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Selimefendigil, F., Oztop, H.F., Chamkha, A.J.

Natural convection in a CuO–water nanofluid filled cavity under the effect of an inclined magnetic field and phase change material (PCM) attached to its vertical wall

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Abstract
In this study, natural convection of CuO–water nanofluid in a square cavity with a conductive partition and a phase change material (PCM) attached to its vertical wall is numerically analyzed under the effect of an uniform inclined magnetic field by using finite element method. Effects of various pertinent parameters such as Rayleigh number (between 10 5 and 10 6), Hartmann number (between 0 and 100), magnetic inclination angle (between 0 ∘ and 90 ∘), PCM height (between 0.2H and 0.8H), PCM length (between 0.1H and 0.8H), thermal conductivity ratio (between 0.1 and 100) and solid nanoparticle volume fraction (between 0 and 0.04) on the fluid flow and thermal characteristics were numerically analyzed. It was observed that when magnetic field is imposed, more reduction in average Nusselt number for water is obtained as compared to nanofluid which is 31.81 % for the nanofluid at the highest particle volume fraction. The average heat transfer augments with magnetic inclination angle, but it is less than 5 %. When the height of the PCM is increased which is from 0.2H to 0.8H, local and average Nusselt number reduced which is 42.14 % . However, the length of the PCM is not significant on the heat transfer enhancement. When the conductivity ratio of the PCM to the base fluid within the cavity is increased from 0.1 to 10, 29.5 % of the average Nusselt number enhancement is achieved. © 2018, Akadémiai Kiadó, Budapest, Hungary.

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