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Vibration Damping Properties of Electrorheological Materials Based on Chitosan/Perlite Composite

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Abstract : Electrorheological (ER) fluids are a class of smart materials exhibiting reversible changes in their rheological and mechanical properties under an applied electric field (E). ER fluids generally are composed of polarisable solid particles dispersed in non-conducting oil. ER fluids are fluids which exhibit. The resistance to motion of the ER fluid can be controlled by adjusting the applied E, due to their fast and reversible changes in their rheological properties presence of E. In this study, a series of chitosan/expanded perlite (CS/EP) composites with different chitosan mass fractions (10%, 20%, and 50%) was used. Characterizations of the composites were carried out by Fourier Transform Infrared (FTIR), X-ray diffraction (XRD) and Scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM-EDX) techniques. Antisedimentation stability and dielectric properties of the composites were also determined. The effects of volume fraction, electric field strength, shear rate, shear stress, and temperature onto ER properties of the CS/EP composite particles dispersed in silicone oil (SO) were investigated in detail. Vibration damping behavior of the CS/EP composites were determined as a function of frequence, storage (G′) and loss (G′ ′) moduli. It was observed that ER response of the CS/EP/SO ER fluids increased with increasing electric field strength and exhibited the typical shear thinning non-Newtonian viscoelastic behaviors with increasing shear rate. The maximum yield stress was obtained with 1250 Pa under E = 3 kV/mm. Further, the CS/EP/SO ER fluids were observed to sensitive to vibration control by showing reversible viscosity enhancements (G′ > G′ ′). Acknowledgements: The authors thank the TÜBİTAK (214Z199) for the financial support of this work.

Keywords : chitosan, electrorheology, perlite, vibration control
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