Black phosphorus has good application prospects in energy storage

Can black phosphorus be used for energy storage?
Black phosphorus is a potential candidate material for next-generation energy storage devicesand has attracted tremendous interest because of its advantageous structural and electrochemical properties,including its large theoretical capacity,high carrier mobility,and low redox potential.

What are the advantages of black phosphorus?
Some of the great advantages of black phosphorus are the special structure with puckered layers, high theoretical capacity, enhanced charge carrier mobility and anisotropic in-plane properties. BP is expected to significantly improve the specific capacity without changing the basic performance of the batteries.

What is single- or few-layered black phosphorus?
Recently,a new two-dimensional material,single- or few-layered black phosphorus (BP),has attracted considerable attention for applications in electronics,optoelectronics,and batteries due to its unique properties,including large specific surface area,anisotropy,and tunable and direct band gaps.

What is black phosphorus?
Black phosphorus (BP) is a type of relatively novel and promising material with some outstanding properties,such as its theoretical specific capacity (2596 mAh/g) being approximately seven times larger than that of graphite as a negative material for batteries. Phosphorene,a one-layer or several-layer BP,is a type of two-dimensional material.

What is the specific capacity of black phosphorus?
In particular,black phosphorus has a folded structure,and each P atom can react with three Li or Na atoms to form Li 3 P and Na 3 P,giving it a very high theoretical specific capacity of 2596 mAh/g[31],which is far more than the graphite negative electrode (372 mAh/g) with its excellent energy storage properties.

Could black phosphorus open a new chapter for energy materials?
All in all,with persistent attempts by researchers around the world,it is out of questionthat black phosphorus would not only open a new chapter for a new generation of energy materials but also provide a remarkable market potential in the foreseeable future. There are no conflicts to declare.

Furthermore, it discusses recent advancements of black phosphorus in various applications such as transistors, photodetectors, energy storage and conversion, biomedicine, ...

Since phosphorene was mechanically exfoliated from bulk black phosphorus (BP) crystal in early 2014 [1,2], BP has been rediscovered from the perspective of a two-dimensional (2D) layered material, which has drawn considerable attention both in terms of fundamental research and in exciting potential applications, such as energy storage and conversion, ...

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Two-dimensional (2D) crystals have emerged as a class of materials that can impact future electronics (Li et al., 2014), with excellent electrochemical properties and a high specific surface area, which are ...

The article highlights the potential applications of these materials in energy storage (e.g., high-capacity batteries), flexible electronics (e.g., bendable displays), environmental sensing, and ...

and the energy gap of 10-layer black phosphorus i s very close to that of bulk material, and the energy band cleavage due to the interaction between layers is the direct cause of the decrease of ...

Red phosphorus also has high theoretical specific capacity, similar to BP, but red phosphorus is non-conducting so that it cannot be used directly for energy storage. Distinct from red phosphorus, BP or phosphorene is a fairly good conductor of electricity, which exhibits mobility on the order of ~1000 cm 2 /V/s [19, 46, 47].

Few-layer black phosphorus (BP) is a two-dimensional material that has attracted intensive attention for application in energy storage and catalysis due to its large surface area, and good ...

Black phosphorus (BP), as a typical two-dimensional material, exhibits excellent lithium ion lithiation/delithiation properties when used in lithium-ion battery energy storage processes, primarily relying on the intercalation mechanism [6].This intercalation mechanism provides a high specific capacity for lithium-ion batteries but does not meet the demand of high ...

Black phosphorus with a long history of ~100 years has recently attracted extraordinary attention and has become a promising candidate for energy storage and conversion owing to its unique layered structure, impressive carrier ...

Black phosphorus with a long history of ~100 years has recently attracted extraordinary attention and has become a promising candidate for energy ...

Black phosphorus-based materials for energy storage and electrocatalytic applications, Xiong-Xiong Xue, Haiyu Meng, Zongyu Huang, Yexin Feng, Xiang Qi ... The latest recent advances of BP-based functional ...

The atomic structure of layered BP as seen from different sides is shown in Fig. 2.Based on first-principles calculations, the sp 3-hybridized P atoms bond covalently and form the distinctive structure of BP (Fig. 2 a) [43].The angle between two adjacent P atoms on the same atomic plane of a layer is 98.15° while that between two adjacent P atoms on adjacent planes ...

Black magic: Recent advances in black phosphorus applications in energy conversion and storage are comprehensively reviewed. Black phosphorus possesses advantages such as tunable band gap, high carri...

