Experimental Investigation of Thermal Conductivity and Electrical Conductivity of BioGlycol - Water Mixture Based Al_2O_3 Nanofluid

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ABSTRACT

Nanofluid as a new brand of cooling fluid consisting of nanometer-sized particles dispersed in base fluid. In this study, the thermal conductivity and electrical conductivity of BioGlycol (BG)–water (W) mixed nanofluids containing Al_2O_3 nanoparticles were studied. Nanofluids with 0.5 to 2.0% concentrations were prepared by the two-step method. The nanofluids demonstrated excellent stability over the temperature range of 30 to 80 °C after using the long term sonication process. Comparisons of the experimental data with many existing models illustrated that they do not display good agreement. Therefore, a new nonlinear model has been developed with 5% maximum deviation for the thermal conductivity of nanofluids as a function of temperature and volume concentration. The results of BG:W mixtures have displayed improvement in thermal performance of 7.5% in comparison with Propylene glycol (PG):W in similar circumstances. The thermal conductivity of nanofluid increased as a function of volume concentration and temperature. The maximum thermal conductivity enhancement using 40:60% (BG:W) mixture ratio was twice as high as 60:40% in the same conditions. Electrical conductivity was observed to decrease as the volume concentration increased. Thermo-electrical conductivity ratio (TEC) has been evaluated theoretically based on thermal and electrical conductivity results.

KEYWORDS: Nanofluids; BioGlycol; Aluminium oxide; Thermal conductivity; Electrical conductivity

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