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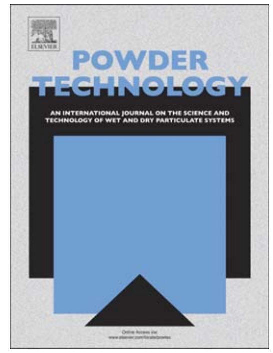

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Magnetic field effect on entropy generation in a nanofluid-filled enclosure with sinusoidal heating on both side walls

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Abstract:

This paper examines the laminar natural convection and entropy generation in a square enclosure filled with a water-Al2O3 nanofluid and is subjected to a magnetic field. The side walls of the cavity are sinusoidally heated. The horizontal walls are adiabatic. Lattice Boltzmann method (LBM) is applied to solve the coupled equations of flow and temperature fields and the finite difference method is used to calculate the entropy generation. The effects on fluid flow, heat transfer and entropy generation are investigated at various Rayleigh numbers (Ra=10^3 to $5x10^4$), Hartmann number (Ha=0 to 50), phase deviation (γ=0, π/4, π/2, 3π/4 and π) and solid volume fractions (ϕ=0 to 0.06). The results show that for Ra=5×10^4 and Ha=20 the heat transfer rate and entropy generation respectively increases and decreases with the increases of volume fraction. Also for Ha=50 at γ =π/2, adding nanoparticles increases heat transfer rate but does not affect the entropy generation. The proper choice of Ra, Ha, γ and ϕ could be able to maximize heat transfer rate simultaneously minimizing entropy generation.

Keywords: Entropy generation, Lattice Boltzmann Method, Natural convection, Nanofluid, Magnetic field, Sinusoidal temperature.