Non-precious metal sulfide energy storage materials

What are high entropy metal sulfides?
Learn more. Controlled synthesis of high-entropy materials offers a unique platform to explore unprecedented electrochemical properties. High-entropy metal sulfides (HEMSs) have recently emerged as promising electrodes in electrochemical energy storage applications.

What are metal sulfide nanomaterials?
Metal sulfide nanomaterials have attracted great attention because of their excellent properties and promising applications in electronic, optical and optoelectronic devices. Well-aligned nanostructure arrays on substrates are highly attractive for their enhanced properties and novel applications.

Are transition metal sulfides suitable for electrocatalytic applications?
Transition metal sulfides have become some of the most promising non-precious metal catalysts due to their high specific surface area,unique electronic structure,and rich phase and property modulation methods. However,defects such as high overpotential and slow reaction kinetics hinder their implementationin electrocatalytic applications.

Are high entropy metal sulfides a promising electrode?
High-entropy metal sulfides (HEMSs) have recently emerged as promising electrodes in electrochemical energy storage applications. However, synthesizing HEMSs with a tunable number of components and composition is still challenging.

Why are metal sulfide nanostructures important?
Metal sulfide nanostructures are important nanomaterials due to their extensively promising applications in electronic,optical,optoelectronic and magnetic devices. The aligned nanostructure arrays on substrates are highly attractive due to their enhanced properties and novel applications.

What are electrochemical energy storage devices?
In the past few decades,electrochemical energy storage devices including rechargeable batteries and supercapacitorshave attracted significant attention due to their widespread applications in hybrid electric vehicles,smart portable electronics and industrial power and energy management ,,.

Transition metal sulfides are highly promising for their remarkable electrochemical activity together with low electronegativity for energy storage applications [2]. Small band gap ...

Energy Storage Materials. Volume 41, October 2021, Pages 404-426. MOFs-derived transition metal sulfide composites for advanced sodium ion batteries. Author links open overlay panel ... It is a real-life technique with the non-destruction of the electrode material and can directly obtain the information about the topography evolution and the ...

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ConspectusHydrogen is an ideal energy carrier and plays a critical role in the future energy transition. Distinct from steam reforming, electrochemical water splitting, especially powered by renewables, has been considered as a ...

In this context, special emphasis is placed on nickel, cobalt, molybdenum, tin, manganese, and tungsten metal sulfides and their composites as advanced electrode materials for supercapacitor applications. Finally, the benefits and challenges of using transition metal sulfide-based electrode materials for future clean energy storage are discussed.

Hydrogen is a carbon-free alternative energy source for use in future energy frameworks with the advantages of environment-friendliness and high energ...

Herein, we summarize recent advances in nanostructured metal sulfides, such as iron sulfides, copper sulfides, cobalt sulfides, nickel sulfides, manganese sulfides, molybdenum sulfides, tin sulfides, with zero-, one-, two-, and three ...

Pre-intercalation is a process that involves engineering the interface between electrode materials and carriers to enhance diffusion kinetics in energy storage systems. This method is effective at stabilizing the structure, shielding the electrostatic interaction between carriers and electrode materials, and increasing the ionic conductivity ...

The amorphous molybdenum sulfide films are among the most active non-precious catalysts for hydrogen evolution reactions. 77c With the unique characteristics of nanostructured materials, metal sulfide ...

Additionally, the paper showcases a range of high-performance applications of these materials in the arena of energy storage and conversion. Finally, the review concludes by summarizing the current status and offering insights into future application prospects of metal-based mesoporous materials within the domain of energy storage and conversion.

Provides a comprehensive outlook of development of precious and non-precious metal catalyst for ammonia decomposition. ... Its volatility and low volumetric energy density makes the storage and transportation of hydrogen, or a reagent from which it can be generated, a grand challenge. In early 2001, Schlapbach et al. published a review on ...

Therefore, it is urgent to find a non-precious metal-based catalyst with abundant natural resources, low cost and high catalytic stability. Recently, transition metal sulfides (TMSs) have attracted much attention as important electrocatalytic materials for water splitting due to their reasonable design, high activity and easy synthesis [13 ...

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Insights into charge storage and electroactivation of mixed metal sulfides in alkaline media: NiCoMn ternary metal sulfide nano-needles forming core-shell structures for hybrid ...

Electrochemical Energy Reviews, 2022, 5(4): 11-. Yiqun Chen, Junru Zhang, Lijun Yang, Xizhang Wang, Qiang Wu, Zheng Hu. Recent Advances in Non-Precious Metal-Nitrogen-Carbon Single-Site Catalysts for CO 2 Electroreduction Reaction to CO[J

Recent developments demonstrated that transition metal sulfides (TMSs) have emerged as a promising class of materials for ASCs due to their low cost, fascinating redox ...

