



# Heat pipe technology battery

Heat pipe technology is being used in the thermal management of electronics to enhance their cooling systems. Addressing overheating issues of electronic devices will improve their performance and helps ... battery, and the thermal condensation coefficient of the HP were considered. It was found that the optimum performance

Li-Ion Battery Immersed Heat Pipe Cooling Technology for Electric Vehicles. December 2023; Electronics 12(24):4931; ... Phase Change Material (PCM), Heat Pipe (HP), liquid, and immersion cooling ...

Numerical study on power battery thermal management system based on heat pipe technology. Energy Rep. (2023) J.S. Kim et al. Thermal performance of aluminum vapor chamber for EV battery thermal management. ... Investigation on liquid cold plate thermal management system with heat pipes for LiFePO<sub>4</sub> battery pack in electric vehicles. Appl. Therm ...

In this paper, the performance of a heat pipe based thermal management technique for batteries has been investigated experimentally. In this regard, a test rig was developed and used to demonstrate the effectiveness of flat heat pipe (heat mat) technology at controlling and maintaining the temperature of a prototype battery module, which consisted of ...

The critical review presented here exclusively covers the studies on battery thermal management systems (BTMSs), which utilize heat pipes of different structural designs and operating parameters as a cooling medium. The review paper is divided into five major parts, and each part addresses the role of heat pipes in BTMS categorically. Experimental studies, ...

DOI: 10.3390/electronics12244931 Corpus ID: 266131307; Li-Ion Battery Immersed Heat Pipe Cooling Technology for Electric Vehicles @article{Oh2023LiIonBI, title={Li-Ion Battery Immersed Heat Pipe Cooling Technology for Electric Vehicles}, author={In-Taek Oh and Ji-Su Lee and Jin-Se Han and Seong-Woo Lee and Su-Jong Kim and Seok-Ho Rhi}, journal={Electronics}, ...

Heat pipe cooling. a, Effect of the number of heat pipes on heat dissipation [81]. b, c, Heat pipes coupled with phase change materials [82], [83]. d, Immersing the condensing section of the heat pipe in a water box [84]. e, Heat pipe coupled with the cold plate [85]. f, Heat pipe coupled with spray cooling and phase change material [86]. g ...

China Automotive Technology & Research Center, Co., Ltd., No. 68 Xianfeng East Road, Dongli District, Tianjin, 300300, China. ... Chen and Li adopted an oscillating heat pipe with a Li-ion battery as the heat source; under this circumstance, the working condition is more realistic as temperatures near the anode and cathode are higher for a real ...

Abstract This paper presents an analysis of the performance of a heat pipe assisted battery thermal



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management system (BTMS) as a means of passive heat dissipation from EV batteries ...

Vibration is a highly common phenomenon in electric vehicles; therefore, it should be considered in the investigations regarding battery thermal management based on heat pipe technology [41,42,43]. Accordingly, this section tested the thermal performance of a half-length MHPA at an amplitude of 10 mm, a frequency of 10 Hz, and a heat generation ...

Over the years, studies on battery thermal management systems (TMS) have been widely developed. Generally, the cooling medium in a battery thermal management system (TMS) can be air-cooling [9], liquid cooling [8], phase change material (PCM) [10], or heat pipe [11]. Utilizing forced air convection with a fan to circulate air directly to the battery is easy and ...

The heat pipes are two-phase flow passive and reliable devices that transfer heat effectively and are vastly utilized in thermal systems. A summary of experimental and numerical studies related to advanced technologies of applications of heat pipes and thermosiphons is offered in this review. This paper focused mainly on the hybrid combinations ...

Heat pipes include a range of devices including Loop Heat Pipes (LHP), Pulsating Heat Pipes (PHP), Rotating Heat Pipes (RHP) [18], etc. [19] The loop heat pipe is a highly efficient two-phase heat transfer device that uses the evaporation-condensation phase change of the working mass to transfer the heat from the heat source to the condenser ...

In Battery Thermal Management System (BTMS), Loop Heat Pipes (LHPs) may act as thermal vectors connecting the bottom of the battery pack with the remote chiller of the EV's HVAC system, whilst graphite sheets allow to achieve satisfactory temperature homogenization of the cell surface, containing the added system weight and thermally isolating ...

Research on flat heat pipes, oscillating heat pipes, micro-heat pipes, and hybrid (HP + PCM) battery thermal management systems are discussed in this review article. Based on the review, it is determined that heat pipe-based hybrid (HP + PCM) battery thermal management systems perform significantly better than other BTMSs.

2.1. Geometric model description. Figure 1 shows a schematic diagram of the battery pack with HCLC, comprising 15 18650 LIB (connected in 5 series and 3 parallel (5S3P)), aluminum thermal conductive element, curved flat heat pipes, and liquid-cooled plate. The main physical parameters of these elements are shown in Table 1. An aluminum block with curved grooves serves as the ...

