Heat pipe energy storage and heat dissipation

Why are heat pipes used in energy storage systems?
Heat pipes have been used extensively in a variety of energy storage systems. They are suited to thermal storage systems,in particular,in the role of heat delivery and removal,because of their high effective thermal conductivityand their passive operation.

Can gravity heat pipe with heat storage improve thermal performance?
Thermal enhancement methods concerning configurations of heat storage units are analyzed. For the thermal performance enhancement of electronic components under intermittent high heat load, this paper proposes a gravity heat pipe with heat storage (GHPHS) that couples the advantages of GHPs and latent heat storage (LHS) units.

Can heat pipes and phase change materials be used in thermal systems?
This section reviews the previous work carried out on thermal systems using the combination of heat pipes and phase change materials. Phase change materials (PCMs) are widely used in thermal energy storage and thermal managing applications.

What is a latent heat thermal energy storage system?
Latent heat thermal energy storage systems have the benefit of saving a high amount of thermal energy with a low-temperature swing. Still,they have a low thermal conductivity,which impacts their performance significantly. As a result of these conditions,interest in heat pipe applications on land has grown in recent years.

Can suspended finned heat pipes improve thermal performance of PCM storage system?
Experimental facility of the suspended finned heat pipes (Khalifa et al.) Yogev and Kribus offered different methods to improve the thermal performance of a PCM storage system with an integrated active HP.

Can phase change materials improve latent thermal energy storage?
The low thermal conductivity of phase change materials (PCMs) limits their large-scale application in the field of thermal storage. The coupling of heat pipes (HPs) with PCMs is an effective method to enhance latent heat thermal energy storage.

There was a wide application of heat pipes with conventional working fluids (mentioned in Table 3), such as photovoltaic systems [94], latent heat storage systems [95], thermal modeling of solid oxide fuel cells [96], de-icing of bridge deck [97], heat recovery in solar stills [98], heat exchangers and energy saving systems [99] and thermal ...

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 ...

Heat took away by heat pipe is closely related with heat dissipation of cabinets. Figure 67.6 shows that heat dissipation of 14 cabinets through heat pipe are different and ranges from 3 to 8 kW. Total cooling capacity received is 72.0 kW, and unbalance rate is 11 % comparing with total cooling capacity of outdoor chiller, indicating that the ...

Heat transfer and heat dissipation path Heat can be transferred through objects and spaces. Transfer of heat means that the thermal energy is transferred from one place to another. Three forms of heat transfer The heat transfer occurs in three forms: thermal conduction, convection (heat transmission), and heat radiation.

Li-ion battery is an essential component and energy storage unit for the evolution of electric vehicles and energy storage technology in the future. Therefore, in order to cope with the temperature sensitivity of Li-ion battery ...

Proposed heat pipe-based energy Storage system gave 186% enhancement in melting and solidification time of PCM as compared with solid copper rod. Naghavi et al. [85] designed solar water heating system by combining the heat pipe and PCM. In their setup, heat pipe was used to transfer heat from solar collector to PCM storage unit.

Latent heat thermal energy storage systems have the benefit of saving a high amount of thermal energy with a low-temperature swing. Still, they have a low thermal ...

Fin and tape cases enhance the liquid fraction and energy storage performance. PCM melting process modelled using Enthalpy-Porosity method. The stearic acid is used as ...

Also, the heat dissipation from the un-finned section of the HPs is neglected. The average temperature of the cooling air is calculated from an energy balance on the air. ... High temperature latent heat thermal energy storage using heat pipes. Int. J. Heat Mass Transfer, 53 (2010), pp. 2979-2988, 10.1016/j.ijheatmasstransfer.2010.03.035. View ...

Insulated-gate bipolar transistor (IGBT) modules for energy conversion and transmission are commonly utilized in various fields such as electric vehicles, rail transit, high-voltage direct current power, and renewable energy sources like wind and solar [1], [2], [3], [4].Recently, the increase in power density and integration of IGBT modules has led to a ...

The liquid-cooled thermal management system based on a flat heat pipe has a good thermal management effect on a single battery pack, and this article further applies it to a power battery system to verify the thermal management effect. The effects of different discharge rates, different coolant flow rates, and different coolant

inlet temperatures on the temperature ...

The heat pipe is an efficient heat transfer element widely utilized in diverse scenarios requiring rapid and reliable heat dissipation. Practice and research in energy utilization and storage are still needed. ... Taking the staggered plate micro-heat pipe heat storage/release device as an example, we can observe the rapid transfer of heat to ...

This analysis allowed us to maximize heat dissipation with only one heat pipe mounted on the vital region. For further evaluation of the proposed strategies, a computational fluid dynamic (CFD) model is built in COMSOL Multiphysics® and validated with surface temperature profile along the heat pipe and cell. ... Besides, their energy storage ...

