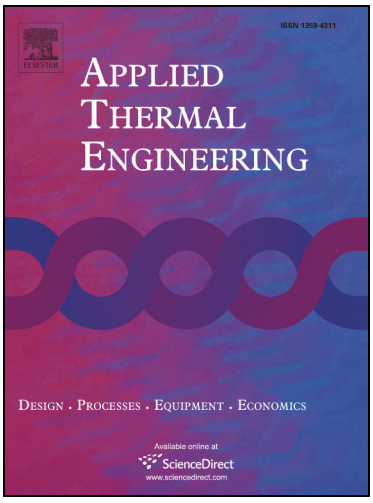

Investigation of the effect of inclination angle on the melting enhancement of phase change material in finned latent heat thermal storage units

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Investigation of the effect of inclination angle on the melting enhancement of phase change material in finned latent heat thermal storage units

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Abstract

Large-scale deployment of Phase Change Materials (PCMs) based Latent Heat Thermal Storage (LHTS) systems is limited by the low charging and discharging rates of the PCMs. In this paper, the effect of the inclination angle of finned enclosures on the development of buoyancy-driven convection flows is investigated. 1-fin and 3-fin rectangular enclosures heated from one side are studied under different inclination angles varied from 0^o to 180^o. Transient numerical simulations using a control volume approach are carried out to obtain the phase fields, flow fields, temperature distributions, heat transfer rates, as well as thermal energy storages for different configurations. The results showed that the melting time reduces by decreasing the inclination angle of the enclosure due to the intensification of the natural convection flows and increase in the number of vortices in the liquid PCM. The maximum melting time reduction compared to the unfinned vertical enclosure is 72% obtained by the 0^o-3-fin enclosure. There are critical liquid fractions beyond which heat transfer rates in the 1-fin enclosure surpass the 3-fin enclosure when the inclination angle of the former is less than the latter one. It was also found that the total heat content of the enclosures is increased by increasing the inclination angle of the enclosure and decreased by adding the number of fins.

Keywords

Phase change material; Fin; Inclination angle; Natural Convection heat transfer; Lauric acid

Nomenclature

A	heat transfer area (m^2)
C_p	specific heat capacity (J/kg K)

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