Documents

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Melting of nanoparticles-enhanced phase-change materials in an enclosure: Effect of hybrid nanoparticles
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Abstract
The present paper studies the melting of nanoparticles-enhanced phase-change materials (NEPCM) in a square cavity using the finite element method. The enhancement is based on the hybrid nanofluid strategy. A linearized correlations procedure has been followed to determine the properties of the hybrid nanofluid. The Rayleigh, Prandtl, and Stefan numbers have been fixed at 10^8, 50, and 0.1, respectively. The left wall is kept at a higher temperature T_h = 40 °C, the right wall is kept at a lower temperature T_c = 30 °C, while the horizontal walls are kept adiabatic. The enthalpy-porosity model is used to simulate the melting of the phase-change materials (PCM). The study is governed by tracing the liquid–solid interface by varying the total nanoparticles volume fraction ϕ = 0–5%, and four different sets of models parameters combinations (N_c, N_v) = (0,0), (5,18), (18,18), (18,5). The results have shown the consistency of the liquid–solid phase progress with the available experimental results, i.e. the melting process expedites when the enhancement in the thermal conductivity, which is characterized by N_c, is much greater than the enhancement of the dynamic viscosity. Compared with the available experimental data, hybrid nanoparticles composed of Mg–MgO demonstrate the best fusion performance. © 2017 Elsevier Ltd

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