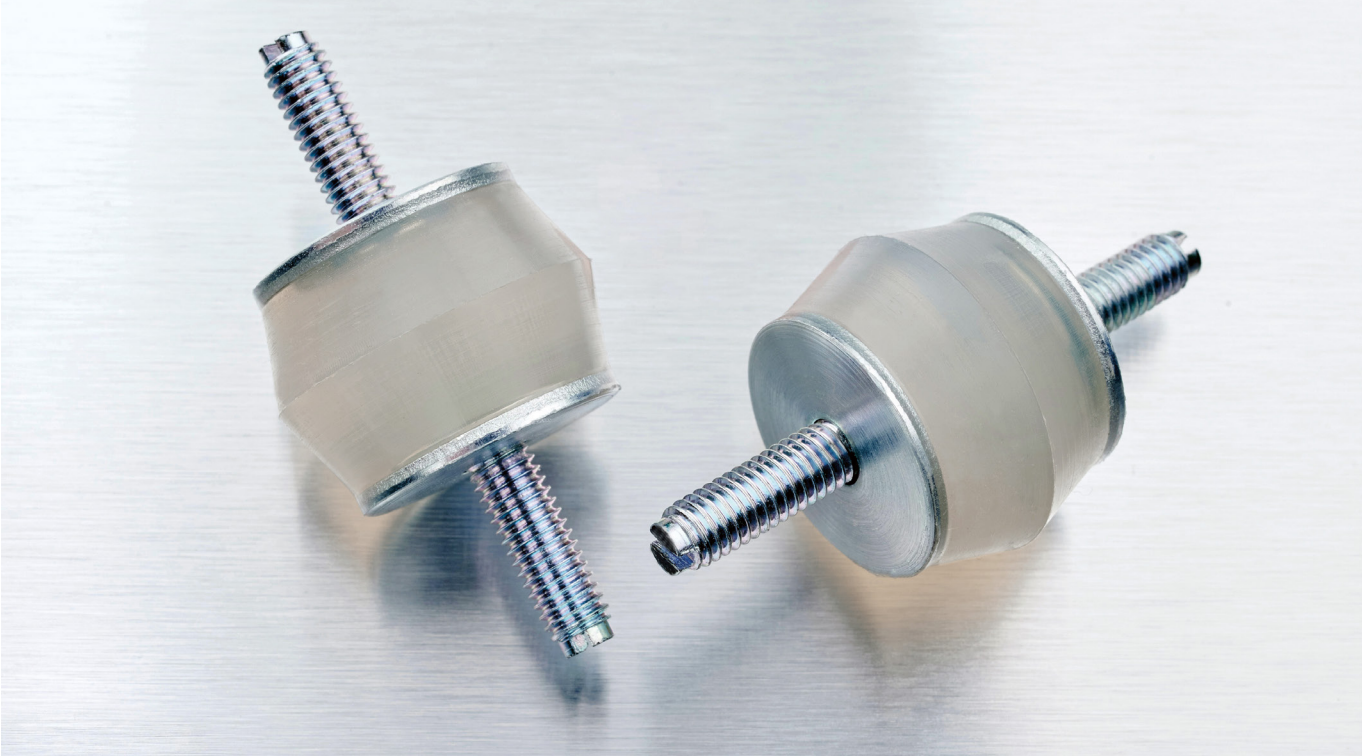


# AEROSIL® R 8200

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.

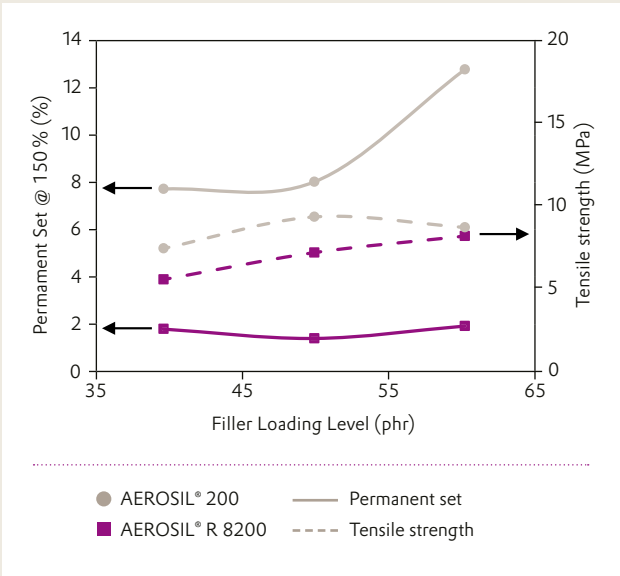
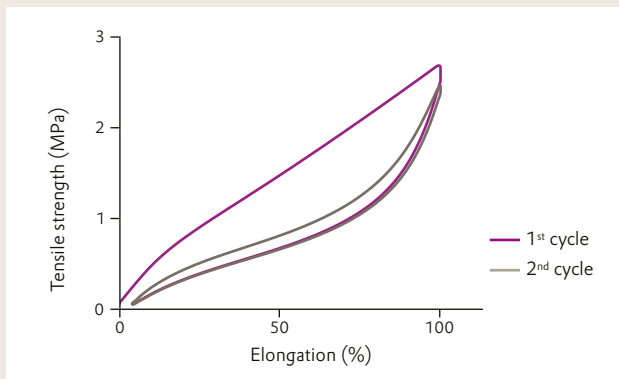


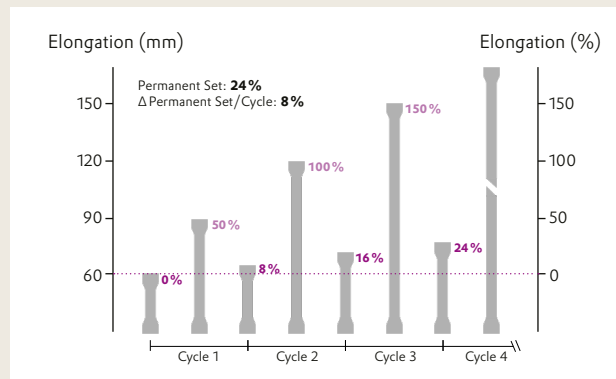
Figure 1 Comparison of permanent set and tensile strength of HCR filled by AEROSIL® R 8200 and AEROSIL® 200 at different loading levels

## 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.*

This information and any recommendations, technical or otherwise, are presented in good faith and believed to be correct as of the date prepared. Recipients of this information and recommendations must make their own determination as to its suitability for their purposes. In no event shall Evonik assume liability for damages or losses of any kind or nature that result from the use of or reliance upon this information and recommendations. EVONIK EXPRESSLY DISCLAIMS ANY REPRESENTATIONS AND WARRANTIES OF ANY KIND, WHETHER EXPRESS OR IMPLIED, AS TO THE ACCURACY, COMPLETENESS, NON-INFRINGEMENT, MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE (EVEN IF EVONIK IS AWARE OF SUCH PURPOSE) WITH RESPECT TO ANY INFORMATION AND RECOMMENDATIONS PROVIDED. Reference to any trade names used by other companies is neither a recommendation nor an endorsement of the corresponding product, and does not imply that similar products could not be used. Evonik reserves the right to make any changes to the information and/or recommendations at any time, without prior or subsequent notice. AEROSIL® is a registered trademark of Evonik Industries or its subsidiaries.

**Evonik Operations GmbH**  
Silica business line  
Rodenbacher Chaussee 4  
63457 Hanau  
Germany

Phone +49 6181 59-12532  
Fax +49 6181 59-712532  
ask-si@evonik.com  
www.silica-specialist.com

The Silica specialists at Evonik – Inside, to get it right.