Thermal management of electronic equipment and energy storage devices

What is electronic thermal management?
In the field of electronics thermal management (TM), there has already been a lot of work done to create cooling options that guarantee steady-state performance. However, electronic devices (EDs) are progressively utilized in applications that involve time-varying workloads.

Can thermal management systems be used in electronic devices?
This work undertakes a literature review of thermal management systems in different applications, such as mobile phones, laptops, data centers, electric vehicles, and aircraft, and then goes on to discuss the selection of the most suitable PCMs for use in the TMS of electronic devices.

What is the most common thermal management strategy for electronic devices?
Currently,the most common thermal management strategy toward electronic devices is to utilize heat conducting materialsto dynamically remove the excessive heat in the operation units. Different materials have different heat conduction carriers due to different compositions and microstructures.

What is thermal management system?
Otherwise, the thermal management is called passive . Generally, a proper design of the thermal management system is crucial to achieve high dissipation rates and a uniform cooling, capable of ensuring stable temperature profiles inside the electronic device , .

What are the applications of thermal management systems?
Thermal management systems are crucial for the efficient operation of electronic devices and equipment,ranging from small and compact devices like mobile phones to larger equipment like aircraft. In section 1,five applications in which TMS play critical role were proposed: mobile phones,laptops,data centers,electric vehicles,and aircraft.

What is a thermal management system (TMS)?
Effective thermal management systems (TMS) are crucial for the optimal operation of electronic devices in computing, data centers, and transportation. This review begins by highlighting the essential role that TMS plays in today's electronics, where performance, reliability, and energy efficiency are of utmost importance.

This Special Issue aims to provide a collection of the latest research and findings in the field of thermal management of electronic equipment and energy storage devices. Both research and review papers are welcome. Potential research topics include, but are not limited to, the following: (1) High/ultra-high heat flux dissipation;

A host of high-voltage-capable electronic packaging approaches have emerged in recent years for usage in nextgeneration power electronics. In this article, the focus is on the challenge of managing the thermal

characteristics in these cutting edge packaging options, where power densities are exceeding 25 kW/L. Utilizing wide bandgap semiconductors like SiC and GaN ...

17.3.1 Thermal management of electronics using other fluids. The demand for storage of data has increased in recent years and is increasing day by day. It is challenging for electronic thermal management [29].The result is the storage of data in compact and portable devices and this leads to the heating of that device due to improper thermal management of electronic components [30].

Recently, the thermal management of power electronic converters has gained significant attention due to the continuous trend of developing very compact power electronic converters with high power density. With the evolution of power semiconductor devices, high operating temperatures and large thermal cycles have become possible, necessitating a ...

of thermal management in electronic devices, solutions and recommendations for effective cooling strategy, upcoming research methods and conclusion gives the summary of the electronic cooling.

Jet impingement cooling is one of effective cooling methods with relatively low thermal resistance; and has widely been employed as r thermal management solutions for power electronics devices and industry. A schematic diagram of distinction of air-jet impingement regions is shown in Fig. 9. The jet impingement cooling process is similar to ...

However, since the fan requires power, this thermal management system now becomes an active cooling system. You"ll see active cooling technology at work in devices that create large amounts of thermal energy, ...

Combining CNFs with high-thermal-conductivly fillers is an effective thermal management technique. This paper focuses on the thermal management of electronic devices and highlights the potential of CNF-based materials for efficient thermal management of energy storage electronic such as supercapacitors, lithium-ion batteries and solar cells.

Thermal management of power supplies was done by using heat pipes and heatsink. The efficiency of the output power is increased from 80.7 to 85.7% at an ambient of 46 °C. Novel heat spreaders and heatsinks are designed to cool the IGBTs. Cold plates are used to cool the power electronics devices.

Why is thermal management essential? Manage and dissipate heat Limit failure, increase reliability Increase power density . Transition to wide-bandgap (WBG) devices changes, but does not reduce, need for thermal management . WBG devices o More efficient Less heat o Yield and cost issues Smaller die sizes/Reduced area

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Abstract: · Low-cost, high-performance thermal management technologies are helping meet aggressive power density, specific power, cost, and reliability targets for power electronics and electric machines. · NREL is working closely with numerous industry and research partners to help influence development of components that meet aggressive performance and ...

