

Constructal Enhancement of Fins Design Integrated to Phase Change Materials

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Abstract : The latent heat thermal energy storage system is a thrust area of research due to exuberant thermal energy storage potential. The thermal performance of PCM is significantly augmented by installation of the high thermal conductivity fins. The objective of the present study is to obtain optimum size and location of the fins to enhance diffusion heat transfer without altering overall melting time. Hence, the constructal theory is employed to eliminate, resize, and re-position the fins. A numerical code based on conjugate heat transfer coupled enthalpy porosity approach is developed to solve Navier-Stoke and energy equation. The numerical results show that the constructal fin design has enhanced the thermal performance along with the increase in the overall volume of PCM when compared to conventional. The overall volume of PCM is found to be increased by half of total of volume of fins. The elimination and repositioning the fins at high temperature gradient from low temperature gradient is found to be vital.

Keywords : constructal theory, enthalpy porosity approach, phase change materials, fins

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