

How do photothermal materials store solar energy?

Under solar radiation, photothermal materials capture photons and convert light energy into heat, which raises the temperature of the PCM. Once the temperature exceeds the phase transition temperature, the PCM undergoes a phase change and stores thermal energy in the form of latent heat, thus achieving the storage of solar energy [63,64].

How important are photothermal materials in solar energy systems?

In photothermal conversion systems, photothermal materials are typically the most critical and indispensable component, playing a decisive role in the overall system efficiency. However, the poor light absorption ability of PCMs and most minerals hinders their application in solar energy systems.

What are the environmental disadvantages of photothermal catalysis?

Despite their remarkable efficiency in harnessing solar energy and converting it chemically, these technologies have environmental disadvantages. One factor to assess is the energy consumption while preparing materials for photothermal catalysis. For instance, creating and activating photothermal catalysts requires significant energy.

How can photothermal materials harness solar energy?

To fully harness solar energy, combining photothermal materials with mineral-based PCMs is an effective approach. Under solar radiation, photothermal materials capture photons and convert light energy into heat, which raises the temperature of the PCM.

What are the advantages of photothermal conversion of solar energy?

Among all the solar energy conversion technologies, photothermal conversion of solar energy exhibits unique advantages when applied for water purification, desalination, high-temperature heterogeneous catalysis, anti-bacterial treatments, and deicing.

What are photothermal conversions of solar energy?

Then, the state-of-the-art progress for photothermal conversions of solar energy is introduced in detail, mainly including photothermal water evaporation and desalination, photothermal catalysis, photothermal electric power generation, photothermal bacterial killing, photothermal sensors, and photothermal deicing.

Solar photothermal power generation refers to the use of large-scale array parabolic or dish mirror to collect solar heat energy, through the heat ...

In recent years, solar-driven evaporation has attracted widespread research interest in desalination as the water shortage and energy crisis are ...

Photothermal catalysis has been proposed as a promising alternative to conventional photocatalysis and thermocatalysis for energy transformation and environmental remediation due to ...

Solar energy, the most promising renewable energy, suffers from intermittency and discontinuity. Phase change material (PCM)-based energy ...

As an innovative approach to the utilization of solar energy, photothermal catalysis is based on the principle of generating localized high ...

Conversion and utilization of solar energy is one of the most important strategies being proposed to mitigate the foreshadowed global energy crisis and environmental issues. Amongst the ...

Optimizing broadband lossy waves excitation at ultrathin metal layer interface for enhanced photothermal solar water evaporation

Abstract Interfacial photothermal solar evaporation (IPSE) is a process that uses direct solar heating to generate water vapour. Research in this process has grown explosively in the past decade and ...

This review presents a broad scope of photothermal applications, offers a comprehensive understanding on the photothermal conversion of solar ...

Here we report a hybrid device consisting of a photocatalyst (PC) and a solar vapour generator (SVG) for simultaneous overall water splitting and water purification from open water sources.

Focusing on practical applications, it summarizes the latest research and application advancements in SPCS, discusses the bottleneck issues faced by these systems, and provides ...

Exploring interfacial solar evaporation heat transfer mechanisms of photothermal solar still systems Case Studies in Thermal Engineering (IF 6.4) Pub Date : 2025-02-15, DOI: ...

We will also expatiate on the recent significant developments toward the applications of photothermal nanomaterials in solar water ...

Solar energy is an increasingly popular renewable energy source due to its many advantages. While solar panels are the most well-known form of ...

What is solar energy photothermal conversion & storage? For solar energy photothermal conversion and storage systems, materials not only have efficient photothermal conversion capabilities, but also ...

Heat-localized solar distillation (HLSD) is an emerging environmentally- friendly high-efficiency distillation technology for clean water production. Solar interfacial distillation (SID) and ...

Increasing plastic pollution presents a significant challenge for humanity and ecosystems. Photothermal (light-to-heat) conversion has emerged ...

Solar desalination could fully utilize two of the most abundant resources on earth: solar energy and seawater, promising a solution to the severe freshwater shortage problem, but the conventional two ...

Photothermal catalysis has emerged as a promising sustainable energy and environmental protection approach by utilizing solar energy to drive ...

Finally, we discuss the challenges encountered during the synthesis, modification, and application processes of photothermal mineral ...

2.1 Concerning the claims of Interfacial Photothermal Solar Evaporation It is a very common practice in the field of interfacial photothermal solar evaporation (IPSE) for researchers to begin their abstract or ...

When fully absorbed with water, the photothermal reservoir was sufficient for one day solar-steam generation without additional water supply, leading to a significantly simplified design of the device ...

Solar energy is a major source of renewable energy with the potential to meet the energy demand and to support the sustainable development of the world. The ...

Interfacial photothermal solar evaporation (IPSE) is a process that uses direct solar heating to generate water vapour. Research in this process has grown explosively in the past decade and claims about its ...

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.

A photothermal reservoir composed of a water storage core encapsulated by a graphene-based aerogel sheet is designed for solar-steam generation without bulk water. The ...

It is pivotal to improving the photothermal catalytic conversion by exploring efficient photothermal catalysts with intense broadband solar energy absorption and high efficiency of solar-to-heat ...

Colored wide-bandgap semiconductor oxides with abundant mid-gap states have long been regarded as promising visible light responsive photocatalysts. However, their catalytic activities are hampered by ...

A water splitting system capable of operating stably using contaminated water sources for decentralized H₂ production would be a more practical approach towards solar H₂ ...

In this paper, the effects of different photothermal materials on solar energy absorption efficiency were

reviewed from the aspects of interface evaporation, volume evaporation and different ...

In solar interfacial evaporation, photothermal materials exhibit a wide range of additional characteristics, but a systematic overview is lacking. This paper encompasses an examination of ...

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