Effects of temperature and concentration on thermophysical properties of TiO_2-MWCNTs - doped graphene nanofluids

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ABSTRACT

This paper presents to investigate the effects of temperature and concentration on thermophysical properties of titanium dioxide (TiO_2) nanofluids containing multi-walled carbon nanotubes (MWCNTs)-doped graphene. In this present study, the ethylene glycol-based hybrids TiO_2-MWCNTs and MWCNTs-doped 10 wt per cent graphene nanofluids were prepared five concentrations (0.02 to 0.10 per cent) using a two-step, direct-mixing methods. The effect of the temperature, concentration and type of nanofluid and its interaction with TiO_2-MWCNTs and MWCNTs' thermal conductivity and viscosity has been studied using a central composite design technique. The significance of the analytical, statistical model being developed is validated using variance analysis. Twenty-four experiments were conducted to develop second-order polynomial equations for target outputs. Based on the results obtained, the predicted values were insensible in agreement with the experimental data. More than 85 per cent of thermal conductivity and viscosity variations of nanofluids can be predicted by models that convey the applied model's precision. The expected optimised value shown in the optimisation plot is 0.6035 W/°C for thermal conductivity and 14.673 mPa/s for viscosity. The desirable parameters such as temperature, concentration and nanofluid type are 30 °C, 0.06 per cent and TiO_2-MWCNT, respectively. The validation with the experimental result indicates that the model can reasonably predict the optimal experimental conditions. Viscosity decreases due to an increase in temperature and concentration. It demonstrates the effect of concentration and temperature on viscosity.

KEYWORDS

Concentration; Multi-walled carbon nanotubes; Temperature; Thermal conductivity; Titanium dioxide-multi walled carbon nanotubes; Viscosity

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