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Flow Characteristics and Heat Transfer Performance of Magnesium Oxide-Water Nanofluid in the Entrance Region in Circular Cross Section Microchannel

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ABSTRACT

The present paper reports the flows characteristic and the heat transfer performance of Magnesium Oxide-water nanofluid entering a microchannel with circular cross section area. The flow is studied by CFD method using finite volume method. The simulation results were validated with data from the literature. A recently introduced viscosity correlation is used to predict the nanofluid effective viscosity. A range of Re number is investigated in the present paper. Various temperature ranges were used as constant temperature boundary condition. The increase of the nanoparticle volume fraction was found to increase the heat transfer rate. Nanofluid showed better enhancement in heat transfer compared to the conventional water fluid. The increase in Re number promoted the heat transfer rate.

The change of velocity, temperature and viscosity in the entrance region was extensively investigated. The effect of the temperature and Re number on the effective viscosity in the channel was also reported. The friction factor is investigated and studied against the available conventional correlations. The present prediction of friction factor highlighted the needs for further experimental investigation to predict the friction factor in microchannels accurately.