Heat transfer and friction factor of water and ethylene glycol mixture based TiO_2 and Al_2O_3 nanofluids under turbulent flow

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ABSTRACT

It has been a great challenge in heat transfer to provide efficient thermal fluids for cooling purposes especially in engineering practice. The concerns on various operating temperatures become the main concern in the present study to investigate the heat transfer and friction factor of titanium oxide (TiO_2) and aluminium oxide (Al_2O_3) under turbulent flow in a tube. The nanofluids were prepared using the two-step method and dilution process for volume concentrations of 0.5% to 1.0% in a mixture of water (W) and ethylene glycol (EG) at a volume ratio of 60:40 (W:EG). The convective heat transfer investigations were conducted at a constant heat flux boundary condition and operating temperatures of 30, 50 and 70 °C. The enhancement of thermal conductivity and viscosity of Al_2O_3 was found to be influenced by the temperature while the enhancement of the TiO_2 nanofluid properties was observed to be independent of temperature. Both Al_2O_3 and TiO_2 nanofluids were observed to have almost the same values of heat transfer coefficients for 1.0% concentration at 50 and 70 °C with an average enhancement of 24%. However, the heat transfer coefficients of Al_2O_3 nanofluids were found to be higher than TiO_2 nanofluids at the operating temperature of 30 °C. The heat transfer concentrations increased with volume concentration and observed for both types of nanofluids at all operating temperatures. The friction factors for both TiO_2 and Al_2O_3 nanofluids slightly increased with volume concentration.

KEYWORDS: Heat transfer; Friction factor; Nanofluids; Thermal conductivity; Viscosity

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