Energy storage in heat transfer

Compared with indirect container, direct-contact container has an extremely simple structure and rapid heat exchange due to the negligible heat transfer tubes [18, 19] a direct-contact container, the PCM mixes with the heat transfer fluid (HTF) directly, such as paraffin/water, concrete/water system, etc. [20], [21], [22].Some work studied the performance ...

Although the large latent heat of pure PCMs enables the storage of thermal energy, the cooling capacity and storage efficiency are limited by the relatively low thermal conductivity (~1 W/(m ? K)) when compared to metals (~100 W/(m ? K)). 8, 9 To achieve both high energy density and cooling capacity, PCMs having both high latent heat and high thermal ...

Thermal energy storage (TES) is a technology that stocks thermal energy by heating or cooling a storage medium so that the stored energy can be used at a later time for heating and cooling applications and power generation. TES systems are used particularly in buildings and in industrial processes. This paper is focused on TES technologies that provide a way of ...

Over the last decade, the development of thermal energy storage techniques effectively promotes the utilization of renewable and clean energy and alleviates the environmental pollution caused by fossil energy combustion [1], [2], [3], [4].Among the various heat storage techniques, latent heat thermal energy storage (LHTES) has attracted extensive ...

2 days ago· Ben Khedher, N., Ullah, Z., Boujelbene, M. et al. Variable viscosity and activation energy aspects in convection heat transfer over gravity driven solar collector plate for thermal ...

A 21.17% improvement of the heat transfer performance is obtained when the total length of unequal-length fins is 18 mm. The present study is helpful to make further efforts to enhance heat transfer and energy storage of shell-and-tube latent heat thermal energy storage unit with unequal-length fins.

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Thermal energy can be stored in several ways, using different categories of materials based on their storage method: sensible heat storage materials, latent heat storage materials, and thermochemical materials. Sensible Heat Storage Materials: These materials store energy by changing their temperature without undergoing a phase change.

In a latent heat thermal energy system, heat is transferred mainly by convection and conduction, the size and quantity of fins, heat exchange tubes, and the arrangement of heat storage device will affect the heat transfer performance of heat storage device, many researchers at home and abroad have studied it.

On the other hand, latent heat thermal energy storage (LHTES) systems have a large thermal heat capacity, high energy storage density, negligible temperature change throughout the charge ...

Thermal energy storage using sensible heating of a solid storage medium is a potential low-cost technology for long-duration energy storage. To effectively get heat in and out of the solid ...

However, in most applications, LHTES are required to respond quickly to changes in heat load, but the low thermal conductivity of PCM limits the efficiency of thermal energy storage and release [6].Many techniques have been proposed and applied to improve the thermal performance of the LHTES units, such as the addition of highly thermally conductive porous ...

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Energy Storage is a new journal for innovative energy storage research, covering ranging storage methods and their integration with conventional & renewable systems. Abstract Current concentrated solar power (CSP) plants that operate at the highest temperature use molten salts as both heat transfer fluid (HTF) and thermal energy storage (TES ...

The thermophysical properties of thermal energy storage materials should be presented in the following aspects according to the given requirements of the application fields. Melting point: Phase change materials should have a melting point near the required operational temperature range of the TES system.

Various enhancement techniques are proposed in the literature to alleviate heat transfer issues arising from the low thermal conductivity of the phase change materials (PCM) in latent heat thermal energy storage systems (LHTESS). The identified techniques include employment of fins, insertion of metal structures, addition of high conductivity ...

The amount of heat stored in thermochemical energy storage involving solid-gas phase depends upon the pressure of the gas, whereas the heat transfer coefficient as observed by Kuwata et al. is far greater in liquid-solid systems compared to gas-solid systems [55]. They have also reported the short-term cyclic stability in the case of the solid ...

Latent heat thermal energy storage (LHTES) systems can be used to combat the limited collection and long-term storage of renewable energy sources. The key component of an LHTES system is its phase change material (PCM), which thermally stores energy.

Thermal energy storage (TES) is a technology that reserves thermal energy by heating or cooling a storage medium and then uses the stored energy later for electricity generation using a heat engine cycle (Sarbu and Sebarchievici, 2018) can shift the electrical loads, which indicates its ability to operate in demand-side management (Fernandes et al., 2012).

Storage fluid from the high-temperature tank is used to generate steam in the same manner as the two-tank direct system. The indirect system requires an extra heat exchanger, which adds cost to the system. This system will be used in many of the parabolic power plants in Spain and has also been proposed for several U.S. parabolic plants. The ...

The efficiency and functioning of latent heat thermal energy storage units are significantly impacted by the efficient heat transfer between the heat exchanger tube and the PCM. Poor thermal management can cause slow charging and discharging rates, which could prevent latent heat thermal energy storage devices from being widely used [41]. The ...

China is committed to the targets of achieving peak CO2 emissions around 2030 and realizing carbon neutrality around 2060. To realize carbon neutrality, people are seeking to replace fossil fuel with renewable energy. Thermal energy storage is the key to overcoming the intermittence and fluctuation of renewable energy utilization. In this paper, the relation ...

Intermittent renewable energy sources such as solar and wind necessitate energy storage methods like employing phase change materials (PCMs) for latent heat thermal energy storage (LHTES). However, the low thermal conductivity of PCMs limits their thermal response rate. This paper reviews recent progress in active heat transfer augmentation methods for ...

In this article, the influences of four T-shaped fins and three PCM layouts on the energy storage and heat transfer performances of a rectangular LHES unit were numerically investigated by means of the enthalpy-porous medium model, and comparisons were carried out with the unfinned cavity and the cavity with rectangular fins. ...

By accurately measuring these properties, it becomes possible to evaluate the heat transfer performance, energy storage capacity and overall thermal behaviour of concrete. This information is critical for the development of efficient and effective TES systems, enabling the storage and utilisation of thermal energy in a wide range of ...

Molten salts are suitable both as heat storage medium and heat transfer fluid (HTF). In general, there is experience with molten salts in a number of industrial applications related to heat treatment, electrochemical treatment and heat transfer for decades. ... In 2010 he started working on a sensible heat thermal energy storage system at DLR ...

This paper provides a comprehensive review on the development of latent heat storage (LHS) systems focused on heat transfer and enhancement techniques employed in PCMs to effectively charge and discharge latent heat energy, ...

Heat transfer is the energy exchanged between materials (solid/liquid/gas) as a result of a temperature

difference. ... Thermal engineering concerns the generation, use, conversion, storage, and exchange of heat transfer. As such, heat transfer is involved in almost every sector of the economy. [7] Heat transfer is classified into various ...

Among the available options, Latent Heat Thermal Energy Storage (LHTES) systems comprised of phase change materials (PCMs) show two of the most desirable properties for heat storage systems: high energy density, which allows the construction of compact designs well-suited for distributed applications [1], and minimal operating temperature ...

The heat transfer processes (or kinetics) are governed by the rates at which various related physical phenomena occur, such as (for example) the rate of particle collisions in classical mechanics. These various states and kinetics determine the heat transfer, i.e., the net rate of energy storage or transport.