Photothermal energy storage regulation

What is photothermal regulation?
Photothermal regulation concerning solar harvesting and repellinghas recently attracted significant interest due to the fast-growing research focus in the areas of solar heating for evaporation,photocatalysis,motion,and electricity generation,as well as passive cooling for cooling textiles and smart buildings.

What are the underlying mechanisms and criteria of highly efficient photothermal regulation?
The underlying mechanisms and criteria of highly efficient photothermal regulation in terms of optical absorption/reflection,thermal conversion,transfer,and emission propertiescorresponding to the extensive catalog of nanostructured materials are discussed.

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.

Can photochemical energy and photothermal energy be stored together?
For the solar-chemical-thermal fuel application,the solar spectra should be rationally split for simultaneous storageof the photochemical energy and photothermal energy. The emerging photoswitchable PCMs could attract interdisciplinary efforts from chemistry,material science,and energy engineering.

What is thermal energy storage based on phase change materials?
Thermal energy storage based on phase change materials (PCMs) is of particular interest in many applications,such as the heating and cooling of buildings,battery and electronic thermal management,and thermal textiles.

Does photothermal regulation improve solar heating/cooling efficiency?
The parallel development of photothermal regulation strategies through both material and system designs has further improvedthe overall solar utilization efficiency for heating/cooling. In this review,we will review the latest progress in photothermal regulation,including solar heating and passive cooling,and their manipulating strategies.

The isomerization enthalpy value (DH) was used to assess the solar energy storage capacity of azobenzene-grafted graphite-like carbon nitride materials. Azobenzene/graphite-like carbon nitride is expected to develop high energy density solar thermal storage materials based on hydrogen bond regulation and molecular structure design.

Addressing the challenges of energy storage liquid leakage and long-term stability in energy storage is crucial for achieving sustainable energy efficiency. In this study, polymethyl methacrylate (PMMA) is innovatively employed as an encapsulation film on the surface of the wood-based phase change material, resulting in a

recyclable wood-based ...

In fact, researchers are very familiar with the photothermal effect of sunlight, such as in the application of solar water heaters. In addition, there are photothermal power generation and photothermal energy storage device design (Figure 1 C). 14, 17, 18 Particularly, intensive attempts and strategies have been devoted to realizing photothermal industrialization.

We developed a new type of photoluminescence phase-change microcapsules. o The microcapsules are based on an n-eicosane core and a Eu 3+-doped CaCO 3 /Fe 3 O 4 composite shell.. The microcapsules show a good thermal regulation capability under a latent-heat capacity of 125 Jog -1.. The microcapsules exhibit enhanced photothermal conversion ...

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. The octyl stearate as a phase change material (PCM) was encapsulated using a polytrimethylolpropane triacrylate (PTMPTA)/polyaniline (PANI) ...

In this review, we will review the latest progress in photothermal regulation, including solar heating and passive cooling, and their manipulating strategies. The underlying mechanisms and criteria of highly efficient photothermal regulation in terms of optical ...

Phase change material (PCM) with outstanding thermal energy storage and temperature regulation, holds tremendous interest in energy conservation and management. However, the application of conventional PCMs is limited due to issues of liquid leakage, poor mechanical properties, and insufficient photothermal conversion efficiency this work, ...

In the last few decades, many kinds of nanomaterials have been fabricated successfully, including metals, semiconductors, carbon-based materials, [4, 5] MXenes, etc., and they are widely applied in the fields of catalytic reactions, [7-9] energy storage, [9-11] energy conversion, [12, 13] biomedicine, [14-17] etc. Among all the factors which ...

In this work, smart thermoregulatory textiles with thermal energy storage, photothermal conversion and thermal responsiveness were woven for energy saving and personal thermal management. Sheath-core PU@OD phase change fibers were prepared by coaxial wet spinning, different extruded rate of core layer OD and sheath layer PU was investigated to ...

A novel thermal energy storage (TES) composites system consisting of the microPCMs based on n-octadecane nucleus and SiO 2 /honeycomb-structure BN layer-by-layer shell as energy storage materials, and wood powder/Poly (butyleneadipate-co-terephthalate) (PBAT) as the matrix, was created with the goal of improving the heat transmission and ...

However, solar energy has limitations due to its low intensity and variability, influenced by daily and seasonal changes [1].Implementing solid-liquid phase change materials (PCMs) to create photothermal PCMs offers an effective way to stabilize energy supply for photothermal applications [23], [24], [25].PCMs absorb and release thermal energy by ...

