Development of magnetic composites (SR/IRON) type isotropic MRE based on silicone rubber and iron powders to be applied in vibration absorption systems

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In recent decades, an increasing effort has been made not only to foster cost-effective, competitive and innovative industries but also to create smart materials. Consequently, one of the key enabling technologies (KET), has emerged as a potential candidate to achieve these goals. However, improvements in the preparation route, greater variations in mechanical properties and the evaluation of the effects of temperature are still being sought for magneto-rheological elastomers (MRE) [1]. In this work, we present the structural characterization and the effect of the magnetic field on the mechanical properties of a magnetic composite type MRE ,based on carbonyl iron particles, embedded in a silicone elastomer (SR/IRON). This MRE was prepared by the curing process at room temperature of the silicone rubber and different concentrations of iron particles, 18%, 33% and 48% in volume. An easy, rapid and low energetic cost route was designed in order to facilitate a possible transfer process to the productive sector. Morphological (SEM) and structural (FTIR) assays showed: (i) an acceptable compatibility of the composite's components was achieved, suggesting that the preparation process and the vulcanization system were adequately utilized and (ii) strong chemical bonds between the composite's material constituents were not observed [2]. Mechanical tests assisted by a magnetic field showed: (i) a strong dependence on the mechanical response with the application of a magnetic field in the samples and (ii) a variation between 34% and 61% on the mechanical properties of the MRE related to the particle concentration in the samples. These results point to the possibility of using these composites based on silicon rubber and iron as smart materials type MRE once they exhibit acceptable values of mechanical dependence with the applied external magnetic field. Furthermore, the production of these composites will add technological value and open up new economic possibilities for MREs.

Keywords: Magneto-rheological elastomers, Magneto-rheological effect.

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