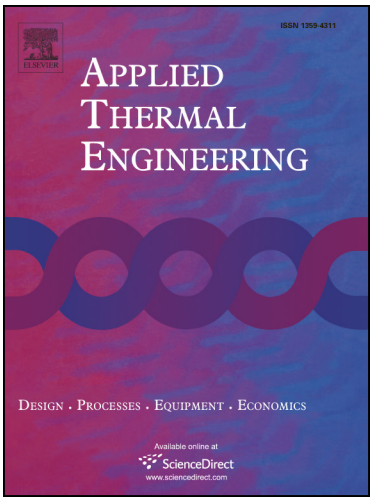

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Investigation of PCM Charging for the Energy Saving of Domestic Hot Water System

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Abstract

In this paper an investigation on the charging process of a phase change material (PCM) integrated in a domestic hot water system is presented. In order to increase the amount of the stored energy in a limited portion of time during maximum solar radiation it is preferred to reduce the melting time of the PCM used in the heat exchanger. Therefore the effect of mass distribution of a PCM in a multi-tube heat exchanger is studied. Paraffin RT50, is used as the PCM and water as the heat transfer fluid (HTF) carries the energy gained in solar flat plate collector. Enthalpy porosity method is applied for modeling the phase change process and an experimental result is used to validate the model. There are six different cases in order to examine the effect of mass distribution on the melting time to reach the minimum value. Temperature and heat flux versus time as well as liquid fraction contours and behavior of the charging process are described. The results show that by distributing the PCM mass in a specific arrangement in which 40% of PCM mass is in inner tube, 52% reduction in melting time is achieved hence solar energy can be used more efficiently in the time of maximum solar radiation.

Keywords: PCM charging, domestic hot water system, Heat exchanger, solar

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