

What is energy storage materials?

Energy Storage Materials is an international multidisciplinary journal for communicating scientific and technological advances in the field of materials and their devices for advanced energy storage and relevant energy conversion (such as in metal-O₂ battery). It publishes comprehensive research ...Manasa Pantrangi,... Zhiming Wang

Why are advanced materials important for energy storage devices?

Advanced materials play a critical role in enhancing the capacity and extending the cycle life of energy storage devices. High-entropy materials (HEMs) with controlled compositions and simple phase structures have attracted the interest of researchers and have undergone rapid development recently.

Which ionic materials can be used for energy storage?

In this Perspective, we argue that HEMs have tremendous potential in fields such as energy storage, energy conversion and electronics (Table 1). We focus on promising ionic materials, including oxides, sulfides, carbides, nitrides, fluorides and metal-organic frameworks (MOFs).

What are high entropy materials?

The emergence of high-entropy materials (HEMs) with their excellent mechanical properties, stability at high temperatures, and high chemical stability is poised to yield new advancement in the performance of energy storage and conversion technologies.

Why is electrochemical energy storage important?

Improving electrochemical energy storage is crucial to the global transition to a greener and more sustainable future. In particular, the growing demand for next-generation batteries with superior energy and power densities and alternative mobile charge carriers (such as Na⁺) has stimulated research into substitute materials.

What are high entropy alloys?

The properties exhibited by high-entropy alloys (HEAs) have led researchers to modify non-metallic elements with "high entropy", resulting in a series of HEMs. In 2015, Rost et al. prepared the first entropy-stabilized crystals of (MgCoNiCuZn)O and defined them as "entropy-stabilized oxides".

Abstract Among metal-based phase change materials (PCMs), Al and its alloys have garnered significant attention due to their high latent heat and high thermal conductivity. ... Additionally, the applications of Al and its alloy PCMs in solar thermal energy storage, catalysis, and electric vehicles are reviewed. Finally, current challenges ...

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Rationally designed alloy phases for highly reversible alkali metal batteries. Junxiong Wu, Xiaochuan Chen, Wei Fan, Xiaoyan Li, ... Yuming Chen ...

The addition of rare earth elements lanthanum and samarium to Mg-Ni-type alloys enhanced the hydrogen absorption and desorption kinetics. The microstructures of these alloys were characterized by using XRD, SEM, TEM, HTREM, and SAED methods. PCT equipment was employed to test the hydrogen storage performance. It was observed that ...

The thermal analysis results demonstrate that the Al-Si alloy particles prepared in this study have high melting latent heat (approximately 500.87 J/g) and solidification latent heat (approximately 467.26 J/g), showcasing their potential as high-efficiency phase change materials for high-temperature thermal energy storage.

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Rare-earth-metal-based materials have emerged as frontrunners in the quest for high-performance hydrogen storage solutions, offering a paradigm shift in clean energy technologies. This comprehensive review delves into the cutting-edge advancements, challenges, and future prospects of these materials, providing a roadmap for their development and ...

The lead acid battery has been a dominant device in large-scale energy storage systems since its invention in 1859. It has been the most successful commercialized aqueous electrochemical energy storage system ever since. In addition, this type of battery has witnessed the emergence and development of modern electricity-powered society. Nevertheless, lead acid batteries ...

This study focuses on the preparation of a Mg₂Ni hydrogen storage alloy through high-energy ball milling, further enhanced by composite graphene and multi-walled carbon nanotubes (MWCNTs) modification. It is evident that high-energy ball milling successfully incorporates graphene and MWCNTs onto the surface of Mg₂Ni particles. This process not ...

The aim of this Special Issue entitled "Advanced Energy Storage Materials: Preparation, Characterization, and Applications" is to present recent advancements in various aspects related to materials and processes contributing to the creation of sustainable energy storage systems and environmental solutions, particularly applicable to clean ...

In this work the thermal energy storage of the so called solar salt (60% NaNO₃ - 40% KNO₃) was improved by adding a phase change material composed of Al-Cu alloy nanoencapsulated with an aluminium oxide layer naturally formed when exposed to oxygen. The resistance of the oxide shell to thermal cycling up to 570 °C and its compatibility with ...

Although the large latent heat of pure PCMs enables the storage of thermal energy, the cooling capacity and storage efficiency are limited by the relatively low thermal conductivity (~1 W/(m · K)) when compared to metals (~100 W/(m · K)). To achieve both high energy density and cooling capacity, PCMs having both high latent heat and high thermal ...

1 Introduction. Entropy is a thermodynamic parameter which represents the degree of randomness, uncertainty or disorder in a material. The role entropy plays in the phase stability of compounds can be understood in terms of the Gibbs free energy of mixing (ΔG_{mix}), $\Delta G_{mix} = \Delta H_{mix} - T\Delta S_{mix}$, where ΔH_{mix} is the mixing enthalpy, ΔS_{mix} is the mixing ...

Hydrogen is the energy carrier with the highest energy density and is critical to the development of renewable energy. Efficient hydrogen storage is essential to realize the transition to renewable energy sources. Electrochemical hydrogen storage technology has a promising application due to its mild hydrogen storage conditions. However, research on the ...

High-entropy alloys (HEAs), also known as "multi-principal element alloys", expand the library of advanced materials and demonstrate potential applications in energy storage and catalysis because they possess unique crystallographic and electronic structures, high mechanical properties, and special physical characteristics.

Energy storage material discovery and performance prediction aided by AI has grown rapidly in recent years as materials scientists combine domain knowledge with intuitive human guidance, allowing for much faster and significantly more cost-effective materials research. ... And Yao et al. screened calcium metal alloy anode materials suitable for ...

However, the high-cost hydride-storage metal alloys make Ni-MH systems expensive. Some elements of hydride-storage materials are less abundant in nature. ... are required to harness the high energy density and the high elemental abundance of these two interesting anode materials for real energy-storage applications.

As a kind of new materials, high-entropy alloys (HEAs) avoid the traditional "base element" concept and display a variety of interesting and unusual properties. HEAs have been considered promising electrode materials for energy storage and conversion technologies due to their excellent mechanical, chemical, and physical properties.

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attracted the interest of researchers and have undergone rapid development recently.

Scandium is also a vital component for fabricating high-strength alloys [21]. Ceria is a star material in catalysis which is of great significance in industrial catalysis as well as fuel cells and ... Potential use of RE element in electrode material for energy storage: (a), (b) concept of using ultrathin RE nanowires for alkali metal anode ...

High entropy alloys (HEAs) have attracted substantial attention in diverse fields, including hydrogen storage, owing to their unique structural and functional properties. The diverse components of HEAs have made them a focal point in research, aiming to develop new hydrogen storage materials with exceptional comprehensive properties.

Phase change material (PCM)-based thermal energy storage significantly affects emerging applications, with recent advancements in enhancing heat capacity and cooling power. This perspective by Yang et al. discusses PCM thermal energy storage progress, outlines research challenges and new opportunities, and proposes a roadmap for the research community from ...

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