Organic framework materials for energy storage

Can covalent organic frameworks be used for energy storage?
The review article provides a comprehensive overview of covalent organic frameworks (COFs) and their potential for energy storage applications. Synthesis strategies, structural design, and energy storage mechanisms exhibited by COFs are systematically analyzed and presented.

Can functional organic materials be used for energy storage and conversion?
The review of functional organic materials for energy storage and conversion has revealed several key findings and insights that underscore their significant potentialin advancing energy technologies. These materials have demonstrated remarkable promise in meeting the increasing demand for efficient and sustainable energy solutions.

Can organic materials be used for energy storage?
Organic materials have gained significant attention in recent years for their potential usein energy storage applications (Iji et al. 2003; Solak and Irmak 2023; Duan et al. 2021). They offer unique advantages such as low cost,abundance,lightweight,flexibility,and sustainability compared to traditional inorganic materials.

Are organic materials the future of energy storage & conversion?
As research and development continue to advance in this field, organic materials are expected to play an increasingly pivotal role in shaping the future of technology and innovation. To fully harness the potential of functional organic materials in energy storage and conversion, future research efforts should prioritize several key areas.

What are metal-organic framework (MOF) based materials?
Among the emerging materials,metal-organic framework (MOF)-based materials,including pristine MOFs,MOF composites,and MOF derivatives,have drawn tremendous attention due to their remarkable superiority over conventional materials for energy conversion and storage applications. 3

Can organic materials be used in energy-related applications?
Moreover,the commercialization of organic photovoltaics (OPVs) and organic light-emitting diodes (OLEDs) has already demonstrated the feasibilityand potential of organic materials in energy-related applications (Dumur and Goubard 2014).

It is preliminarily proved that the side reactions of covalent organic framework materials are reduced and the electrochemical performance get improved after copper ion coordination modification. ... This work hints a novel strategy to improve the electrochemistry performance of COFs as energy storage material, and promotes the application of ...

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Selecting and assembling metal ions and bridging ligands can fabricate two-dimensional metal-organic framework nanosheets, which can act as prospective materials for efficient energy applications.Thanks to large surface area and more porosity, ultrathin 2D MOFs nanosheets and their derived two-dimensional nanosheet materials exhibit more highly ...

Covalent organic framework-based materials for energy applications ... challenges and perspectives according to previous contributions are also discussed for developing more efficient energy conversion and storage COF materials. It is anticipated that this review could boost further research enthusiasm for COF-based materials in energy ...

The metal organic frameworks (MOFs), are porous crystalline hybrid materials fashioned by linkage of the metal centers (clusters) and organic linkers (organic ligands), have been recognized as very active research domain due to their broad range of applications as energy storage and conversion materials, regioselective chemical refinements, and ...

Metal organic frameworks (MOFs) are a family of crystalline porous materials which attracts much attention for their possible application in energy electrochemical conversion and storage devices due to their ordered structures characterized by large surface areas and the presence in selected cases of a redox-active porous skeleton. Their synthetic versatility and ...

Over the past two decades, the synthesis of covalent organic framework materials has undergone a remarkable evolution, ... However, the choice of energy storage material should be application-specific, as each material has its own set of advantages and limitations. In this regard, COFs stand out as particularly promising candidates, especially ...

Covalent organic frameworks (COFs) are designable polymers that have received great research interest and are regarded as reliable supercapacitor (SC) electrode materials. However, the poor capacitive performance in pristine form due to their insoluble non-conductive nature is the primary concern that restricts their long term use for energy storage applications. ...

Metal-organic frameworks (MOFs), with their high porosity, multifunctionality, structural diversity, and controllable chemical composition, can serve as catalysts in electrode materials, regulate interface interactions, and improve electrochemical redox kinetics, providing new ideas and possibilities for energy storage materials. Despite these ...

This review addresses the remarkable versatility and boundless potential of COFs in scientific fields, mainly focusing on multivalent metal ion batteries (MMIBs), which include AIB (Aluminium-ion batteries), MIB ...

The electrode materials are key components for batteries and supercapacitors, which influence the practical energy and power density. Metal-organic frameworks possessing unique morphology, high specific surface

area, functional linkers, and metal sites are excellent electrode materials for electrochemical energy storage devices.