Thermal energy storage (TES) is essential for solar thermal energy systems [7].Photothermal materials can effectively absorb solar energy and convert it into heat energy [8], which has become a research hotspot.Phase change materials (PCM) with high energy density and heat absorption and release efficiency [9], have been widely used in many fields as ...

In addition, there are photothermal power generation and photothermal energy storage device design (Figure 1C). 14, 17, 18 Particularly, intensive attempts and strategies have been devoted to realizing photothermal industrialization. ... structure regulation, such as using small or in-plane holey materials composited with semiconductors, ...

[18, 109] During the photothermal catalysis process, solar energy can be used to destroy the chemical bonds to degrade organic pollutants. At the same time, it also can generate new chemical bonds for energy storage in hydrogen (H 2), carbon oxide (CO), methane (CH 4), and so on. Therefore, photothermal catalysis can be an alternative or ...

To upscale photothermal catalysis technology, two key components are required: efficient and stable photothermal catalysts that are scalable and precise for high-throughput processes, and development of green and cost-effective technological processes that minimize energy loss [23].To achieve these objectives, researchers have been utilizing materials ...

These two heat capacity data can still satisfy the request for temperature regulation and photothermal energy storage of PANi@TiO 2 @C 22 MePCM when used in the PU/MePCM composite films. Such a satisfactory latent heat capacity is attributed to a well-defined core-shell structure of TiO 2 @C 22 MePCM, which can be confirmed by a manually ...

Semiconductor-based photocatalysis emerged amid the energy crisis in 1970s and thereafter it has been deemed as a promising strategy towards conversion and storage of solar energy into chemical stocks [1].To date, the quantum efficiency (QE) of photocatalysis is still unsatisfied despite of numerous studies in the past decades [2], [3], attributing to the intrinsic ...

To meet the requirement of multipurpose applications in infrared thermal camouflage and solar photothermal energy storage, we have developed a series of multifunctional composite films based on polyurethane (PU) as a flexible matrix and double-layered phase-change microcapsules as an additive. The double-layered microcapsules were first ...

The paraffin incorporation in device of glass envelope allows the thermal regulation, increasing the thermal

comfort and energy efficiency of buildings. ... performances make the hybrid aerogel/PEG composites capable of dealing with a wide range of applications in solar photothermal energy capture and storage. This study provides a promising ...

Photothermal energy storage materials need not only high photothermal conversion efficiency, but also excellent thermal response. Therefore, the photothermal material added to the capsule shell should have considerable thermal conductivity. ... and cyclic stability. The effect of microcapsule proportions on the temperature regulation ability of ...

gap can lead to energy loss through photon emission. Hence, the band-gap width of semiconductors can crucially determine the photothermal conversion efficiency. For the semiconductors with narrow band gap, the energy of most photons from sunlight is higher than the band-gap energy, leading to the production of elec-tron-hole pairs above the ...

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 ...

The PCMs based on photothermal energy storage are involved in the light-to-heat conversion, ... PVB/ ZrC/Al 2 O 3 as coating layer, sandwich structure yarns with photothermal conversion and heat storage and temperature regulation functions were successfully fabricated through sizing coating. The composite yarns containing paraffin (A ~ D yarn ...

Thermal storage can be categorized into sensible heat storage and latent heat storage, also known as phase change energy storage [16] sensible heat storage (Fig. 1 a1), heat is absorbed by changing the temperature of a substance [17].When heat is absorbed, the molecules gain kinetic and potential energy, leading to increased thermal motion and ...

Photothermal and Energy Storage Performance of PCF/DOX/Az Scaffold. To verify the thermal energy storage performance of the PCF-based composite scaffolds, 20 mg of PCF/DOX/Az scaffolds were placed on a heating platform and heated at a rate of 3 °C/min from 37 °C for 10 min before cooling naturally for 10 min.

As a result, the photothermal energy storage efficiency of POW-B/PEG and POW-S/PEG are ? 86.7% and 79.8% (Figure 4c), respectively. The POW/PEG composites also show great potential in the thermal regulation of buildings. ... showing excellent radiative heating performance and thermal regulation ability by continuous energy release. This ...

tantly, the photothermal conversion and storage efficiency of ODA@MOF/ PPy -6% is up to 88.3%. Additionally, our developed MOF based photothermal composite PCMs also exhibit long-standing antileakage

stability, energy storage stability, and photothermal conversion stability. The proposed coating

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