

Are MOF composites the future of energy storage?

Despite the challenges, MOF composites offer tremendous potential for future energy storage technologies. Their versatility extends beyond electrochemical applications, with potential uses in electromagnetic, aerospace, and automotive industries.

What are flexible energy storage devices (FESDs)?

Consequently, there is an urgent demand for flexible energy storage devices (FESDs) to cater to the energy storage needs of various forms of flexible products. FESDs can be classified into three categories based on spatial dimension, all of which share the features of excellent electrochemical performance, reliable safety, and superb flexibility.

What is a good energy storage material?

An excellent contender for energy storage material is nanoporous material. According to Na Xin et al., the Co/Zn-S@rGO bimetallic porous structure exhibits a power density of 800 W kg^{-1} and an energy density of 91.8 Wh kg^{-1} .

Can MOFs be used in energy storage devices?

This review sheds light on the challenges and opportunities in the practical implementation of MOFs in energy storage devices and discusses strategies for enhancing the stability of MOFs in different environments, improving their electrical conductivity, and developing scalable synthesis methods.

What are the different types of energy conversion and storage devices?

There are many different types of effective energy conversion and storage devices on the market right now, including batteries, conventional capacitors, electrochemical capacitors, fuel cells, and hydrogen storage systems [4, 5].

Are asymmetric supercapacitor materials suitable for energy storage applications?

An asymmetric supercapacitor using MOF-MXene-BN and activated carbon achieves a specific capacity of 798 C/g , an energy density of 81 Wh/kg at 365 W/kg , and 81% capacitance retention over 5000 cycles (Fig. 23 k-m). These results indicate a promising pathway for developing high-performance hybrid electrode materials for energy storage applications.

The rapid development of nanotechnology has broken through some of the limits of traditional bulk materials. As the size decreases to micro-nanometers, sub-nano scale, thanks to its specific surface area, charge transfer and size effect characteristics, the new applications in energy storage are achieved. In the last decade, nanomaterials have made significant progress ...

Advanced Porous Composite Materials (APCMs) are a promising class of materials that have a wide range of applications in the sectors of energy and the environment. These materials typically consist of a porous structure embedded within a composite matrix, allowing for enhanced properties and functionalities that enable them to have enhanced application potential.

Rechargeable aqueous alkaline Zn-Ni batteries (AZNBs) are considered a potential contender for energy storage fields and portable devices due to their inherent safety, high output voltage, ...

The world aims to realize the carbon neutrality target before 2060. Necessary measures should be taken, including improving the energy efficiency of traditional fossil fuels and increasing the deployment of renewable energy sources, such as solar energy and wind energy. The massive utilization of renewable energy requires penetration of the renewable power ...

Benefitting from these properties, the assembled all-solid-state energy storage device provides high stretchability of up to 150% strain and a capacity of 0.42 mAh cm⁻³ at a high ...

Electrochemistry and materials science play important roles in the development of electrochemical energy storage and conversion, which deals with the metal-ion interaction between electrical energy and chemical conversions. In this field, advanced materials and electrochemical properties are the key factors to determine the output performance of these devices recent years, ...

The development and implementation of sustainable clean energy have attracted more attention in response to the urgent requirements of environmental pollution and the energy crisis caused by fossil fuels. Consequently, there is a pressing demand for the advancement and implementation of diverse energy conver 2023 Materials Chemistry Frontiers ...

Worldwide, the consumption of building energy is about one-third of the total primary energy consumption. The top three consumers of building energy are space cooling, space heating, and hot water production. Unfortunately, a significant portion of the energy used in the built environment is generated from fossil fuels and emits excessive CO₂, a key contributor ...

The development of thermal and electrochemical energy storage has attracted considerable interest due to the energy crisis and environmental pollution worldwide. Fuel cells, battery and supercapacitors, heat storage devices, etc. are the most promising energy storage technologies to efficiently utilize and save energy sources. However, the application of these energy storage ...

Materials are the core of many aspects of our daily lives. For example, electrode materials are the keys to clean energy storage devices, such as batteries, supercapacitors, fuel cells, electrolyzers, etc. Novel-designed materials, such as specifically oriented crystals, regularly arranged porous structures, single-atom materials, high-entropy catalysts, etc., can effectively reduce costs and ...

Solid-state batteries are a game-changer in the world of energy storage, offering enhanced safety, energy density, and overall performance when compared to traditional lithium-ion batteries (Liu C. et al., 2022). The latter uses a liquid electrolyte to facilitate ion movement between the positive and negative electrodes during charge and discharge cycles.

