Rayleigh-Benard convection of nano fluids based on the pseudo-single phase continuum model

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Nanofluids are composed of fluids and dispersed submicron solid particles. The presence of nanoparticles in the fluids enhances the effective thermal conductivity. In order to predict the enhancement of heat transfer in the nanofluids, it is necessary to model the nanofluid systems rigorously from the viewpoint of fluid dynamics. In the present investigation, we suggest a fluid mechanical model of nanofluids based on a rigorous theory of continuum mechanics. Starting from a two-fluid model, a pseudo one-phase model is derived exploiting the fact that the velocity and temperature of nanoparticles follow tightly those of base fluid. The resulting pseudo one-phase model of nanofluids is employed to investigate the Rayleigh-Benard convection of nanofluids. It is revealed that the presence of nanoparticles retards onset of convection and reduces the Nusselt number due to the dependence of physico-chemical properties of nanofluids on the particle mass fraction. The present pseudo one-phase model of nanofluids may be adopted to predict heat and mass transfer as well as fluid dynamic characteristics in various nanofluid systems.