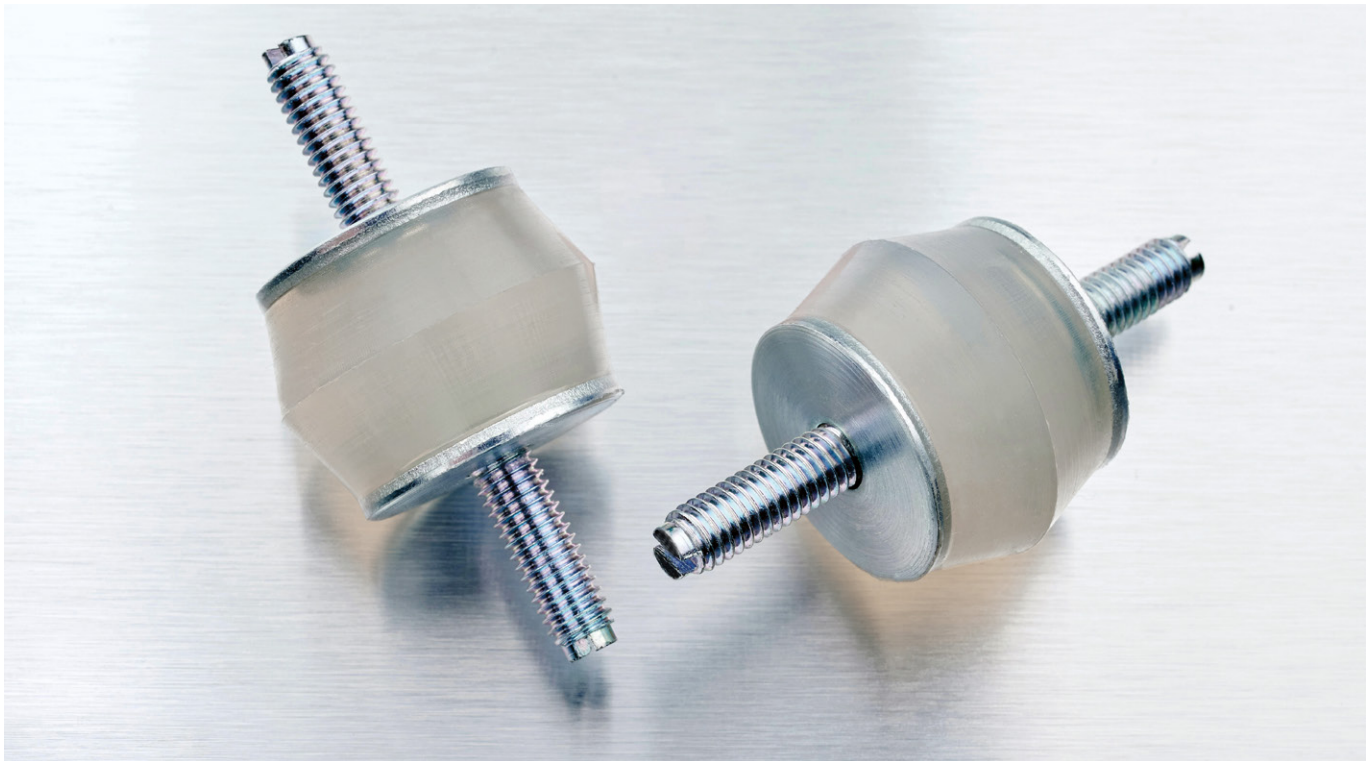
AEROSIL® R 8200

SYNTHETIC AMORPHOUS SILICA FOR IMPROVING FATIGUE RESISTANCE OF SILICONE ELASTOMERS



AEROSIL® silica improves mechanical properties of silicone elastomers by reinforcement

Furthermore, durability and fatigue resistance are important requirements for the long-term mechanical stability of silicones in a wide range of current and future applications that include damping systems in electric vehicles, soft robotics, artificial muscles and biomedical devices.

To improve the fatigue resistance of the silicone elastomers, structure modified hydrophobic fumed silica, AEROSIL® R 8200, ensures a low permanent set, even at high loading levels in combination with good mechanical reinforcement.