Part of a multidisciplinary journal, this section publishes pioneering research on the rational design of materials used in all forms of sustainable energy harvesting, conversion, storage and utili...

Mini Review. Mini Review articles cover focused aspects of a current area of investigation and its recent developments. They offer a succinct and clear summary of the topic, allowing readers to get up-to-date on new developments and/or emerging concepts, as well as discuss the following: 1) Different schools of thought or controversies, 2) Current research gaps, 3) Potential future ...

The realization of a sustainable decarbonized economy requires the widespread use of renewable energy sources. Advanced energy storage technologies such as hydrogen storage, rechargeable batteries, thermal energy storage, etc. are greatly needed due to the fluctuating nature of solar and wind energy sources and the acceptance limit of current power grids. Under such ...

The increasing demand for substantial and efficient energy storage system has driven considerable research into advanced battery materials, such as lithium-air, sodium-air, lithium-sulfur, and solid electrolyte batteries. These materials offer promising solutions for improved energy density and safety in next-generation batteries. However, their complex physical and ...

The specific chemical and physical properties of 2D materials can influence the electrochemical charging and discharging processes, which in turn affects the ability of the device to convert and store energy. 2D materials have been used in numerous applications and in different fields of research such as energy storage and conversion ...

In this context, this review summarizes the material design of CPs for fibrous electrodes and provides a critical discussion on their applications in flexible energy storage devices. ...

A Hybrid Energy Storage System (HESS) consists of two or more types of energy storage technologies, the complementary features make it outperform any single component energy storage devices, such as batteries, flywheels, supercapacitors, and fuel cells. The HESSs have recently gained broad application prospects in smart grids, electric vehicles, electric ships, etc. ...

The role of nanostructured materials in addressing the challenges in energy and natural resource management has attracted wide attention. In particular, oriented nanostructures demonstrate promising properties for energy harvesting, conversion and storage. Although the applications differ from field to field, a common

fundamental challenge is to improve the generation and ...

Porous materials integrate multiple levels of porosity and structure, constituting a very diverse and versatile group of functional materials. Recently, a lot of effort has been devoted to the design of porous materials featuring high surface area, excellent accessibility to active sites, and improved mass transport and diffusion, which show promising applications in energy storage and ...

The upgrading and development of power facilities and 5G devices has led to the continuous increase of power consumption and heat density of equipment. Resultantly, the generated overheating issues seriously reduce the efficiency and reliability of thermal-related electronic devices. In this respect, thermal management materials, including thermal ...

Smart materials represent a cutting-edge field in sustainable and efficient energy solutions, distinguished by their ability to dynamically alter properties in response to external stimuli. These stimuli encompass temperature variations, mechanical stress, electromagnetic fields, light exposure, chemical environments, etc. Integrating smart materials into energy ...

Guest Editor: Prof. Jun-chao Zheng, A Special Issue of Energy Materials, Topic: Frontiers in Advanced Metal Cathode Materials. Special Issue Introduction: The demand for efficient, sustainable energy storage is driving advancements in cathode materials, crucial for next-generation batteries. The Special Issue on “Frontiers in Advanced Metal Cathode Materials” ...

Keywords: Advanced electrode materials, New materials, New methods, Mechanism research, Material design, Material modification, Energy storage and conversion . Important Note: All contributions to this Research Topic must be within the scope of the section and journal to which they are submitted, as defined in their mission statements.

Artificial intelligence (AI), such as learning and analyzing, has been widely used for various advantages. It has been successfully applied to predict materials, especially energy storage materials. In this paper, we present a survey of the present status of AI in energy storage materials via capacitors and Li-ion batteries.

1 Beijing Institute of Smart Energy, Beijing, China; 2 Institute for Advanced Materials and Technology, University of Science and Technology Beijing, Beijing, China; Thermal storage ceramics using metals as phase change materials (PCMs) have both high thermal conductivity and high heat storage density. However, in the process of use is very easy to ...

Keywords: Energy storage materials; Batteries; Theoretical calculations; Electronic waste; Recycling . Important Note: All contributions to this Research Topic must be within the scope of the section and journal to which they are submitted, as defined in their mission statements. Frontiers reserves the right to guide an out-of-scope manuscript to a more suitable ...

Energy consumption utilizing fossil fuels has a serious impact on the world economy as well as the environment. Renewable energy production & storage is an ever-relevant topic until high-performance, sustainable and cost-effective systems are achieved for vast applications. Among the various renewable energy systems, the electrochemical energy ...

Keywords: energy storage, energy conversion, controlling strategies, techno-economic and life-cycle analysis .

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