Thermal energy storage 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. Energy, 255 (2019), p. 113806. View PDF View article View in Scopus Google Scholar [2]

Fig. 1 (a) depicted the design concept for the shell-and-tube LHTES tank concerning solar thermal engineering applications. A bundle of tubes with annular fins attached were inserted in the LHTES tank. To highlight the inner structure of the LHTES tank, Fig. 1 (b) described schematically the physical model for the LHTES unit, where fins with various ...

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 anisotropic copper metal foam (FM) of high thermal conductivity. The PCM-MF composite was modeled as an anisotropic porous medium. Then, a two-heat equation ...

In the study of Seddeq et al. [30], the characteristics of thermal behavior and heat transfer in horizontal and vertical thermal energy storage systems of shell and tube were investigated and compared using a combined conduction and convection model. The study showed that during the process of melting in the horizontal direction, convective ...

The paper presents a survey of the experimental and numerical studies of shell-and-tube systems in which phase change material (PCM) is used. Due to the multitude of design solutions for shell-and-tube systems, the emphasis is placed on double-tube (DT), triplex-tube (TT), and multi-tube (MT) units. Additionally, only single-pass systems are considered. ...

Advance in thermal management system technology for space applications is critical to handling high heat flux systems and reducing overall mass [1].Phase Change Materials (PCM) is an ideal thermal management material that can store and release a large amount of heat through the melting and freezing process [2] tegrating PCM into heat transfer equipment is ...

Thermal energy storage units can be categorized into sensible and latent thermal energy storage units. Latent thermal energy storage (LTES) is especially an engaging technology due to its high-density energy storage [4]. A shell-and-tube LTES unit with an inner straight tube is one of the simplest designs and is widely used in heat storage ...

The shell-and-tube thermal energy storage (TES) system is a widely used method for the storage of thermal energy in engineering applications. Nevertheless, the use of molten salt as a phase change material (PCM) in a shell-and-tube thermal energy storage (TES) system presents a challenge due to its relatively poor thermal

conductivity. ...

Thermal energy storage (TES) is of great importance in solving the mismatch between energy production and consumption. In this regard, choosing type of Phase Change Materials (PCMs) that are widely used to control heat in latent thermal energy storage systems, plays a vital role as a means of TES efficiency. However, this field suffers from lack of a ...

Among these methods, adding fins and metal foam are two relatively simple and efficient strengthening measures, and their applications in the latent heat thermal energy storage unit (LHTESU) have been intensively studied [11, 12].Safari et al. [5] studied the melting behavior of smooth tubes, straight-finned tubes, and bifurcated-finned tubes through experiments and ...

Renewable energy sources are more acceptable and reliable by using efficient and well-design thermal storage. Therefore, enhancing the thermal performance of thermal storage is extensively studied. In the current work, the latent heat storage is a shell and a finned tube heat exchanger, the end of the fins being connected by a coiled spiral. Numerical ...

The heat transfer efficiency of a thermal energy storage unit (TESU) can be improved by the addition of novel longitudinal fins. A series of TESUs are analyzed using the finite volume method (FVM) to determine the effect of fin angle on the heat transfer performance. As the fin angle increases, the TES rate first increases, then decreases, reaching a maximum rate ...

In order to reduce green-house gas emissions, it is necessary to increase the application of renewable energy such as solar energy [1].Thermal energy storage (TES) plays an important role in eliminating the mismatch between supply and demand of solar energy [2].Latent heat thermal energy storage unit (LHTESU) is a promising heat storage method, which has the ...

A goal with thermal energy storage is to make use of low cost and sustainable storage materials for implementing large storage capacities and supplying energy flexibly. In a latent thermal energy storage (LTES), which utilizes the phase change on the storage material side, the latent heat of fusion stores large amounts of energy per unit volume ...

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 ...

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].

The melting process of industrial grade paraffin wax inside a shell-and-tube storage is analyzed by means of numerical simulation and experimental results. For this purpose, the enthalpy porosity method is extended by

a continuous liquid fraction function. The extended method is tested using results gained from a gallium melt test inside a rectangular enclosure.

1. Introduction. Latent heat thermal energy storage system (LHTESS) is a promising energy storage technique to modify the mismatch between energy supply and demand cause of the high energy storage capacity and heat storing/releasing close to a constant temperature [1], [2], [3].Phase change materials (PCM) are employed in LHTESS as the ...

The current study concentrated on how the number of fins can affect the PCM melting in a shell-and-tube thermal energy storage system. A PCM of the Rubitherm RT42 type filled the outer tube and sent hot water (340 K) into the inner tube to provide heat. In this regard, the study introduced three cases: one without fins, one with four fins, and ...

Diao et al. [33] designed an experimental TES device using FMHPA and found that the variation pattern of thermal resistance is very different due to different heat transfer mechanisms in charging and discharging modes.Jinshah et al. [34] combined the PCM with the natural circulation loop to provide a new idea for using TES.The application of TES resulted in ...

However, the low thermal conductivity of phase change materials seriously limits the energy storage efficiency, which put forward more stringent requirements for heat transfer enhancement. In this study, a two-dimensional axisymmetric simulation model with natural convection was established for the shell-and-tube thermal energy storage unit.

Improvement of thermal performance of energy storage leads to energy savings and reduction of carbon emissions. In this study, the effect of tube arrangement on the performance of thermal energy storage is examined during the melting process of a phase change material (RT50). The heat transfer and phase change modeling are based on conservation ...

The International Renewable Energy Agency (IRENA) recently released Innovation Outlook on Thermal Energy Storage in 2020, highlighting how the market for Thermal Energy Storage ... TCHS showed that the increase of the heat transfer area among HTF tube and TCM in the storage can significantly accelerate hydration rate and reduce hydration time.

Previous studies in literatures adequately emphasized that inserting fins into phase change material is among the most promising techniques to augment thermal performance of shell-and-tube latent heat thermal energy storage unit. In this study, the novel unequal-length fins are designed from the perspective of synergistic benefits of heat transfer and energy ...

A new variable rotational strategy has been proposed to optimize the charging characteristics for TES tubes, taking into consideration the non-uniformity of melting. A series ...

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The authors proposed new double-tube latent heat thermal energy storage units (M04, M05 and M06) that combine the features of different techniques to reduce PCM melting time and subsequently improving the energy storage availability. Large amounts of energy can be delivered in a short time, which is important in the context of renewable energy ...

This study shows that the proposed latent heat thermal energy storage unit (M06) significantly reduces PCM melting time compared with vertical (76%), horizontal (66%), and ...