

Magnetorheological Silicone Composites Filled with Micro- and Nano-Sized Magnetites with the Addition of Ionic Liquids

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Abstract : Magnetorheological elastomer composites based on micro- and nano-sized Fe₃O₄ magnetoactive fillers in silicone rubber are reported and studied. To improve the dispersion of applied fillers in polymer matrix, ionic liquids such as 1-ethyl-3-methylimidazolium diethylphosphate, 1-butyl-3-methylimidazolium hexafluorophosphate, 1-hexyl-3-methylimidazolium chloride, 1-butyl-3-methylimidazolium trifluoromethanesulfonate, 1-butyl-3-methylimidazolium tetrafluoroborate, trihexyltetradecylphosphonium chloride were added during the process of composites preparation. The method of preparation process influenced the specific properties of MREs (isotropy/anisotropy), similarly to ferromagnetic particles content and their quantity. Micro and non-sized magnetites were active fillers improving the mechanical properties of elastomers. They also changed magnetic properties and reinforced the magnetorheological effect of composites. Application of ionic liquids as dispersing agents influenced the dispersion of magnetic fillers in the elastomer matrix. Scanning electron microscopy images used to observe magnetorheological elastomer microstructures proved that the dispersion improvement had a significant effect on the composites properties. Moreover, the particles orientation and their arrangement in the elastomer investigated by vibration sample magnetometer showed the correlation between MRE microstructure and their magnetic properties.

Keywords : magnetorheological elastomers, iron oxides, ionic liquids, dispersion

Conference Title : ICMMPPE 2014 : International Conference on Materials, Minerals and Polymer Engineering

Conference Location : Venice, Italy

Conference Dates : August 14-15, 2014