

Numerical study on thermal solar energy storage unit using phase change material

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Abstract

Reducing elevated facade temperature in solar storage unit using internal fins minimizes heat loss and enhances the efficiency of the unit. The use of the phase change material with internal fins in a solar heat storage unit has been investigated by (2D) numerical simulation. The phase change material (PCM27) was stored into a rectangular enclosure which is subjected to a constant heat flux by one vertical side taking into account convective and radiative losses. The remaining walls were insulated. A parametric study was carried out to enhance the energy storage amount for different fin number and spacing maintaining the same copper and PCM amount. The mathematical model is solved using COMSOL Multiphysics. The natural convection in melted PCM was taken into account. This model was validated by comparing numerical results with numerical data by ([Huang, 2006](#)). Numerical simulations showed that adding fins provides the advantage of improving the thermal energy storage by more than 10%. It was also found that optimum stored energy depends on fin geometric parameters.

Keywords: Phase change material, fins, solar energy storage, simulation

[M.J. Huang, P.C. Eames, B. Norton, "Comparison of a small-scale 3D PCM thermal control model with a validated 2D PCM thermal control model" Solar Energy Materials & Solar Cells 90 \(2006\) 1961–1972.](#)