Metal-organic frameworks (MOFs), as porous materials, exhibit excellent properties including abundant exposed reactive sites and high surface areas. These attributes highlight their enormous energy storage potential as supercapacitors [91], [92] and batteries [93], [94]. First-principles calculations provide a convenient and intuitive approach ...

Organic electrode materials present the potential for biodegradable energy storage solutions in batteries and supercapacitors, fostering innovation in sustainable technology.

The linkage between metal nodes and organic linkers has led to the development of new porous crystalline materials called metal-organic frameworks (MOFs). These have found significant potential applications in different areas such as gas storage and separation, chemical sensing, heterogeneous catalysis, biomedicine, proton conductivity, and ...

Metal-organic frameworks (MOFs) are porous materials assembled using metal and organic linkers, showing a high specific surface area and a tunable pore size. Large portions of metal open sites in MOFs can be exposed to electrolyte ions, meaning they have high potential to be used as electrode materials in energy storage devices such as supercapacitors. Also, ...

Developing supporting platforms for energy conversion and storage ameliorating mass transfer and electron transfer has stepped into the center of the energy research arena. Covalent ...

6 · Organic cathodes are considered promising energy storage materials in potassium ion batteries (KIBs) due to their molecular flexibility, cost-effectiveness, and sustainability. ...

Metal-organic frameworks (MOFs) have emerged as a promising class of porous materials for various applications such as catalysis, gas storage, and separation. This review provides an overview of MOFs" synthesis, properties, and applications in these areas. The basic concepts of MOFs, and their significance in catalysis, gas storage, and separation are ...

Covalent organic frameworks are gaining recognition as versatile and sustainable materials in electrochemical energy storage, such as batteries and supercapacitors. Their lightweight ...

Abstract As modern society develops, the need for clean energy becomes increasingly important on a global scale. Because of this, the exploration of novel materials for energy storage and utilization is urgently needed to achieve low-carbon economy and sustainable development. Among these novel materials, metal-organic frameworks (MOFs), a class of ...

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Metal-Organic Framework-based Phase Change Materials for Thermal Energy Storage. Author links open overlay panel Xiao Chen 1, Hongyi Gao 2, Zhaodi Tang 2, Ge Wang 2 3. Show more. Add to Mendeley. Share. ... Microporous metal-organic framework materials for gas separation. Chem, 6 (2020), pp. 337-363. View PDF View article View in Scopus Google ...

Chen et al. review the recent advances in thermal energy storage by MOF-based composite phase change materials (PCMs), including pristine MOFs and MOF composites and their derivatives. They offer in-depth insights into the correlations between MOF structure and thermal performance of composite PCMs, and future opportunities and challenges associated ...

Recently, metal-organic frameworks (MOFs)-based cathode materials have attracted huge interest in energy conversion and storage applications as well as for other applications due to the presence of an extremely high surface area, controlled architecture, porosity, and easy tunability, as well as selective metal sources.

3 · As a new type of composite two-dimensional material formed by the combination of Covalent Organic Frameworks (COFs) and two- dimensional (2D) MXenes, COF/MXene ...

Metal Organic Frameworks and Their Derivatives for Energy Conversion and Storage comprehensively covers the updated design and synthesis of metal organic frameworks (MOFs) and their derived materials, also including their applications in electrochemical energy conversion and storage. The book starts with a systematic description of the rational ...

Through innovative approaches, such as tailored material design, novel synthesis methods, and device integration strategies, researchers are advancing the frontier of organic materials for ...

In this review, we present an updated overview of the most recent progress in the utilization of MOF-based materials in various energy storage and conversion technologies, encompassing gas storage, rechargeable batteries, supercapacitors, and photo/electrochemical energy conversion. This review aims to elucidate the benefits and limitations of MOF-based ...

Metal-organic frameworks are linked by different central organic ligands and metal-ion coordination bonds to form periodic pore structures and rich pore volumes. Because of their structural advantages, metal-organic frameworks are considered to be one of the most promising candidates for new energy storage materials. To better utilize their advantages, ...

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