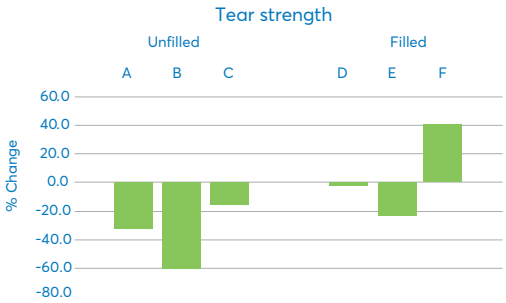

FIGURE 4: Change in tear strength

CONCLUSION

Several methods are available to increase silicone's resistance to thermal degradation, including the addition of fillers or the incorporation of phenyl into the polymer structure. The results show:

1. Including a thermal stability additive significantly increases resistance to thermal degradation more so than the inclusion of phenyl alone (Compare Filled to Unfilled samples).

2. If fillers cannot be utilized, higher levels of phenyl increase resistance to thermal degradation (Compare samples A, B, & C).

3. Both filler and high levels of phenyl show the best resistance to thermal degradation (See Sample F's overall performance).

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