

Molecular solar thermal storage system concept

What is a molecular solar thermal energy storage system?

Photoisomers are referred to as molecular solar thermal energy storage systems (MOST), also known as solar thermal fuels (STF). In this review, we introduce the functional principles and criteria of a general MOST system, then introduce to a broad audience three key candidates and show the efforts made so far to achieve recent advances in results.

Can molecular photoswitches be used to store solar energy?

Recent advances in the design of molecular photoswitches have opened up opportunities for storing solar energy in strained isomeric structures and releasing heat on demand, culminating in molecular solar thermal (MOST) energy storage densities over 0.3 MJ kg^{-1} and validating the potential for achieving thermal battery applications.

What are solar thermal batteries based on?

The solar thermal batteries based on MOST compounds will enable a solar-chargeable, off-grid, and long-term energy storage in light-weight organic materials that are easily produced from low-cost feedstocks, complementing the state-of-the-art energy conversion and storage technologies.

How can a solar system absorb thermal energy from a photoisomerization?

An alternative strategy is to combine solar energy from photoisomerization with latent heat from phase transitions. Using this approach, MOST systems can also absorb thermal energy from the local environment in addition to the stored solar energy.

How can solar energy be stored?

Nature can store sunlight via photosynthesis with an efficiency between 0.1%-0.3%,⁵ leading to biomass production. Artificially, solar energy can be stored as chemical energy, e.g., via electrochemical water splitting for hydrogen production.

How can solar energy storage technology be improved?

In the first mode, the objective will be to reach a stable thermal output, while in the second mode larger temperature gradients will be targeted under shorter durations of time. This work will help to advance solar energy storage technology.

The efficiency of photovoltaic (PV) solar cells can be negatively impacted by the heat generated from solar irradiation. To mitigate this issue, a hybrid device has been developed, featuring a solar energy storage and ...

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Molecular solar thermal energy storage systems (MOST) offer emission-free energy storage where solar power is stored via valence isomerization in molecular photoswitches. ... Status and challenges for ...

Hybrid system combines the concepts of molecular energy and latent heat storage ... with higher temperature than during the day Integrated system with simultaneous harvesting and storage ...

A promising approach for solar energy harvesting and storage is the concept of molecular solar thermal energy storage (MOST) systems also known as solar thermal fuels (STF). Solar energy is used to drive the chemical reaction of a ...

The first key step in the molecular solar thermal energy storage system is the absorption of light by the parent molecule, which undergoes a reversible photoisomerization reaction to its ...

Photoswitchable molecules-based solar thermal energy storage system (MOST) can potentially be a route to store solar energy for future use. Herein, the use of a multijunction MOST device that combines various ...

research is focused on molecular solar thermal energy storage development, including design, synthesis, characterization and building of photoswitchable molecule-based devices for solar ...

One promising solution is the molecular solar thermal energy storage (MOST) system, where a photoswitchable parent molecule that absorbs sunlight undergoes a chemical isomerization to a metastable high energy species. ...

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The development of solar energy can potentially meet the growing requirements for a global energy system beyond fossil fuels, but necessitates new scalable technologies for solar energy storage. One ...

For the transition to renewable energy sources, novel energy storage materials are more important than ever. This review addresses so-called molecular solar thermal (MOST) systems, which appear very promising since ...



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