

Thermal conductivity and viscosity of Al₂O₃ nanofluids for different based ratio of water and ethylene glycol mixture

ABSTRACT

In the thermal engineering applications, suspension of nanoparticles in conventional fluid has positive potential in enhancing the convective heat transfer performance. The evaluation of thermo-physical properties is essential to investigate the forced convection heat transfer of nanofluids. Hence, the present study reports the analysis on thermal conductivity and dynamic viscosity for Al₂O₃ nanoparticle dispersed in a different volume ratio of water (W) and ethylene glycol (EG) mixture. The Al₂O₃ nanofluids are formulated using the two-step method for three different base mixtures with volume ratio of 40:60, 50:50 and 60:40 (W:EG). The measurement of thermal conductivity and viscosity were performed using KD2 Pro Thermal Properties Analyzer and Brookfield LVDV-III Rheometer; respectively for temperature from 30 to 70 °C and volume concentration of 0.2–1.0%. The average thermal conductivity enhancement of Al₂O₃ nanofluids in the three base ratios varied from 2.6 to 12.8%. The nanofluids have better enhancement as the percentage of ethylene glycol increases. Meanwhile, the average dynamic viscosity enhanced up to 50% for 60:40 (W:EG). The enhancement of viscosity for nanofluids decreased with the increment percentage of ethylene glycol. The properties enhancement of the Al₂O₃ nanofluids is significantly influenced by the concentration, temperature, and based ratio.

Keyword: Thermal conductivity; Viscosity; Nanofluids; Water-ethylene glycol mixture; Based ratio