Thermal management techniques ermal management techniques for electronic devices are crucial to prevent overheat-ing, extend the lifespan of components, and ensure reliable performance. is section briey overviews various thermal management techniques and methods for various electronic devices. Fig. 4 Various factors aecting electronic failures

Basic concepts of thermal management. To address the growing cooling issue, it makes sense to review our understanding of the three ways in which thermal energy is transferred: conduction, convection and radiation. All ...

Energy. Volume 216, 1 February 2021, 119223. Thermal management and temperature uniformity enhancement of electronic devices by micro heat sinks: A review. Author links open overlay panel Ziqiang He a b, Yunfei Yan a b, Zhien Zhang c.

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Improving Transient Performance in Thermal Energy Storage Units using Nearest Neighbor Search and ANNs [] improved the transient performance of thermal energy storage units using PCM for latent heat storage by thermal management by applying ML a phenomenon known as subcooling, the solidification of PCM is initialized by significantly reducing the ...

The status of research on the application of phase-change-materials for thermal management of electronic devices was investigated in this work. This review provides an ...

Thermal energy storage and management: Simple material preparation method: Low latent heat: ... The principle of the printing equipment used in the electronic package is shown in Fig. 1 a. The material needed for printing (70PW) is placed in the storage cylinder and heated to the molten state (the operating temperature is set to 100 ...

management in wearable and mobile devices, and acoustic noise management. By considering a wide range of electronics cooling applications with different length and time scales, the paper identifies both common themes and diverging views in the thermal management community. Index Terms -- Information and communication networks; Energy ...

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Thermal management of electronic devices has attracted tremendous attention because of its importance in regulating the operation conditions of electronic devices under very high thermal loads. The most widespread thermal management technologies and solutions can be classified into two main categories: active and passive cooling [12].

All electronic equipment and energy storage devices generate excess heat and thus require thermal management to improve their reliability and prevent premature failure. Thermal ...

In addition to the aforementioned open-loop cooling technologies, thermal regulation using PCMs has emerged as a promising approach for passive thermal ...

It has been well documented that the shrinking size and escalating density of transistors and other integrated circuit devices over time has enhanced computing capabilities at the cost of increasing power dissipation across the device, die, and system levels [5], [6], [7].The power required for high performance computing applications on some modern processor ...

The efficient thermal management of electronic devices is essential, considering overheating is harmful to the efficiency and reliability of electronic components. ... Multifunctional energy storage and conversion devices. Adv. Mater, 28 (2016), pp. 8344-8364. ... Experimental investigations on phase change material based finned heat sinks for ...

Thermal energy storage for heavy electronic equipment cooling applications. Several methods are adopted to reduce the temperature of heavy electronic equipments by removing heat from active devices. Thermal management of electronic equipment is rapidly growing research area, because, of electronic components failure due to overheating ...

The problem of heat dissipation has become a key to maintain the operation state and extending the service time of electronic components. Developing effective thermal management materials and technologies is of great significance to solve this problem. Previously, passive cooling using phase change materials (PCMs) has been proposed as a thermal ...

The cold storage can be water storage or ice storage. The chiller-cooling tower system is connected to the cold storage and helps to provide extra cold energy to the storage water, when the capacity of the heat pipes is not enough. The downtime of the chiller equipment attributed to the cold energy storage system can save electricity cost.

This paper presents a review on the TMTs for electronics in spacecraft environment based on heat transfer processes, including heat acquisition, heat transport, and heat rejection, as summarized in Fig. 2 Section 2, recent investigations on efficient heat acquisition are detailly discussed, including the utilization of high thermal conductance materials, development of ...

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ConspectusPower semiconductors and chips are essential in modern electronics, driving applications from personal devices and data centers to energy technologies, vehicles, ...

Nowadays with the improvement and high functioning of electronic devices such as mobile phones, digital cameras, laptops, electric vehicle batteries...etc. which emits a high amount of heat that reduces its thermal performance and operating life [1], [2].These limitations that lower the effectiveness of electronic gadgets makes researchers take the thermal ...

Previously, passive cooling using phase change materials (PCMs) has been proposed as a thermal management method for electronic devices. In this work, a hybrid ...

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