

## Self-Healing Composites of Silicone Rubber

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**Abstract :** This abstract focuses an overview of the methods used to create self-healing silicone composites. It has been shown how incorporating of polyhedral oligomeric silsesquioxanes (POSS) molecules with acid and basic groups to silicone rubber affects the barrier properties, mechanical properties in room and reduced temperature or the influence on relaxation rates of the methylvinylsilicone rubber vulcanizates. Moreover, the presence of silsesquioxanes, their content and the way of composites preparing affect the amount of ionic bonds, as indicated by dynamic - mechanical thermal analysis (DMTA) as well as measurements of equilibrium swelling in toluene. The aim of this work was to study the influence of concentration and different functional groups types selected silsesquioxanes compounds on self-healing effect of silicone rubber and obtain elastomers with good barrier and mechanical properties. Composites based on the methylvinylsilicone rubber with fumed silica as the fillers were manufactured and studied. To obtain self-healing effect various silsesquioxanes with amino and acid groups were used. Every tested sample demonstrated the ability to the self-treatment. The most significant effect was observed for system containing amic-acid isobutyl POSS/ aminopropylisobutyl POSS. Composite with this silsesquioxanes was exhibited the best improvement of gas permeability after heal. Moreover, the addition of POSS with acid and basic groups clearly affects the mechanical properties of the vulcanizates. The most significant effect was observed for the composite material consisting of amic-acid isobutyl POSS / aminoethylaminopropylisobutyl POSS, which tensile strength was even greater than the reference vulcanizate with fumed silica. The development of autonomous self-healing materials could have an enormous influence on all industry branches from motorization to power industry. Self-repairing materials would have a massive impact on lengthening product lifetimes, increasing safety, and lowering product costs by reducing maintenance requirements.

**Keywords :** barrier properties, mechanical properties, POSS, self-healing composites

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