High-temperature heat pipes (also known as alkali metal heat pipes) are typically defined as heat pipes that operate between 400 and 1100°C. Visit High Temperature Heat Pipes Cryogenic heat pipes are specialized, passive, thermal management devices designed to transfer heat efficiently at low temperatures, typically below -150°C (-238°F).



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Waste heat generated by data centers (DCs) is a low-grade waste heat ( $\approx 100 \text{ }^\circ\text{C}$ ) and is characterized by its large magnitude [4] and stable generation (servers should be operating continuously (24/7/365)) [5]. With the development of information and communication technology, the power consumption of DCs is increasing rapidly.

**Abstract.** An effective battery thermal management system (BTMS) is essential for controlling both the maximum temperature and the temperature uniformity of a battery module. In this study, a novel and lightweight BTMS for prismatic batteries based on a heat pipe is proposed. A numerical model is created to study the influence of heat-transfer designs and ...

Heat pipes are silent heat transfer devices that work on the motion of boiling and condensation process. They have been used in space crafts, heat recovery and ventilation, power conversion, energy, and electronics cooling applications. Over the past few eras, several necessary upgradations in heat pipe technologies have happened to implement new advanced fluids, ...

Several researchers have investigated the effect of tubular heat pipes on battery thermal management by varying external conditions such as discharge rate, ambient temperature, and heating power. ... Review and advances in heat pipe science and technology[J] J. Heat Transf., 134 (12) (2012), Article 123001. View in Scopus Google Scholar [15]

Fig. 1: (a) Schematic of experimental set-up (b) Numbered simulated battery blocks for straight heat pipe setup, (c) Simulated battery blocks for branched heat pipe setup (d) Cross section of BTMS highlighting heat transport from simulated batteries to liquid cooled cold plate showing the location of thermocouples for in each battery, heat pipe ...

There have been some studies using loop heat pipes as a battery cooling technique, Putra et al. [20] studied flat loop heat pipes using distilled water, alcohol, and acetone as working fluids for battery cooling, which could be started at heat fluxes as low as  $0.48 \text{ W/cm}$  with thermal resistance of  $0.22 \text{ W/}^\circ\text{C}$  and liquid operating temperature of ...

Wang et al. [71] investigated a micro heat pipe array for LiBs and enhanced the uniformity by less than  $3.03 \text{ }^\circ\text{C}$ . Jouhara et al. [72] investigated a heat pipe TMS for a battery pack under a  $6\text{C}$  ...

This study proposes an anti-gravity 3D pulsating heat pipe (PHP) for cooling pouch batteries in electric vehicles. The 3D PHP envelops the battery cells and rapidly transfers heat generated from the batteries to the bottom cold plate. While the batteries generate heat on their frontal surface during charging and discharging, structural characteristics lead to localized ...

Research progress and future prospects of battery thermal management system based on heat pipe technology July 2019 Chinese Science Bulletin (Chinese Version) 64(7):682-693



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The application of two-phase heat transfer-based technologies as BTMS has expanded into heat pipe technology. The role of heat pipes has been involved in multiple industries ranging from cryogenics to the ceramics industry [17]. Due to their flexibility, passive operation and low maintenance, the role of heat pipes is rapidly expanding within each ...

This comprehensive review highlights the different heat generation mechanisms of Li-ion batteries and their resulting consequences, followed by the operating principles of heat pipes along...

DOI: 10.1360/N972018-00948 Corpus ID: 108070856; Research progress and future prospects of battery thermal management system based on heat pipe technology @article{Dan2019ResearchPA, title={Research progress and future prospects of battery thermal management system based on heat pipe technology}, author={Dana Dan and Chengning Yao ...

Behi et al. proposed a heat pipe design where the battery is sandwiched between heat pipes to boost the contact area and heat transfer. Tests showed that the sandwich heat pipe system reduced the maximum cell temperatures by 13.7% to 33.4%, depending on the cooling method used, compared to natural convection.

Download Citation | Enhancing battery thermal management: a study on the feasibility of dual-evaporator loop heat pipe technology | The present study aims to evaluate the feasibility of a novel ...

The battery thermal management system (BTMS) embedded heat pipe system cannot only quickly heat the battery, but also improve its temperature consistency. In order to accurately predict the electro-thermal performance of the battery pack with such a BTMS, an electro-thermal model integrating heat pipe model is established for the pack.

In Battery Thermal Management System (BTMS), Loop Heat Pipes (LHPs) may act as thermal vectors connecting the bottom of the battery pack with the remote chiller of the EV's HVAC system, whilst graphite sheets ...

Currently, heat pipe technology is very well established. It is used in various fields because it can work in the cryogenic temperature area to the molten metal temperature area of  $>1000$  °C. ... However, due to its superior performance, the application of heat pipes in battery thermal management systems is gaining interest from manufacturers ...

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