

Effect of iron nanopowder on the rheological behaviour of Magnetorheological grease

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Magnetorheological grease (MRG) comes under the category of smart materials, the rheological properties of which are field-dependent. In this study, two MRG samples are taken, one dispersed with 5% iron nanopowder (NMRG) of 35 nm size and another without it. The effect of temperature, magnetic field strength and nanoparticles on the two samples are studied under rotational and oscillatory shear using a parallel-plate rheometer with a plate diameter of 20 mm. Rotational shear is run at shear rates ranging from 0 to 1000 s^{-1} and oscillatory shear test is performed at a freqency of 10 Hz and shear strain is varied from 0.01 to 100%. It is found that nanoparticles enhance the yield stress as an increase in yield stress with magnetic field strength as well as temperature is noted. Nanoparticles tend to increase the apparent viscosity of NMRG with temperature when the magnetic field is switched on. It can be inferred that the magnetic properties are augmented with the introduction of nanoparticles as they fill the voids between the micro-carbonyl iron particles and thus facilitate strong chain formation. Addition of nanoparticles also affects the elastic properties of grease which is evident from the increase of storage modulus with temperature under both off and on-state conditions. This is due to the fact that addition of nanoparticles suppresses the effect of temperature and thus a dominance of magnetic field is observed.

Biography

Aashna Raj is doing her PhD from Indian Institute of Technology Patna. Her research work mainly focusses on the rheology of grease and magnetorheological grease, CFD of grease flow in different configurations, microPIV visualizations of grease in restricted microchannels. She has published 2 papers in international peer-reviewed journals and has been working on smart materials during the course of her PhD.

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