

Rheological performance of magnetorheological grease with embedded graphite additives

ABSTRACT

The use of highly viscous grease as a medium in magnetorheological grease (MRG) provides the benefit of avoiding sedimentation from occurring. However, it limits the expansion of yield stress in the on-state condition, thus reducing the application performance during operation. Therefore, in this study, the improvement in the rheological properties of MRG was investigated through the introduction of graphite as an additive. MRG with 10 wt % graphite (GMRG) was fabricated, and its properties were compared to a reference MRG sample. The microstructure of GMRG was characterized using an environmental scanning electron microscope (ESEM). The rheological properties of both samples, including apparent viscosity, yield stress, and viscoelasticity, were examined using a shear rheometer in rotational and oscillatory modes. The results demonstrated a slight increase in the apparent viscosity in GMRG and a significant improvement in yield stress by 38.8% at 3 A with growth about 32.7% higher compared to MRG from 0 to 3 A. An expansion of the linear viscoelastic region (LVE) from 0.01% to 0.1% was observed for the GMRG, credited to the domination of the elastic properties on the sample. These obtained results were confirmed based on ESEM, which described the contribution of graphite to constructing a more stable chain structure in the GMRG. In conclusion, the findings highlight the influence of the addition of graphite on improving the rheological properties of MRG. Hence, the addition of graphite in MRG shows the potential to be applied in many applications in the near future.