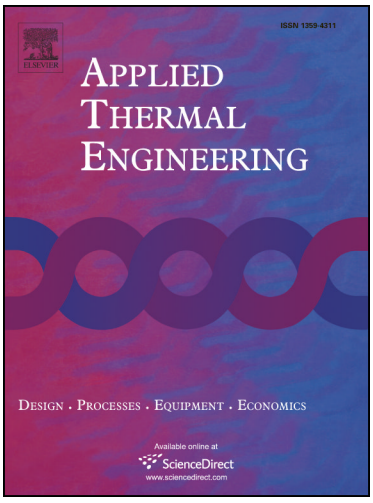

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Performance Tests on Lab–scale Sensible Heat Storage Prototypes

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Abstract

This paper presents the performance tests on lab-scale sensible heat storage (SHS) prototypes made up of cast steel and concrete. Thermal storage performances of the prototypes in terms of charging/discharging times and energy storage/discharge rates have been estimated at various operating temperatures and heat transfer fluid (HTF) flow rates. These prototypes were designed in the form of a shell-and-tube type heat exchanger with a heat storage capacity of 15 MJ. Five different concrete mix designs were studied and the mix design M30 was selected for thermal storage, as they possess high compressive strength-cost ratio. Heat transfer enhancement in the concrete prototypes was incorporated by welding longitudinal fins on the HTF tubes. Hi-tech Therm 60 was used as heat transfer fluid. The charging and discharging times of cast steel (M1) prototype in the temperature range of 353-413 K were 1263 and1803 s, respectively. The effective charging/discharging time of the concrete prototype with copper tubes (M2) and concrete prototype with MS tubes (M3) prototypes in the temperature range of 353-433 K were 5210/6297 s and 7160/7780 s, respectively. The storage performance of the system highly depends on the operating temperature range due to the temperature dependence of the thermo-physical properties of the SHS materials and the HTF.

Key words: Solar energy; sensible heat storage; performance tests; heat transfer enhancement; concrete.

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