

Are porous boron nitride monolayers multifunctional materials?

This study comprehensively examined the structural, electronic, electrochemical, and energy storage properties of boron-vacancy induced porous boron nitride monolayers (BN:VB) as multifunctional materials, anodes for MIBs and H₂ storage applications.

What is boron nitride (BN)?

Use the link below to share a full-text version of this article with your friends and colleagues. As a conventional insulating material, boron nitride (BN) has been mainly investigated in the electronics field.

Is boron nitride a good insulating material?

As a conventional insulating material, boron nitride (BN) has been mainly investigated in the electronics field. Very recently, with the development of preparation/modification technology and deeper understanding of the electrochemical mechanisms, BN-based nanomaterials have made significant progress in the field of electrochemistry.

Why is BN used in electrochemical systems?

Owing to its chemical and thermal stability, as well as its high mechanical strength, BN can alleviate various inherent problems in electrochemical systems, such as thermal deformation of conventional organic separators, weak solid electrolyte interface layers of metal anodes, and electrocatalyst poisoning.

How ion gel electrolyte can be synthesized using amine-functionalized boron nitride nano?

In a recent study, an ion gel electrolyte was synthesized through the incorporation of amine-functionalized boron nitride nanosheets (AFBNNSs) using a thermal polymerization process. The electrolyte achieved a lithium transference number of 0.23, nearly twice larger than its counterpart without AFBNNSs.

Do Li ions transit through boron vacancies?

These investigations revealed a predilection of Li ions for transiting through boron-vacancies (VB) present in the BN structure, owing to its comparatively reduced energy requirement for migration in contrast to that of nitrogen-vacancies (VN) (Figure 15b).

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).

The challenges and possibilities for future application of boron nitride-based nanomaterials in electrochemical energy storage systems are also highlighted. Conventional boron nitride material is a resistant refractory ...

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 ...

Being an isomorph of graphene, hexagonal boron nitride (hBN) has attracted enormous attention to exploring its possible applications in various fields [25, 26]. Unlike graphene, hBN is an insulating material with a band gap of ~6 eV [27, 28] which provides the scope of its tuning by its functionalization to utilize its dynamic properties. However, similar to graphene, 2D ...

The design and fabrication of energy storage devices and electrochemical sensors are two major research fields. Many research groups are dedicated to the development of high-performance energy ...

Developing the novel electrochemical and electrocatalytic characteristics of BN is expected to make the next leap forward for upgrading the energy storage and conversion ...

Comparing to the electrochemical energy-storage technologies, the energy density of the dielectric capacitors is generally low. ... Hayden, J. et al. Ferroelectricity in boron ...

To achieve the high-rate efficiency in a electrochemical energy storage technologies, it is vital for the battery anode to be electronically as well as ionically conductive. Such a requirement has boosted the survey of three-dimensional (3D) porous networks made up of light-weight non-metallic elements, like carbon, boron, and nitride.

Energy storage through metal-ion batteries (MIBs) and hydrogen (H₂) fuel presents significant opportunities for advancing clean energy technologies. This study comprehensively examined the structural, electronic, electrochemical, and energy storage properties of boron-vacancy induced porous boron nitride monolayers (BN:V B) as ...

Recently, various nanostructured boron nitride materials, including nanosheets, nanotubes, nanoparticles, ... The challenges and possibilities for future application of boron nitride-based nanomaterials in electrochemical energy storage systems are also ...

Herein, a concentrated sulfone electrolyte possessing Li⁺ hopping conduction was immobilized with boron nitride (BN) as an "all-in-one" gelator via simple grinding. This method ...

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 ...

The growing adoption of electric vehicles (EVs) has spurred a focused endeavor aimed at advancing rechargeable battery technologies to attain superior electrochemical capabilities, particularly characterized by high-energy density, prolonged cycle-life, and high operational temperatures [1], [2]. Among the most commonly-used types on today's market is ...

Comparing the band structure of a single layer of boron nitride (BN) to a graphene sheet at the Fermi level reveals that they have distinctly different electronic properties (Fig. 1) a graphite sheet, two bands intersect at the Fermi energy level at the K point, whereas in a single layer of h-BN, the non-overlap of these electronic states result in the formation of a forbidden ...