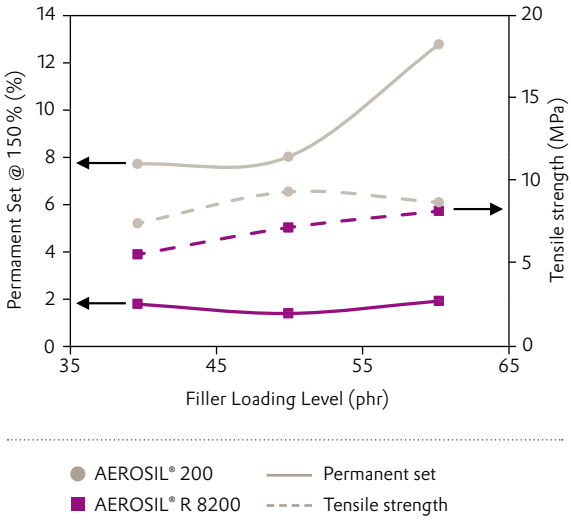


Figure 1 *Comparison of permanent set and tensile strength of HCR filled by AEROSIL® R 8200 and AEROSIL® 200 at different loading levels*

Basics of Fatigue

When filler reinforced silicones are extended to a length never experienced before, Mullins stress softening and a permanent set of the elastomer occur as presented in **Figures 2 and 3** for a high consistency rubber filled with 25 wt% fumed silica.

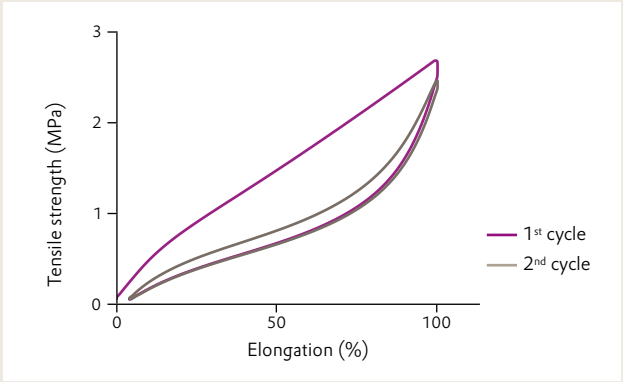


Figure 2 *describes the Mullins effect in a stress-strain curve for HCR filled with 25 wt% fumed hydrophilic silica. During the initial cycle, the silicone rubber exhibits a specific stress response, upon loading a second time, a loss in the exhibited strength occurs, known as the Mullins effect.*

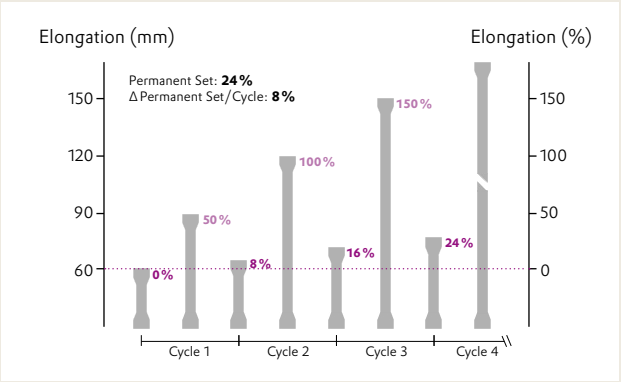


Figure 3 *describes the change in permanent set of the elastomer per loading cycle. The residual elongation remaining, after the initial loading, is known as the permanent set.*

Summary

The structure-modified hydrophobic AEROSIL® R 8200 significantly improves the fatigue resistance of silicones by reducing the permanent set and energy loss, at the same time providing good reinforcement and processability.

As presented in **Figure 1**, tensile strength of the compounds filled with AEROSIL® R 8200 increases gradually with higher loading level, preserving a low permanent set. This behavior allows incorporation of AEROSIL® R 8200 to high loading levels for good reinforcement without losing the low permanent set, which is important for fatigue resistance of silicones. In contrast, compounds with AEROSIL® 200 and processing aid, that are commonly applied for the reinforcement of HCR, reveal tensile strength on identical level, but a significantly higher permanent set than AEROSIL® R 8200.

High fatigue resistance increases the durability and the life-time of silicone components thus, improving their sustainability.

More detailed information and data can be found behind this link in public literature: *V. Allen et al. Compos. Sci. Technol. 214, 108955, 2021.*

FS-45-EN-02-2025/03-RAU

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