A combination of the heat pipe as a superconductor with PCM as a secondary condenser and energy storage is a common method in battery cooling applications. In this method, PCM and heat pipes act together to take the heat from the battery into the surrounding air. ... It is obvious in Fig. 4 the heat pipes assist heat dissipation with a larger ...

The heat dissipation of the heat pipe will reduce the phase transition rate of PCM but have less effect on the heat transfer between the battery and PCM. Thus, the battery temperature in ... and stability study of a form-stable erythritol/expanded graphite composite phase change material for thermal energy storage. Renew Energ, 136 (2019), pp ...

The exponential increase in fossil fuels resulted in global warming and other serious health issues [1], [2], [3].Recent development of different renewable energy resources that are sustainable and have no or low environmental impacts [4], [5], [6], as well as improving the current processes through waste heat recovery [7], [8] can significantly minimize such effects.

Latent heat storage system (LHSS) is better than sensible heat storage system due to its ability to store large amount of heat at constant temperature, high energy density and low cost. Now a days, LHSS is used in building insulation, cold energy storage and waste heat recovery systems [1], [2], [3], [4].

LHS technology is to absorb/release heat during the melting/solidification process of PCMs [5], [6], [7], based on which, heat can be transferred and stored by PCMs because of the dual advantages of high heat storage density and small temperature fluctuations, thus effectively relieving thermal shock of high-power electronic equipment.Existing studies [8], [9], [10] show ...

The PCM with large heat storage capacity and heat pipe coupled with liquid cooling exhibit excellent thermal performance for battery module, which is an effective and reliable method with relative longer working time and appropriate temperature. ... and the results shown that the heat dissipation capacity of the plate heat pipe is better with ...

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Compared with sensible heat energy storage and thermochemical energy storage, phase change energy storage has more advantages in practical applications: ... [13], [14], the rapid heat dissipation of electronic devices such as laptop computers and air conditioners, etc. All have higher requirements for the charging and discharging rate of the ...

Oscillating Heat Pipe (OHP) is a good means of heat dissipation. In this paper, the methods to improve the energy conversion and flow thermal performance of micro-channel OHP are studied and summarized. The working ...

Lithium-ion batteries have many advantages such as long cycle life, high power density and relatively low discharge speed, so in recent years they have played an important role as the main source of power for various industries such as electric vehicles (EV) and solar energy storage tanks [1] order to provide high electric energy in large-scale applications, especially ...

four main classifications of energy storage include chemical, electrical, mechanical and thermal systems. Categorization of systems that store thermal energy can be of 3 types - Latent Heat ...

A specially configured high temperature heat pipe for solar energy storage systems was proposed by Mahdavi et al. [97]. Sodium was chosen as the working fluid due to its low vapour pressure at high temperatures. Heat transfer limits of the heat pipe were determined, which were caused by heat pipe geometry, working fluid, wick structure, and ...

Latent heat storage units are introduced to enhance temperature uniformity. A model of gravity heat pipe with heat storage is developed and verified. Temperature dynamic ...

During the day, solar heat is absorbed by the wall and transferred via microchannel heat pipes (MHPs) to the PCMs, which melt to absorb excess heat and prevent it from reaching the interior. At night, the radiative cooling (RC) wall facilitates heat dissipation to the outside, accelerating the PCM"s solidification and resetting the system for ...

Improving the performance of a shell and tube latent heat thermal energy storage through modifications of heat transfer pipes: A comprehensive investigation on various configurations ... thereby enhancing heat transfer performance and ensuring efficient dissipation of heat from the pipe. Additionally, the fins help reduce temperature gradients ...

The heat pipe played a crucial role in efficiently transferring and managing heat within the PBM, contributing to this energy savings [93]. Battery temperatures were effectively controlled below 50 °C, and temperature differences were maintained below 5 °C, demonstrating that heat pipes were a reliable thermal management solution for power ...

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In the context of heat storage, aspects to consider include the chemical compatibility between the heat pipe wall and the storage material, the method of ...

Entransy dissipation in the heat pipe system is 21.7Q, and in CRAC system, it is 28Q, which means entransy dissipation of CRAC system is 25.4% higher than heat pipe system. Besides, in the heat pipe system, cold air is driven by fans on the back plate of the rack. Thus, the mass flow rate of air is much higher than CRAC system.

The experimental setup was built to investigate the performance of PCM-assisted heat pipe system for the cooling applications. The schematic of the setup and the dimensions of the system are shown in Fig. 1 a and Fig. 1 b respectively. The setup included a power supply that provided heating power, cooling water loop that supplied cooling, a heat pipe, transparent ...

Al-Hallaj et al. [17] designed different modes of heat dissipation for Li-ion battery modules and tested at various constant C-rates, ... Numerical study of finned heat pipe-assisted thermal energy storage system with high temperature phase change material. Energy Convers Manage, 89 (2015), pp. 833-842.

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