

# Application of semiconductors in solar hydrogen storage

What is solar hydrogen?

Hydrogen production using solar power is referred to as solar hydrogen. Photocatalytic water splitting is actively pursued for hydrogen production because it efficiently utilizes solar energy to address environmental and energy challenges. Photocatalysts driven by visible light are primarily used for solar energy conversion.

What is solid hydrogen storage?

Solid hydrogen storage offers a promising solution, providing an effective and low-cost method for storing and releasing hydrogen. Solar hydrogen generation by water splitting is more efficient than other methods, as it uses self-generated power.

Is hydrogen storage a viable alternative to solar energy?

Hydrogen storage offers a potential solution by acting as a long-term storage medium that can absorb excess energy during periods of high solar generation and release energy during periods of low generation. However, the challenge lies in ensuring that hydrogen production and consumption are properly coordinated with grid demand.

Should solar light be used for hydrogen generation and storage?

If proper materials and methods are established for solar hydrogen generation and solid hydrogen storage under ambient conditions, solar light used for hydrogen generation and utilization via solid oxide fuel cells (SOFCs) will be an efficient, safe, and cost-effective technique.

What is a photoanode for solar hydrogen production?

Pihosh et al. prepared polycrystalline tantalum nitride ( $Ta_3N_5$ ) as photoanodes for solar hydrogen production, showing high photocurrent generation. Silicon, a widely used material in solar cells, can also be used for solar water splitting.

How can artificial intelligence improve solar hydrogen production & storage systems?

Additionally, artificial intelligence (AI)-based algorithms are being explored to predict energy demand and optimize the distribution of energy between hydrogen production and storage systems. Integrating solar hydrogen into energy systems demands a comprehensive analysis of strategies to enhance system-level efficiency.

**ABSTRACT:** Solar H<sub>2</sub> production is considered as a potentially promising way to utilize solar energy and tackle climate change stemming from the combustion of fossil fuels. ...

**Capturing sunlight:** Photoelectrochemical (PEC) conversion of solar energy to chemicals requires cost-effective and durable photoelectrodes. Silicon is a promising candidate ...

The solar-driven water-splitting technology for green hydrogen production is considered to be one of effective ways for solar energy harvesting and storage, which may ...

The composite also exhibits desirable reversibility in hydrogen storage and performs well under natural light conditions. Solar-driven reversible hydrogen storage of MgH<sub>2</sub> ...

Abstract Hydrogen is widely regarded as a sustainable energy carrier with tremendous potential for low-carbon energy transition. Solar photovoltaic-driven water ...

Solar-to-hydrogen conversion efficiency using photocatalytic method for all the reported semiconductor-based nanomaterials is low and limit their use for commercial ...

In this context, we provide an overview of recent advances in solar-to-hydrogen conversion, with a particular focus on solar cells, while also exploring key factors influencing ...

Among various hydrogen production methods, photocatalytic water splitting is most significant because it utilizes solar light, a freely available energy source throughout the ...

Various photocatalysts have been developed for photocatalytic water splitting--one of the most important processes that produces dihydrogen as clean energy for ...

Hydrogen is increasingly recognized as a pivotal energy storage solution and a transformative alternative to conventional energy sources. This review summarizes the ...

Integration of p-n silicon junctions with water splitting technology facilitates direct capture and conversion of solar energy into hydrogen fuel. This approach exhibits particular promise for ...

Semiconductor-based photocatalysis has garnered significant research interest due to its potential for clean and sustainable solar-driven water splitting, a process that converts sunlight and ...

Our research provides a straightforward and efficient way to improve the nitride semiconductor/cocatalyst interface, laying a foundation for the subsequent extensive ...

Semiconductor photocatalysis, as discussed, offers a practical approach to harnessing solar energy for hydrogen production, addressing critical environmental and energy ...

Semiconductor photocatalysts are important materials that can be classified into metal oxide and non-oxide materials. Solar photocatalytic water and wastewater treatment, ...

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In this review article, the important roles of electrospun semiconductors as an efficient photocatalytic material for their application in splitting water to produce hydrogen are ...

Provides a timely overview of basic principles and significant advances of semiconductor-based photocatalysts for solar energy conversion Semiconductor Solar ...

Using semiconductor materials for solar-driven hydrogen production is a sustainable alternative to fossil fuels. Organic photocatalysts, composed of elements abundantly available on earth, offer ...

The quest for renewable energy sources has propelled solar-driven hydrogen production via water splitting to the forefront of research. Amongst various materials explored ...

This article discusses the mechanism of photocatalytic water splitting and production of green hydrogen using semiconductor-based nanomaterials, different approaches ...

His work, a subject of the ACS Catalysis paper, explores hydrogen production using light-activated catalysts. "Specifically, I worked with a system that combines a ...

A thorough examination of III-V semiconductor-based solar energy applications for CO<sub>2</sub> reduction and H<sub>2</sub> generation, considering long-term stability, high efficiency, and technical and economic ...

We place particular emphasis on the exploration and analysis of research progress involving the application of HTS and ML in various types of solid-state hydrogen ...

This section discusses the scientific and technical challenges of integrating solar hydrogen with other technologies and highlights potential solutions for optimizing these hybrid ...

In terms of energy applications, semiconductor nanoparticles have demonstrated promise in solar cells and harvesting industries [14]. To provide efficient and environmentally ...

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