

Influence of the Non-Uniform Distribution of Filler Porosity on the Thermal Performance of Sensible Heat Thermocline Storage Tanks

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Abstract : Thermal energy storage is of critical importance for the highly-efficient utilization of renewable energy sources. Over the past decades, single-tank thermocline technology has attracted much attention owing to its high cost-effectiveness. In the present work, we investigate the influence of the filler porosity's non-uniform distribution on the thermal performance of the packed-bed sensible heat thermocline storage tanks on the basis of the analytical model obtained by the Laplace transform. It is found that when the total amount of filler materials (i.e., the integration of porosity) is fixed, the different porosity distributions can result in the significantly-different behaviors of outlet temperature and thus the varied charging and discharging efficiencies. Our results indicate that a non-uniform distribution of the fillers with the proper design can improve the heat storage performance without changing the total amount of the filling materials.

Keywords : energy storage, heat thermocline storage tank, packed bed, transient thermal analysis

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