ENHANCEMENT OF CONVECTIVE HEAT TRANSFER WTIH NANOFLUIDS - SINGLE-PHASE AND TWO-PHASE ANALYSIS

Sadık KAKAÇ, TOBB University of Economics and Technology,

* Sadık KAKAÇ: Fax: +90 312 292 41 78 Email: sadikkakac@yahoo.com

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Abstract

Nanofluids are promising heat transfer fluids due to their high thermal conductivity. In order to utilize nanofluids in practical applications, accurate prediction of forced convection heat transfer of nanofluids is necessary. In the first part of the present study, we consider the application of some classical correlations of forced convection heat transfer developed for the flow of pure fluids to the case of nanofluids by the use of nanofluid thermophysical properties. The results are compared with experimental data available in the literature, and it is shown that this approach underestimates the heat transfer enhancement. Furthermore, predictions of a recent correlation based on a thermal dispersion model are also examined, and good agreement with the experimental data is observed. The thermal dispersion model is further investigated through a single-phase, temperature-dependent thermal conductivity approach. Numerical analysis of hydrodynamically fully developed laminar forced convection of Al_2O_3(20 nm)/water nanofluid inside a circular tube under constant wall temperature and constant wall heat flux boundary conditions has been carried out. Results of the numerical solution are compared with the experimental data available in the literature. The results show that the single-phase assumption with temperature-dependent thermal conductivity and thermal dispersion is an accurate way of heat transfer enhancement analysis of nanofluids in convective heat transfer. Also Hamilton Crosser conductivity model with the effect of Brownian motion are investigated by using single and two- phase flow approaches. The single-phase and two-phase results are compared with a previous experimental study in the literature for the same geometry and boundary conditions. It is observed that the result are in good agreement with experimental findings.