

The thermal response of the shell-and-tube energy storage system consisting of multiple segments holding separate phase-change materials (PCMs) of different melting points was studied. ... Performance enhancement of triplex tube latent heat storage using fins, metal foam and nanoparticles. International Communications in Heat and Mass Transfer ...

1. Introduction. A major breakthrough in energy storage has solved the problem of intermittence of solar energy and thereby fosters the widespread of solar energy applications towards clean and affordable energy supply. Increasing evidence suggests that high-efficient thermal energy storage has been playing an essential role in improving the applicability as well ...

The thermal energy storage (TES) tank of PVT systems is a crucial element that solves the problem of solar discontinuity. Recently, TES tanks with metal fins and rotation have been designed to achieve more efficient operation. The TES tank is always made of multiple heat storage tube units with similar structure in series or parallel.

In this study, a two-dimensional axisymmetric simulation model with natural convection was established for the shell-and-tube thermal energy storage unit. Open-cell metal foam with a porosity of 0.94 and pore density of 15 pore per inch was employed to be arranged in either heat transfer fluid or phase change materials domains.

All the dimensions of eccentric tube TES are the same as the concentric tube thermal energy storage except for the location of inner tube. The inner tube is offset by 6 mm along the direction of gravitational acceleration. ... Design and operating evaluation of a finned shell-and-tube thermal energy storage unit filled with metal foam. Appl ...

Heat energy storage systems offer the benefits of high energy storage efficiency and consistent temperature due to the use of phase change material (PCM); however, its disadvantage is that thermal ...

The impact of fin configurations on the charging and discharging characteristics of energy storage tube was studied by a quantity number of researchers [[26], [27], [28]]. The performance of thermal energy storage and improvement of thermal conductivity by metal fins was reported to be affected by fin parameters [29, 30].

Thermal energy storage has attracted more and more attentions due mainly to its ability of peak load shifting. Shell-and-tube configuration is a typical heat exchanger for thermal ...

To further enhance the heat transfer to boost the overall energy storage efficiency and reduce the apparent inhomogeneity of melting characteristics, fins with gradient height are ...

Experimental investigations of phase change processes in a shell-and-tube latent heat thermal energy storage

unit with an inner square tube were carried out. Paraffin ...

Metal hydride hydrogen storage material is a series of reversible hydrogen absorbing and discharging abilities of a single metal/alloy [7]. Extensive research efforts, both domestically and internationally, have been dedicated to these materials in recent years, with a particular emphasis on rare-earth AB<sub>5</sub>-type alloys (A is a rare earth metal and B is a ...

DOI: 10.1016/j.ens.2023.03.004 Corpus ID: 257906486; Comparative study on heat transfer enhancement of metal foam and fins in a shell-and-tube latent heat thermal energy storage unit

In this study, an innovative thermal energy storage design method was developed by adding the combination of metal foam and fin to phase change materials (PCMs). A ...

Latent heat storage in a shell-tube is a promising method to store excessive solar heat for later use. The shell-tube unit is filled with a phase change material PCM combined with a high porosity ...

Design and operating evaluation of a finned shell-and-tube thermal energy storage unit filled with metal foam. Author links open overlay panel Xiaohu Yang a b, Jiabang Yu a, Tian Xiao c, Zehuan Hu a, Ya-Ling ... The proposed novel finned shell-and-tube thermal energy storage unit filled with metal foam outperformed other competing heat transfer ...

Without any heat transfer enhancement techniques, the energy storage in bare tube accumulates gradually till the completion of melting. Energy storage coefficient could reflect the energy storage rate, with fin-foam hybrid tube taking the lead, followed by metal foam tube, fin tube and bare tube.

Reducing the liquid metal content by using a solid storage medium in the thermal energy storage system has three main advantages: the overall storage medium costs can be reduced as the parts of the higher-priced liquid metal is replaced by a low-cost filler material. At the same time the heat capacity of the storage can be increased and the ...

Experiments were conducted on a copper tube with helical fins, a steel tube with longitudinal fins, and a smooth stainless steel tube. ... A review of performance investigation and enhancement of shell and tube thermal energy storage device containing molten salt based phase change materials for medium and high temperature applications. Appl ...

(b) Multi-tube in shell (single pass): In this type of arrangement, a single shell incorporates multiple tubes with all the tubes having their axis parallel to each other as well as parallel to the axis of the shell gure 13.7a consists of a cylindrical block of PCM with HTF flowing through a set of parallel tubes traversing the block. A single module is shown in Fig. 13.7b.

1. Introduction. Thermal processes can be improved by using thermal energy storage (TES) systems in several

ways. They allow to take advantage of waste heat, to work as a thermal shock absorber protecting the device, or to solve the mismatch between the energy supply and demand, the latter helps to integrate renewable energies [1]. Among the different ...

The performance of hydrogen energy storage in this study is investigated based on two heat exchanger configurations (including a helical tube for case 1 to case 3 and a semi ...

Thermal energy storage has attracted more and more attentions due mainly to its ability of peak load shifting. Shell-and-tube configuration is a typical heat exchanger for thermal energy storage. To enhance phase change heat transfer, open-cell metal foam has been involved in various kinds of shell-and-tube heat exchangers.

Shell-and-tube latent heat thermal energy storage units employ phase change materials to store and release heat at a nearly constant temperature, deliver high effectiveness of heat transfer, as ...

Of course, combining these methods is another way that has been studied too. For instance, Yang et al. [12] investigated the thermal energy storage in a finned tube filled with metal foam ...

A two-dimensional schematic of the cascaded shell-and-tube TES module is shown in Fig. 1. The module consists of two horizontally-mounted concentric tubes made of aluminum having outer diameters of 12.7 mm (0.5 in. and 48.3 mm (2 in. with wall thickness of 1.27 mm (0.05 in. [12]. The composite of cascaded metal foam in PCM occupies the annulus ...

The study on a shell and tube thermal energy storage with PCM, partially filled with metal foam, elucidates to understand the better configurations in terms of melting and solidification times and, consequently, velocity for assigned properties of PCM and metal foam. ... Heat transfer enhancement for thermal energy storage using metal foams ...

The perspective is focused on thermal energy storage systems using liquid metal as heat transfer fluids, but not necessarily as heat storage medium. For the latter, the ...

MF has been used as one of the effective heat transfer enhancement techniques in latent heat thermal energy storage systems. The present study aims to combine the MF with wavy designs to provide a locally enhanced layer of wavy metal foam over the heat transfer tube in a shell-tube thermal energy storage design for the first time. 2.

Combines nanoparticles with fins in a triplex-tube PCM energy storage system. ... Heat transfer enhancement for thermal energy storage using metal foams embedded within phase change materials (PCMs) Sol. Energy, 84 (2010), pp. 1402-1412. View PDF View article View in Scopus Google Scholar

Researchers have proved the effect of foam metal in improving the thermal conductivity and temperature uniformity of PCM through heat transfer experiments [21, 22], visualization experiments [23], theoretical

calculations [24] and numerical simulations [25, 26]. Sathyamurthy et al. [27] used paraffin as an energy storage medium in recycled soda cans ...

Fig. 12 (a) shows that the energy storage rate is considerably high at the beginning of the charging process because of the initially high temperature difference between the PCM-metal foam combination and the tube surface. The maximum value of the thermal energy stored depends on the foam porosity and nanoparticle content.

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