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EFFECT OF ACCELERATED AGEING ON MAGNETHORHEOLOGICAL ELASTOMER PROPERTIES

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Summary: Magnetorheological elastomers (MREs) consist of magnetically permeable particles embedded in an elastomeric matrix. They belong to the group of smart materials. Application of magnetic field during the crosslinking of the polymer matrix leads to the formation of anisotropic microstructure of particle's chains. MREs exhibit reversible changes of their properties and shape under the magnetic field, what makes them attractive for applications as dampers, sensors or actuators.

The aim of this study was to develop the magnetorheological elastomer for coupled mechanical systems with enhanced energetic effectiveness. By the changes of MRE stiffness it can be possible to keep the mechanical system close to the resonance. In the real conditions the MRE element will be subjected to the high mechanical loads as well as the influence of environmental conditions such as outdoor temperature and humidity. Therefore, the effect of accelerated ageing on rheological properties of MRE was studied. The samples were obtained by mechanical stirring of reactive mixture of substrates with carbonyl-iron particles and next the particles were oriented into chains under the external magnetic field of 240 kA/m. In this study as a ferromagnetic component carbonyl–iron powder, with particle size from 6-9 μm, produced by Fluka, was used. Samples with particles volume fraction equal to 11% and 33% were examined. As a matrix commercial Biresin® U1404 system, supplied by SIKA was used. The accelerated ageing was carried out in a climatic chamber JEIOTECH model TH-ME-025. The samples were placed in the chamber for 168 and 336 hours at the temperature of 30oC and humidity varied from 30 up to 90% or with the same humidity and temperature varied from -20 to +70oC. The changes of samples mass, microstructure, glass transition temperature and rheological properties with and without magnetic field were evaluated. Absolute and relative magnetorheological effects were calculated. The obtained results confirmed the resistance of fabricated MREs to degradation.

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