

<div class="df\_qntext">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].

<div class="df\_qntext">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.

<div class="df\_qntext">What are the applications of photothermal materials?

The investigation of photothermal materials with broadband absorption is beneficial for the utilization of renewable solar energy, while the engineering of materials with efficient heat generation abilities can be widely useful in various fields, including water evaporation, (6,7) photothermal catalysis, (8,9) and biomedicine. (10,11)

<div class="df\_qntext">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.

<div class="df\_qntext">What are the different types of photothermal materials?

Based on chemical composition, photothermal materials are primarily divided into four types: carbon-based materials, semiconductor materials, plasmonic materials, and conjugated polymers.

<div class="df\_qntext">Can photothermal materials be used as nanostructures?

With the rapid development in both advanced nanotechnologies and materials science, a library of photothermal materials has been developed into nanoscale ones and designed into functional nanostructures.

Developing efficient and adaptive photothermal materials is crucial for advancing solar steam generation (SSG) technologies for sustainable water purification. Here, we investigate the influence of ...

The use of carbon aerogels as photothermal materials in solar water evaporation, thermal energy storage, photothermal catalysis, photothermal therapy, and photothermal de-icing are ...

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 ...

Recent advances in photothermal materials including carbon-based structures, semiconductors, polymers and plasmonic composites have significantly improved solar absorption, heat conversion ...

Abstract Solar photothermal steam generation promises decentralized water purification, but the lack of materials that have strong sunlight absorption in wide spectral range, ...

Compared with other technologies, solar-driven seawater evaporation needs only sunlight as the energy source, and has attracted great attention [14], [15]. The key for solar-driven ...

Photothermal conversion of solar energy, to produce hot fluid or hot air, takes place in solar collectors. Efficient conversion requires that a solar-absorbing surface is in thermal contact with the fluid or gas, ...

Also, the Cu-CATM enabled solar utilization for synchronous photothermal desalination and photocatalytic degradation, which highlighted the broader environmental application for water ...

Abstract Through solar-driven evaporators, freshwater and electricity can be simultaneously obtained to realize high solar energy utilization rate. Here, we demonstrate a type of ...

Solar-driven evaporation, when combined with other separation processes such as membrane separation, adsorption, and crystallization, holds immense significance and offers ...

In this paper, cellulose nanofibers (CNF) incorporate molybdenum disulfide (MoS<sub>2</sub>) has been self-assembled into a flexible layered porous film, which has been used to encapsulate polyethylene ...

Self-floating all-in-one photothermal evaporators are fabricated by freeze-drying, casting, and surface-hydrogenation, in which the hydrophilic black TiO<sub>2</sub> provides a path for water ...

An integrated photothermal storage device was constructed and heated by a Fresnel lens to concentrate the 1000 W/m<sup>2</sup> light from a solar simulator, and the heat storage efficiency was ...

Current photothermal absorbers often face limitations in achieving optimal solar energy conversion and thermal storage, hindering their broader adoption in clean water production (solar ...

Despite that great efforts have been made in photothermal materials, conventional solar-driven desalination system still suffers from poor photothermal energy management and limited ...

All-in-one self-floating porous foams as robust heat-blocking layers for efficient photothermal conversion and solar desalination Liping Ren a, Wei Zhou a,b,?, Lei Wang a, Kuo Lin a, Yachao Xu a, Jiaying ...

Solar-driven desalination represents a promising approach to alleviate global water scarcity by utilizing

photothermal conversion to transform solar energy into heat for water evaporation.

Photo-thermal catalysis, combining the advantages of photocatalysis and thermocatalysis, has emerged as a new fast-growing research area. In this review, we first discuss three different mechanisms of ...

This makes SIE an ideal choice for water treatment applications. In the photothermal process of SIE, sunlight irradiation causes photothermal materials to absorb photons, resulting in ...

This review developed the principles of coupling solar photon and thermal fields underlying the photothermal effect, exploration of efficient nanocatalysts, development of optofluidic ...

To meet the durability requirement of solar evaporation, tedious treatments are necessary to enhance binding of photothermal ingredients with fabric skeletons. A common method is ...

The second part is devoted to the emerging aspects and new directions of using these photothermal materials for the development of photothermal membranes. Lastly, the prospects of ...

Photothermal [4] and photovoltaic [5] conversions are currently the most widely developed and utilized techniques for harnessing solar energy, with photobiological [6] and ...

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

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