Boron nitride electrochemical energy storage

Energy conversion and storage materials have received wide attention as fossil fuels are gradually running out and climate change is looming. Hexagonal boron nitride (h-BN) is not usually considered as a promising material for these applications because of its chemical inertness and poor electronic conductivity. However, through physical and chemical ...

In this review, we examine recent progress using boron nitride (BN) and molybdenum disulfide (MoS2) nanostructures for electronic, energy, biomedical, and environmental applications. The scope of coverage includes zero-, one-, and two-dimensional nanostructures such as BN nanosheets, BN nanotubes, BN quantum dots, MoS2 nanosheets, ...

The prominence of two-dimensional hexagonal boron nitride (2D h-BN) nanomaterials in the energy industry has recently grown rapidly due to their broad applications in newly developed energy systems. This was necessitated as a response to the demand for mechanically and chemically stable platforms with superior thermal conductivity for ...

A unique approach has been applied for the synthesis of 1D boron carbon nitride nanotubes (BCN-NTs) using MnO2 nanowires as templates. BCN-NTs have been evaluated in Na-ion batteries, Li-ion batteries, and supercapacitors as electrode material and exhibited excellent and stable electrochemical performance. BCN-NTs as an anode for Na-ion ...

Although boron nitride (BN) is called "white graphene" due to its atomic structure similar to the carbon-based material of graphene, BN cannot be treated as an active material that frequently employed in the electrochemical energy storage and ...

Two-Dimensional Hexagonal Boron Nitride (2D h-BN) in Energy Conversion and Storage Devices. Energies 2022, 15, ... performance of 2D h-BN in different energy storage/conversion devices. ... 2D h-BN. Electrochemical energy production/storage systems including fuel cells, batteries, and supercapacitors, together with thermoelectric and ...

Energy storage and conversion (ESC) devices are regarded as predominant technologies to reach zero emission of carbon dioxide, which still face many challenges, such as poor safety, limited cycle life, low efficiency,etc. Hexagonal boron nitride (h-BN), distinguished by its robust mechanical strength, chem-

One-step and efficient preparation of few-layer hydroxylated boron nitride nanosheets (OH-BNNSs) in electrochemical methods is still challenging. Here, we developed an electrolyte composed of a mixture of deep eutectic solvent (DES, choline chloride-urea) and water for electrochemical methods to enhance the

exfoliation and oxidation processes, enabling the ...

Energy catalysis and storage are the key technologies to solve energy and environmental problems in energy systems. Two-dimensional (2D) boron nitride nanomaterials have aroused a great interest in the synthesis and application because of their unique 2D nature, large band gap, metal-free characteristic, high thermal/mechanical stability, and easy ...

Utilizing electrochemical CO 2 reduction reaction (CO 2 RR) to synthesize chemical fuels is an effective strategy to alleviate environmental pollution and energy crisis. In this work, a series of single transition metal atoms (TM = Mn, Fe, Co, Ni, Cu, Ru, Rh, Pd) are doped into boron nitride nanotubes (BNNTs) of BN divacancy defect with different curvature ...

In a typical synthesis process, 7 mg of bismuth metal powder and 3 mg of hexagonal boron nitride powder were loaded in a 500 mL Zirconia jar and subjected to ball milling process in a RETSCH -PM-100 GmbH high energy planetary ball miller charged with the 16 stainless steel ball of 0.6 cm diameter at 200 rpm for 8 h.

Supercapacitors are regarded as reliable energy storage devices to alleviate the energy crisis and environmental pollution. However, the relatively low capacitance and low energy density limit the practical application of supercapacitors. In this context, boron carbon nitride (BCN) nanomaterials have been extensively studied in the past decade due to their chemical ...

As an important power storage device, the demand for capacitors for high-temperature applications has gradually increased in recent years. However, drastically degraded energy storage performance due to the critical conduction loss severely restricted the utility of dielectric polymers at high temperatures. Hence, we propose a facile preparation method to suppress ...

Particularly, their emerging applications in electrochemical energy storage, ... (BP), hexagonal boron nitride (hBN), transition metal dichalcogenides (TMDs), layered double hydroxides (LDHs), graphitic carbon nitride (g-C 3 N 4) and transition-metal carbides/nitrides (MXene). Among them, BP is a rising-star 2D material, which has attracted ...

Recent studies have shown that integrating hexagonal boron nitride (h-BN) nanomaterials into LBs enhances the safety, longevity, and electrochemical performance of all LB components, including electrodes, electrolytes, and separators, thereby suggesting their potential value in advancing eco-friendly energy solutions.

Boron nitride (BN) nanotubes were synthesized through chemical vapor deposition over a wafer made by a LaNi5/B mixture and nickel powder at 1473 K. Scanning electron microscopy, transmission electron microscopy, energy-dispersive spectroscopy, X-ray diffraction, and X-ray photoelectron spectroscopy were performed to characterize the microstructure and ...

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Hexagonal boron nitride nanosheets as metal-free electrochemical catalysts for oxygen reduction reactions. ... this class of metal-free nanostructured materials can be employed as inexpensive catalysts for the electrochemical H-storage and ORR within various energy storage/conversion devices (e.g., batteries, electrolyzers, and fuel cells).

Particular interest is devoted to applications in electrochemical energy storage, whereby 2D MXenes work either as electrodes, additives, separators, or hosts. This review summarizes recent advances in the synthesis, fundamental properties and composites of MXene and highlights the state-of-the-art electrochemical performance of MXene-based ...

Powdery hexagonal boron nitride (h-BN), as an important material for electrochemical energy storage, has been typically synthesized in bulk and one/two-dimensional (1/2D) nanostructured morphologies. However, until now, no method has been developed to synthesize powdery three-dimensional (3D) h-BN.

A polyaniline (PANI)-incorporated boron nitride (BN) with different mass ratios (0.1-10 g) were prepared by two-step in situ oxidative chemical polymerization method for pseudocapacitor application. The surface morphology of BNPANI composites reveals that the PANI was uniformly decorated over the BN matrix. The electrochemical studies of PANI ...

1 Introduction. The relentless pursuit of high-performance and sustainable energy storage systems, fueled by the ever-increasing demand for portable electronics, electric vehicles, and grid-scale energy storage solutions, has driven extensive research efforts worldwide. [] In this quest, two-Dimensional (2D) nanomaterials have emerged as promising ...

Energy storage and conversion (ESC) devices are regarded as predominant technologies to reach zero emission of carbon dioxide, which still face many challenges, such as poor safety, limited cycle life, low efficiency, etc.Hexagonal boron nitride (h-BN), distinguished by its robust mechanical strength, chemical inertness, exceptional thermal stability, and superior ion ...

The review offers a clear and engaging perspective, diving into the possibilities and challenges that could shape future research in MXene composites for electrochemical energy applications. The main aim is to support the development of high-quality MXene-based composites and expand their potential uses in energy storage and conversion systems.

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