Investigations on Thermal Conductivity, Heat Transfer Coefficient and Viscosity of Graphite Nanoparticle Dispersed Nanofluid

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The thermal conductivity (k), heat transfer coefficient (HTC) and viscosity of the ethylene glycol/water dispersed with graphite nanoparticles was studied under heating and cooling conditions for temperatures ranging from 0 °C to 75 °C using tubular heat exchanger system built in house. Flow rate was varied from 5 l/h to 25 l/h giving Reynolds number (Re) ranging from 50 to 750. The HTC increased with the increase of Re as well as temperature. The thermal conductivity of the nanofluid was determined at constant low Re (200) for all concentrations and temperatures used in the experiment. The concentration dependence of thermal conductivity was found to be much different than that predicted by models suggested in literature. The viscosity was measured for different concentrations of nanoparticles (0 to 0.8%) as well as temperatures 275 K to 340 K. The temperature dependence of viscosity was found to follow Arrhenius type equation $\eta = \eta_o \exp(E/k_b T)$ with very little change in the activation energy from that of the base fluid. On the other hand the pre-exponential constant increased six folds with the increase in nanoparticle concentration. An empirical relation derived from Brownian motion was found between the product of viscosity and thermal conductivity ($\Omega = k_r \cdot \eta_r$) with respect to concentration of the nanoparticles which was found to be true for whole range of temperature and compositions studied.

KEYWORDS: Nanofluid, Graphite Nanofiber, Heat Transfer Coefficient, Thermal Conductivity, Viscosity.

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