Non-metallic materials for energy storage

What are the future directions of non-noble metal-TMO materials for electrochemical energy storage?
The future directions of non-noble metal-TMO materials for electrochemical energy storage are as follows. 1) For TMO/NM-S materials, ordered array nanostructures with an enhanced cyclability and rate capability are required as binder-free electrodes for EESDs.

Which materials can be used for energy storage?
Materials possessing these features offer considerable promise for energy storage applications: (i) 2D materials that contain transition metals(such as layered transition metal oxides 12,carbides 15 and dichalcogenides 16) and (ii) materials with 3D interconnected channels (such as T-Nb 2 O 5 (ref. 17 or MnO 2 spinel 12).

How can low-cost non-noble metals improve electrochemical performance of electrochemical energy storage devices?
To improve the electrochemical performances of electrochemical energy storage devices (EESDs),low-cost non-noble metals can be coupled to TMOs to yield diversified nanostructures,such as non-noble metal decorated-TMO nanoparticles (NPs) or nanoarrays,non-noble metal-TMO core-shell nanostructures.

What is the difference between non-metallic charge carrier based and metallic charge carrier-based batteries?
Non-metallic charge carrier-based and metallic charge carrier-based batteries have a different electrochemical nature and performance,owing to the distinct interactions between the charge carriers and the electrode materials,which is a key consideration for the design of energy storage devices.

What are the three types of non-noble metal-TMO materials?
Moreover,the three types of non-noble metal-TMO materials are described based on different substrates (Cu,Ti,Nisubstrates,etc),TMOs (Cu x O,NiO,TiO 2,NiCo 2 O 4,ZnCo 2 O 4,etc) and NM/TMO composites. Finally,this review presents challenges and perspectives for the future development of electrochemical energy storage.

What is non-noble metal-TMO on substrates (nm/TMO/s)?
Non-noble metal-TMO on substrates (NM/TMO/S) NM/TMO/S combine the advantages of both of the above two types of non-noble metal-TMO materials. Compared with non-noble metal-TMO composite,this type of architecture as an electrode material is not required to mix the active materials with some highly conductive materials .

This review ends with the unaddressed problems of metal-based mesoporous materials and the future application prospects within the domain of energy storage and ...

The performance and scalability of energy storage systems play a key role in the transition toward intermittent

renewable energy systems and the achievement of ...

This paper reviews the current development status of electrochemical energy storage materials, focusing on the latest progress of sulfur-based, oxygen-based, and halogen-based batteries. ...

The review explores a range of porous support materials used in PCM composites, including non-carbonaceous options such as diatomite, metal-organic frameworks, ...

Benefiting from its surface-rich functional groups, eco-friendliness, impressive electrochemical properties, excellent light absorption, structural tunability at the ...

Thermal energy storage (TES) systems provide a means to enhance the energy efficiency and cost-effectiveness of metal hydride-based storage by effectively coupling thermal ...

Abstract High-entropy battery materials (HEBMs) have emerged as a promising frontier in energy storage and conversion, garnering significant global research interest. These ...

Currently, non-precious metal-based materials play a vitally important role in functional materials and devices, such as structural components, energy storage, conversion ...

Besides, other significant applications of macroporous materials have also been explored from sensing to energy storage systems [5, 6, 7]. In the past decade, a variety of ...

Redox-active non-conjugated radical polymers are promising candidates for metal-free aqueous batteries but their energy storage mechanism in an aqueous environment ...

Abstract | Topological quantum materials (TQMs) have symmetry protected band structures with useful electronic properties that have applications in information, sensing, energy, and other ...

In summary, this Research Topic discussed various non-precious metal-based materials for energy storage, energy conversion and structural applications, especially in ...

Unlike organic compounds, these materials excel in high-temperature environments and exhibit excellent chemical stability. Common types include ceramics, glass, ...

This article looks forward to the research and development direction of non-noble metal based catalysts for carbon-based porous materials, which hope to promote the ...

Metallic-like transition metal-based nanostructures (MLTMNs) has recently arisen as robust and highly efficient materials for energy storage and conversion.

To improve the electrochemical performances of electrochemical energy storage devices (EESDs), low-cost non-noble metals can be coupled to TMOs to yield diversified ...

The organic-inorganic layered composites requiring more complex preparation processes are different from the physical blending, or non-metal oxides, and other inorganic ...

Rechargeable batteries base on alternative metal elements (Na, K, Mg, Ca, Zn, Al, etc.) can provide relatively high power density and energy density using abundant, low-cost ...

In addition, the development of new eco-friendly building materials and practices is of prime importance owing to the growing environmental concerns. This review reflects the key ...

To meet the rapid advance of electronic devices and electric vehicles, great efforts have been devoted to developing clean energy conversion and storage systems, such as hydrogen ...

Most transition metal oxides (TMOs) with medium conductivity and large volume expansion upon lithiation have a relatively poor rate capability and cycling life. To improve the ...

Energy storage technologies, which are based on natural principles and developed via rigorous academic study, are essential for sustainable energy sol...

Until the discovery of intercalation-type ANIBs in the past decade, many more novel electrode materials have been explored successively. Herein, our work mainly focuses ...

Latent heat energy storage system is one of the promising solutions for efficient way of storing excess thermal energy during low consumption periods. One of the challenges ...

Finally, we compare the performance of non- metallic and metal-lic charge carrier storage, and discuss design principles of electrode reactions and selection criteria of ...