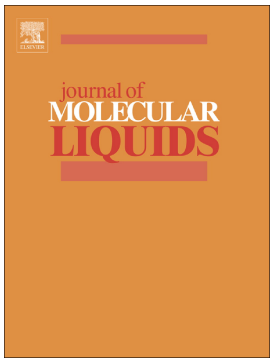

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Lattice Boltzmann simulation of natural convection and entropy generation in cavities filled with nanofluid in existence of internal rigid bodies-Experimental thermo-physical properties

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Abstract

The lattice Boltzmann simulation of natural convection heat transfer in cavities with active internal rigid bodies and filled with DWCNTs-water nanofluid is performed. The thermo-physical properties of the nanofluid, thermal conductivity and dynamic viscosity, are measured experimentally by means of modern measuring devices in different solid volume fraction of 0.01%, 0.02%, 0.05%, 0.1%, 0.2%, and 0.5% and a temperature range of 300 to 340. Two sets of correlations for thermal conductivity and dynamic viscosity are developed and used in the numerical simulations. The influences of different governing parameters such different arrays of rigid bodies, different concentrations of nanofluid and temperature differences of side walls on the fluid flow, temperature filed, Nusselt number and entropy generation are presented. The local fluid friction irreversibility and heat transfer irreversibility contours are depicted graphically which show the concentration of two components of total entropy generation. It is concluded that the array of refrigerant bodies has significant influence on streamlines and isothermal lines. Moreover, the effects of rigid body arrays on the average Nusselt number, total entropy generation and heatlines are considerable. The Nusselt number and entropy generation are highest at case B. Also, the Nusselt number has direct relationship with Rayleigh number and solid volume fraction. On the other hand, the total entropy generation has direct and reverse relationship with Rayleigh number and solid volume fraction, respectively.