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Numerical Study of PCM Melting Effects in Fin Type Rectangular Encapsulation Incorporating Aluminum Spiral Fillers

L. Tan, Y. Kwok, A. Date, A. Akbarzedah

Abstract

A numerical investigation was carried out to understand the melting characteristics of PCM in an internal fin type rectangular encapsulation with the addition of aluminum spiral fillers. Increasing the number of fins in PCM thermal storage encapsulation can significantly improve melting performance but to some values where only lead to marginal improvement in heat transfer rate. Adding aluminum spiral fillers within the fin gap can be an option to improve heat transfer internally. This paper presents extensive computational visualizations on the PCM melting patterns of the proposed fin-spiral fillers configuration in a four fins rectangular encapsulation. The aim of this investigation is to understand the PCM's melting behaviors by observing the natural convection currents movement and melting fronts formation. Fluent 6.3 simulation software was utilized in producing two-dimensional visualizations of melting fractions, temperature distributions and flow fields to illustrate the melting process internally. The results have shown that with the present of aluminum spiral fillers in fin-type slab have better melting rate than pure fin type slab. Greater liquid regions are observed internally which promoted more active natural convection currents and improved melting performance.