

Photothermal phase change energy storage capsule

What is photothermal phase change energy storage?

To meet the demands of the global energy transition, photothermal phase change energy storage materials have emerged as an innovative solution. These materials, utilizing various photothermal conversion carriers, can passively store energy and respond to changes in light exposure, thereby enhancing the efficiency of energy systems.

What is photo-thermal conversion phase-change composite energy storage?

Based on PCMs, photo-thermal conversion phase-change composite energy storage technology has advanced quickly in recent years and has been applied to solar collector systems, personal thermal management, battery thermal management, energy-efficient buildings and more.

What are photothermal conversion and energy storage microcapsules?

In order to maintain thermal comfort in the human body, photothermal conversion and energy storage microcapsules were designed, developed, and applied in a light-assisted thermoregulatory system.

Does phase change capsule improve thermal management efficiency?

The phase change capsule's thermal conductivity increased by 859.9%, revealing excellent thermal management efficiency. Phase change capsule with photothermal conversion efficiency at 64.4% in the near infrared light region. 1. Introduction

What are photo-thermal conversion materials & PCMs?

They consist of photo-thermal conversion material and PCMs, which can store or release a large amount of thermal energy during the solid-liquid phase-change process. These materials have great potential for applications in desalination, heating, construction, and solar energy storage systems.

What are the advantages of photothermal conversion materials?

As one of photothermal conversion materials, GO exhibits many advantages, such as abundant resources, low cost, light weight, high thermal conductivity, etc., especially its flexibility and two-dimensional structure, which has attracted widespread attention in the field of energy storage.

The global energy transition requires new technologies for efficiently managing and storing renewable energy. In the early 20th century, Stanford Olshansky discovered the phase change storage properties of paraffin, advancing phase change materials (PCMs) technology []. Photothermal phase change energy storage materials (PTCPCEsMs), as a ...

Solar photothermal energy storage using phase-change material (PCMs) provides sustainable penetration in comprehensive utilization. However, PCMs are obliged to suffer from low conversion and storage

effectiveness in solar photothermal energy due to a low optical absorption capacity. In this study, we developed a type of magnetic phase-change microcapsule system ...

Herein, a photothermal energy-storage capsule (PESC) by leveraging both the solar-to-thermal conversion and energy-storage capability is proposed for efficient anti-/deicing. Under illumination, the surface temperature can rise to 55 °C, which endows fast droplet evaporation to prevent the subsequent bulk freezing, and the accumulated ice and ...

The reinforced photothermal effect of conjugated dye/graphene oxide-based phase change materials: Fluorescence resonance energy ... Photothermal Energy-Storage Capsule with Sustainable . tothermal energy-storage capsule (PESC) by leveraging both the solar-to-thermal. conversion and energy-storage capability is proposed for efficient anti ...

Photothermal materials can convert the absorbed light energy into heat energy, and combined with phase change energy storage materials can realize the utilization of solar energy. The encapsulated PCM is a good combination platform with PCM as core material and shell composed of photothermal materials.

Photothermal conversion and phase-change materials show great potential application in the field of heat storage and management. Herein, a novel form-stable phase change composite yarn with photothermal conversion was fabricated through two steps sizing coating. Polyester (PET) yarn or PET/polyvinyl butyral (PVB) / zirconium carbide (ZrC) / aluminum oxide (Al₂O₃) acted as core ...

These hybridized phase change microcapsules achieved the combined functions of photothermal conversion, phase change energy storage, ... With the continuous advancement of photothermal phase change capsule preparation technology, its application in the textile field will become more extensive. 16,24. Silk, derived from nature, is renowned for ...

Photo/thermal energy-storage capsules with glyceryl monostearate based waterborne polyurethane as the shell, manganese phthalocyanine as the photothermal agent, and ethyl palmitate as the phase change material are fabricated. The compositions and morphologies of capsules are characterized by Fourier transform infrared spectrometer, field scanning ...

Firstly, nanoscale poly (p-phenylenediamine) (PPPD) as stabilizer and photothermal conversion material was synthesized and used in the encapsulation of lauryl myristate as phase change material (PCM) with phase change temperature of 34.6 °C based on Pickering emulsion, following photoinduced energy storage microcapsules were successfully ...

