Experimental investigation on thermo-physical properties of metal oxide composite nanolubricants

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ABSTRACT

The thermal conductivity and dynamic viscosity of three different combinations of metal oxide composite nanolubricant had been investigated at different nanoparticle volume concentrations (0.02 to 0.1%) and different temperatures (303–353 K). The prepared Al_2O_3—SiO_2, Al_2O_3—TiO_2 and TiO_2—SiO_2 composite metal oxide nanoparticle was dispersed in Polyalkylene Glycol (PAG 46) lubricant by espousing the two-step preparation method. The thermal and viscosity experiment was performed using KD2 Pro Thermal Properties Analyzer and LVDV-III Rheometer, respectively. All the considered metal oxide composite nanolubricants were witnessed to behave as Newtonian fluids. A maximum viscosity enhancement of 20.50% recorded for Al_2O_3—TiO_2/PAG nanolubricant with 0.1% nanoparticle volume concentration and at the temperature of 303 K. Whereas, the highest thermal conductivity improvement recorded for Al_2O_3—SiO_2/PAG nanolubricant with 2.41% improvement at 0.1% nanoparticle concentration and temperature of 303 K. A new regression model to estimate the dynamic viscosity and thermal conductivity of metal oxide composite nanolubricants were proposed based on the finding obtained..

Keywords: Hybrid nanolubricants; Thermal conductivity; Dynamic viscosity; Newtonian; Refrigeration compressor