

Microstructural analysis on the compatibility of various dilution oils on magnetorheological grease performance

ABSTRACT

This research explores the effects of dilution oils on the storage stability of magnetorheological grease (MRG) by studying the effect of dilution oil viscosity on the microstructure of carrier fluids medium for MRG, which can help address practical challenges encountered in the development and deployment of MRG. Three samples of MRG with 70 wt% CIP are prepared; a control, and 2 samples diluted until 10 wt% hydraulic fluid and kerosene respectively. The resulting samples were analysed using a modular compact rheometer (MCR) for oscillatory strain sweep and rotational current sweep. Rheological analyses were repeated after one year in storage. Fourier-Transform Infrared (FTIR) spectroscopy and Atomic Force Microscopy (AFM) results show significant microstructural and performance deterioration of grease thickener in the sample with kerosene, which concludes that kerosene had a very significant effect on the degradation of the grease thickener. From this study, it was revealed that low viscosity oils disrupt the reconstruction of the thickener of lithium grease, which in turn causes deteriorating shear rheological performance of MRG at off-state conditions. This comprehensive analysis explains the relationships between MRG composition, microstructural characteristics, and performance parameters, offering a foundational framework for further exploration and advancement in this scientific field.