

An Experimental Determination of Thermal Conductivity and Electrical Conductivity of Bio Glycol Based Al₂O₃ Nanofluids and Development of New Correlation

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ABSTRACT

Nanofluid, as a kind of new engineered material consisting of nanometer-sized additives and base fluids, has attracted great attention from investigators for its superior thermal properties and many potential applications. In this paper, the thermal conductivity, dispersion stability and electrical conductivity of 100% bioglycol (BG) based nanofluids containing Al₂O₃ nanoparticles were studied in a temperature range of 30 to 80 °C. Nanofluids with 0.1, 0.3, 0.5, 0.7, and 1% volume concentrations were prepared using the two-step method without using surfactant. The nanofluids demonstrated excellent stability over this temperature range after using long-term sonication. A new correlation has been developed for the thermal conductivity of nanofluids as a function of temperature and particle volume concentration. This study also revealed that the thermal conductivity enhancement of bio glycol (BG), ethylene glycol (EG) and propylene glycol (PG) of 1.0% volume concentration at 30 °C was 17%, 9% and 3.6% respectively. However, the increment in temperature reacts inversely to the thermo-electrical conductivity (TEC) ratio. The maximum value of TEC is 9.5 at 0.5% volume concentrations and temperature of 30 °C.

KEYWORDS: Nanofluids; Bio glycol; Alumina nanoparticles; Dispersion stability; Thermal conductivity; Electrical conductivity

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