High energy density Li-CO 2 batteries have attracted much attention owing to the "two birds with one stone" feature in fixing greenhouse gas CO 2 and providing renewable energy. However, poor reversibility of the discharge product Li 2 CO 3 is one of the main problems that limit its application, resulting in poor cycling stability and severe polarization. . Herein, copper indium ...

Engineering of non-precious metal nanomaterials as cocatalysts can play a significant role in low-cost, sustainable, and large-scale photocatalytic hydrogen production. Herein, MnCdS-Vs/NiCo 2 S 4 (MCSN) Schottky junction nanomaterials with strong electron coupling effect were prepared by a two-step hydrothermal method and successfully applied ...

Energy Storage Materials. Volume 7, April 2017, ... perovskite solar cells employ gold or silver as counter electrode materials. The use of the precious metals is a serious obstacle to the practical application of perovskite solar cells. In this work, low-cost non-precious transition metals are investigated to replace gold or silver as counter ...

Controlled synthesis of high-entropy materials offers a unique platform to explore unprecedented electrochemical properties. High-entropy metal sulfides (HEMSs) have recently emerged as promising electrodes in ...

Lithium-sulfur (Li-S) batteries are considered as one of the most promising candidates for next-generation energy storage systems with high energy density and reliable performance. However, the commercial applications of lithium-sulfur batteries is hindered by several shortcomings like the poor conductivity of sulfur and its reaction products, and the loss ...

Except for the electrode materials, the reaction circumstance is an essential factor for ORR process [12].For example, the alkaline nature allows the surface-independent transfer of outer electrons during the first stage of ORR [22].The non-specificity of the environment permits the utilization of a variety of nonprecious metal electrocatalysts [23].

Electrochemical water splitting is an important issue for sustainable production of hydrogen for energy storage

in recent years [[1], [2] ... In non-precious metal electrocatalysts, ... Results showed that metal sulfide improves intrinsic conductivity of electrocatalysts while (oxy)hydroxide on the surface acts as the catalytic site for OER ...

Herein, recent developments of non-precious transition metal-based catalysts in electrochemical nitrate reduction and the pertinent mechanisms are described. In addition to the important techniques, future challenges and prospects are discussed to guide future research on non-precious metal catalysts for commercial NH 3 synthesis by NO 3 - ...

Transition metal sulfides have become some of the most promising non-precious metal catalysts due to their high specific surface area, unique electronic structure, and rich ...

Hydrogen produced via water electrolysis can act as an ideal clean chemical fuel with superb gravimetric energy density and high energy conversion efficiency, solving the problems of conventional fossil fuel exhaustion and environmental contamination. Transition metal sulfides (TMS) have been extensively explored as effective, widely available alternatives to precious ...

The exposure of an abundance of catalytic sites in nanosheet clusters enhances catalytic activity for the hydrogen evolution process. The optimized WS 2 /NiS x composite outperforms most non-precious metal electrocatalysts and demonstrated good catalytic stability with 10 mA/cm 2 of just 72 mV value for overpotential in alkaline conditions [92].

The fossil fuels will be exhausted in the near future, and the need for groundbreaking sustainable energy solutions has been urgent. Electrochemistry-based energy conversion and storage devices with high efficiency, reliability and environmental friendliness (such as metal-air batteries, fuel cells, water splitting, and solar fuel synthesis) have become an important ...

Metal-organic frameworks (MOFs) are a class of three-dimensional porous nanomaterials formed by the connection of metal centers with organic ligands [1].Due to their high specific surface area and tunable pore structures, and the ability to manipulate the chemical and physical properties of such porous materials widely through the substitution of metal nodes ...

As a group of interstitial compounds, transition metal nitrides (TMNs) have attracted considerable interests in energy storage and conversion techniques due to the unique physicochemical properties, especially the resemblance of electronic structure to noble metals [40], [41].To date, more than one hundred TMNs have been developed as electrocatalysts for ...

The creation of hydrogen and oxygen from water can be a paramount way to produce clean fuel through Earth-abundant and non-precious photoelectrochemical (solar to hydrogen production) and electrocatalysis ...

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The energy storage field has witnessed a dramatic expansion in terms of short charging time of supercapacitors, especially in the highly active electrode materials. Metal-organic frameworks (MOFs) materials have been extensively applied as precursors or templates for the synthesis of carbon, metal oxides/sulfides-based compounds as high ...

Metal sulfide nanostructures : synthesis, properties and applications in energy conversion and storage . Nanostructured metal sulfide materials, such as MoS 2 nanotubes and Bi 2 S 3 nanorods, have attracted much attention for electrochemical hydrogen storage

Metal-free materials, transition-metal oxides/phosphides/sulfides, and polyoxometalate-based materials, are promising precious-metal-free candidates for efficient water oxidation in acidic media. Here, this emerging research field is reviewed regarding design concepts, key practical issues, and the outlooks for future research directions.

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