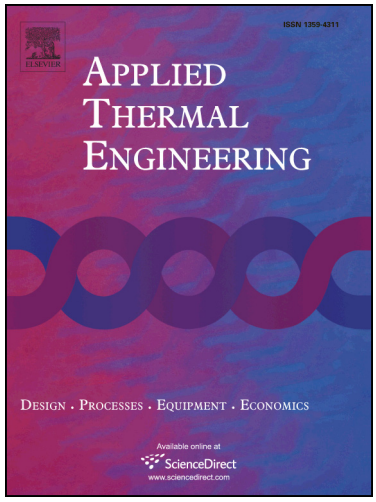

Lattice Boltzmann modeling of melting of phase change materials in porous media with conducting fins

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Lattice Boltzmann modeling of melting of phase change materials in porous media with conducting fins

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Abstract: Based on the averaged energy equation in terms of enthalpy, a modified lattice Boltzmann (LB) model is proposed for simulating melting of phase change materials in porous media with a conducting fin. Different from previous LB models, the present model incorporates the total enthalpy and a free parameter into the equilibrium distribution function, and thus makes it suitable for modeling conjugate heat transfer and has high computational efficiency by avoiding iteration procedure for phase change. To ensure the numerical stability, the multiple-relaxation-time collision scheme is adopted in the model. The model is validated by three benchmark problems. It is found that the numerical results are in good agreement with the analytical solutions and numerical results. In addition, the effect of adding the conducting fin on the melting processes in a porous cavity is investigated. The numerical results indicate that the melting heat transfer can be further enhanced by adding a conducting fin into the porous medium. The melting speed increases as the length of the fin increases and the heat capacity of the fin decreases. However, the vertical position of the fin has no remarkable impact on the melting speed.

Keywords: lattice Boltzmann method; porous media; melting; conjugate heat transfer; fins

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