Recently, because of the extraordinary success of graphene, two-dimensional (2D) materials and their related nanohybrids have been exploited in various nanoelectronics and energy storage systems [3], [32], [33]. Among various 2D materials, the hexagonal boron nitride (h-BN) shares a similar honeycomb lattice structure to graphene, in which equal alternating ...

Scalable synthesis of sodium thiosulfate functionalized boron nitride/graphene oxide composites via liquid-phase exfoliation achieves high electrochemical performance even after 3000 cycles, demonstrating potential for advanced energy storage systems.. Download: Download high-res image (346KB) Download: Download full-size image

The hexagonal-Boron Nitride (h-BN) is a sp^2 hybridized 2D material showing high thermal conductivity, good mechanical strength but low electrical conductivity because of its high band-gap of 6.08 eV [13]. The nano-compositing of h-BN with other carbonaceous compounds enhances electron mobility and thereby increases electrical conductivity due to the formation ...

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, ...

High-performance boron nitride/graphene oxide composites modified with sodium thiosulfate for energy storage applications. Shamsiya Shams+ a, B. Bindhu * a, Adhigan Murali+ b, R. Ramesh * c, Abdullah Al Souwaileh d and Sung Soo Han * b a Department of Physics, Noorul Islam Centre for Higher Education, Kumaracoil, Thuckalay, 629180, Tamilnadu, India.

There is provided an improved electrochemical energy storage device. The storage device includes using functionalized boron nitride nanoparticles as electroactive materials in the electrodes. US10693137B2 - Functionalized boron nitride materials as electroactive species in electrochemical energy storage devices - Google Patents ...

Boron nitride-based materials are known as a Li-ion conductor despite being electrically insulating ... Synthesis and modification of boron nitride nanomaterials for electrochemical energy storage: from theory to

application. Adv. Funct. Mater., 31 (2021), Article 2106315, 10.1002/adfm.202106315.

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 ...

Boron nitride nanostructures (BNNs), including nanotubes, nanosheets, and nanoribbons, are renowned for their exceptional thermal stability, chemical inertness, mechanical strength, and high surface area, ...

Because of its chemical stability, thermal stability, and strong mechanical strength, boron nitride (BN) has been widely studied. In recent years, with the modification and functionalization of BN, g...

Boron Nitride-Integrated Lithium Batteries: Exploring Innovations in Longevity and Performance. Shayan Angizi, Shayan Angizi. ... The electrochemical energy storage mechanism of LBs relies on the movement of ...

The growing demand for clean and renewable energy has aroused considerable interest in energy storage and conversion systems. Among them, electrochemical energy storage devices such as rechargeable ion batteries and supercapacitors have shown great potential for the utilization of renewable energy with high efficiency and quality [1], [2]. However, the poor ...

Owing to its chemical and thermal stability, as well as its high mechanical strength, BN can alleviate various inherent problems in electrochemical systems, such as thermal ...

Electrochemical energy storage systems play an irreplaceable role in today's society, among which batteries and supercapacitors are included. ... N - Cs were greater than 0.5. These results indicated that the charge storage process of nickel sulfide/boron-nitrogen-carbon (NiS/B - N - Cs) was closer to the diffusion process control, which ...

Two-dimensional (2D) atomic layer materials have attracted a great deal of attention due to their superior chemical, physical, and electronic properties, and have demonstrated excellent performance in various ...

Hexagonal boron nitride (h-BN) as a type of two-dimensional (2D) materials has gained significant attention in green energy applications recently. ... Well-defined nanostructures for electrochemical energy conversion and storage. Adv. Energy Mater. (2021) S. Zhao et al. Carbon-based metal-free catalysts for key reactions involved in energy ...

Additionally, as for energy storage devices, supercapacitors (SCs) is considered as one of the most effective energy storage devices owing to its high power density, prolonged cycle life, rapid charge-discharge characteristics, ease of fabrication, safe operation and other unique functionalities [6]. Recently, the design of self charging piezoelectric SCs have been ...

Boron nitride electrochemical energy storage

Owing to overwhelming advantages of earth abundance, high electronic conductivity and low cost, carbon based materials hold great potentials as electrode materials and conductive additives of electrode for clean electrochemical energy storage systems [1]. So far, a huge number of carbon based materials (e.g., carbon nanotubes, graphene, 3D carbon and ...

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