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Research papers

Melting process of RT-25 as a phase change material by placing innovative rectangular and parallelogram fins: Effect of shape and angle of fins

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Highlights

- This numerical study investigates the melting process of the PCM by placing innovative fins.
- This study evaluates the melting behavior of different fin models with different angles.
- Changing the fin model reduces the melting time, which leads to a higher energy charging rate.
- Maximum and minimum melting times occur at 0° and 60°, respectively.
- The average power for angles from 15° to 90° is almost equal, and at angle 0°, it is less than other angles.

Abstract

This numerical research used innovative fins that mix parallelogram and rectangular fins to look at the melting of the phase change material (PCM). This paper analyzed, in 2D and using a numerical solution, the melting behavior of several fin models with various angles under constant flux circumstances in a rectangular cavity. The left wall of the storage was subjected to a heat flux of 2500W/m^2. The major objective of the current research was to introduce fins with novel models, which are a mix of rectangular and parallelogram fins, in order to further enhance the melting performance of PCM. For this purpose, the effect of different fin models (with different angles:15°, 30°, 45°, 60°, 75°, and 90°) in the condition of constant heat flux in a rectangular cavity was studied. The results show that among various geometries studied by fin, proposed geometry of model E was selected among the models. Changing the fin model reduces the melting time, which led to a higher energy charging rate. Moreover, by examining different melting angles, the maximum and minimum melting times occurred at 0° and 60°, respectively. The heat flux had an inverse relationship with the melting time; the higher the heat flux, the shorter the melting time. E model with an angle of 60° had the best performance. Because it had reached complete melting in the shortest time, in this model, after 52.25min, the PCM completely melts. The stored energy for PCM at 60° was less than other angles, and equal to 236.04MJ. The average power for angles from 15° to 90° was almost equal, and at angle 0°, it was less than other angles.