Direct-photothermal energy conversion and storage experiment: The 300 W Xe-lamp was used as the solar simulator in the direct-photothermal energy conversion and storage experiment with the intensity adjusted from 0.5 to 2 kW/m². During the experiment, the thermocouple was attached to the surface at different

positions of the SA-PCB-20 to ...

can passively store energy and respond to changes in light exposure, thereby enhancing the efficiency of energy systems. Photothermal phase change energy storage materials show immense potential in the fields of solar energy and thermal management, particularly in addressing the intermittency issues of solar power.

All-weather, high-efficiency solar photothermal anti-icing/deicing systems are of great importance for solving the problem of ice accumulation on outdoor equipment surfaces. In this study, a photothermal phase change material with a micro-porous structure (MP@PPCM) is prepared via salt-template and melt-blending methods. Owing to the synergistic effect of the ...

Phase change nanocapsules exhibit significant potential in harnessing photothermal energy to address the ever-growing energy demand; however, their application is restricted by limited solar absorption capacity and low thermal conductivity. In this study, nanodiamonds (NDs) were firstly incorporated with phase change nanocapsules to solve these issues owing to their broad light ...

Photo-thermal conversion phase-change composite energy storage materials (PTCPCESMs) are widely used in various industries because of their high thermal conductivity, high photo-thermal conversion efficiency, high latent heat storage capacity, stable physicochemical properties, and energy saving effect. PTCPCESMs are a novel type material that can harness solar energy for ...

ciencies of solar energy due to its weather and space dependence.[1] Emerging phase change material (PCM)-based photothermal conversion and storage technology is an effective and promising solution due to large thermal energy storage density, high conversion efficiency, good thermochemical stability, and small carbon footprint.[2-4 ...

Solar energy is a high-priority clean energy alternative to fossil fuels in the current energy landscape, and the acquisition, storage, and utilization of solar energy have long been the subject of research [[1], [2], [3], [4]].The development of new materials has facilitated the technique for utilizing solar energy [5], such as phase change materials (PCMs), which have ...

The development of fibers is a testament to human innovation and has been integral to the advancement of civilization since ancient times. The 19th century marked a significant milestone with an unprecedented technological revolution in chemical fibers, which promoted the progress of the fiber industries [1, 2].Among the many innovations, smart fibers have garnered significant ...

Thermal energy storage (TES) techniques are classified into thermochemical energy storage, sensible heat storage, and latent heat storage (LHS). [1 - 3] Comparatively, LHS using phase change materials (PCMs) is considered a better option because it can reversibly store and release large quantities of thermal energy from the surrounding ...

With the continuous advancement of photothermal phase change capsule preparation technology, its application in the textile field will become more extensive. ... but also lay a solid foundation for an in-depth exploration of the performance of these functionalized microcapsules in phase change energy storage materials as well as other potential ...

The thermal energy storage capacity of phase change capsules is a critical metric in the assessment of their performance. As shown in Fig. 16, upon complete melting of all structures, the phase change capsule with 6 fins and a wall thickness of 0.5 mm exhibited the highest average temperature of the PCMs, at 352.03 K. Conversely, the capsule ...

A novel form-stable phase-change material with high enthalpy and long endurance for photo-thermal energy storage YUNYUN YANG^{1,2,*}, CHANGHUI LIU^{1,2}, YANLONG SHI, JINTAO HU, HUIKUN CHANG^{1,2} and YUANHUA HE^{1,2} ¹College of Civil Aviation Safety Engineering, Civil Aviation Flight University of China, Guanghan 618307, China ²Civil Aircraft Fire Science and ...

Photothermal materials can convert the received solar irradiation into thermal energy due to the inherent photothermal conversion characteristic [7]. However, it is worth noticing that the solar irradiation will be fluctuant because of the influence of the climate change and seasonal variation, and this instability will also bring the defect of unstable output of thermal ...

Form-stable phase change materials based on graphene-doped PVA aerogel achieving effective solar energy photothermal conversion and storage Sol Energy, 255 (2023), pp. 146 - 156 View PDF View article View in Scopus Google Scholar

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