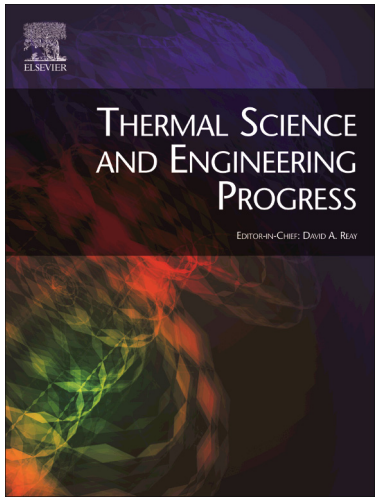

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Numerical simulation of the melting of a NePCM due to a heated thin plate with different positions in a square enclosure

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Abstract

Melting of a PCM (Paraffin wax) dispersed with Al_2O_3 nanoparticles in a square enclosure due to a heated thin plate is studied using the Enthalpy-Porosity technique. The walls of the cavity are thermally insulated. The proposed system may have numerous potential applications including energy conservation in buildings, greenhouses and human body. The simulations are performed for a fixed Ste number of 6.25, different concentrations of nanoparticles and different locations of the heated plate. The results are given in terms of isotherms, streamlines, melting interface and melting rate. A Terminal dimensionless time (Fourier number) is defined after which the natural convection and conduction are the dominated heat transfers respectively to the melted NePCM placed above the heated plate and to the non-melted NePCM located beneath the plate. It was found that for a given location of the heated plate the increase of nanoparticles enhances the melting rate of NePCM in comparison to the pure PCM. In addition, the highest and the lowest melting rates are associated with the Bottom and Top positions of the heated plate, respectively.

Keywords: Phase Change Material (PCM); Melting; Nanoparticles concentration; Heated plate; Square enclosure.