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On this basis, nanoscale flame-retardant additives have progressively emerged as a focal point of research. BP, as the strong performer, had gradually accepted by scientists because of its unique structure [23], [24], [25].As an allotrope of phosphorus, each phosphorus atom combines with three adjacent atoms to form a honeycomb structure, which can be arranged ...

Abstract: As a novel fine phosphorus chemical product,black phosphorus has a promising application prospect in energy ator-age due to its high theoretical specific capacity,high carrier mobility, and good conductivity recent years,many new techno-logies,methods,and strategies have been emerged for the preparation and energy storage application of black ...

Among them, black phosphorus has attracted attention because of its large theoretical specific capacity (2596 mA h/g). However, the moderate conductivity of black phosphorus itself makes it less effective. The addition of graphite to form P-C and P-O-C bonds with black phosphorus enhances the performance of the battery cell.

Beyond their exceptional structure, black phosphorus (BP) and phosphorene exhibit remarkable potential in various applications. Their favourable electrochemical properties and high theoretical specific capacity make them promising candidates for advanced lithium-ion batteries and efficient photovoltaic devices [32].Notably, their sensitivity to chemical and physical stimuli ...

This review has comprehensively presented the current progress of 2D BP materials with their synthesis, properties, and energy storage applications. In summary, the attractive properties (e.g., high mechanical strength, good ion conductivity) of thin-layer 2D BP allow it to be further studied for future energy storage applications.

2.1.2. Fundamental properties. Among all the other 2D materials explored over the past few years like graphene, hexagonal- boron nitride (h-BN), MoS 2, and WSe 2, phosphorene has been considered as one of the best 2-D materials ...

Black phosphorus is a potential candidate material for next-generation energy storage devices and has attracted tremendous interest because of its advantageous structural ...

Black phosphorus with a long history of ~100 years has recently attracted extraordinary attention and has become a promising candidate for energy storage and conversion owing to its unique layered structure, impressive carrier mobility, remarkable in-plane anisotropic properties, and tunable bandgap from 0.3 eV in the bulk to 2.0 eV in the monolayer.

As a rising star in the family of two-dimensional (2D) materials, black phosphorus (BP) has recently attracted tremendous attention all over the world and demonstrated great potential in energy applications owing to its direct and narrow bandgap, high carrier mobility ...

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The successful isolation of phosphorene (atomic layer thick black phosphorus) in 2014 has currently aroused the interest of 2D material researchers. In this review, first, the fundamentals of phosphorus allotropes, phosphorene, and black ...

Two-dimensional black phosphorus (2D BP) possesses huge potential in electrochemical energy storage field owing to its unique electronic structure, high charge carrier mobility, and large ...

BP, phosphorene or their composite materials can significantly improve the performance of energy storage devices, e.g., mainly lithium ion batteries, sodium ion batteries ...

Biomedical applications of black phosphorus. ... and energy storage. There are two main approaches for the synthesis of BP: top-down and bottom-up approaches [69], ... Black phosphorus has emerged as a promising 2D material in the field of optoelectronics due to its unique electronic and optical properties. BP possesses a direct bandgap, which ...

Two-dimensional black phosphorus: Properties, fabrication and application for flexible supercapacitors Author links open overlay panel Yaopeng Wu a, Wei Yuan a, Ming Xu a, Shigen Bai a, Yu Chen b, Zhenghua Tang b, Chun Wang a, Yang Yang a, Xiaoqing Zhang a, Yuhang Yuan a, Mingyue Chen a, Xing Zhang a, Bin Liu c, Lelun Jiang c

Black phosphorus with a long history of ~100 years has recently attracted extraordinary attention and has become a promising candidate for energy storage and conversion owing to its...

In recent years, black phosphorus (BP) has attracted extensive attention. Studies have shown that black phosphorus has shown good application prospects in energy storage, catalysis,photoelectronics, biomedicine and other fields.Black phosphorus

Recently, a new two-dimensional material, single- or few-layered black phosphorus (BP), has attracted considerable attention for applications in ...

Catalysts 2022, 12, 1403 3 of 13 et al. takes black phosphorus as its active ingredient, and has the highest weight capacity among all known potassium ion anode materials [77].

The 2D BP in a single layer is not a perfect plane structure, as it presents a folded state in the plane. There are two types of p-p bonds inside the crystal lattice: one is a p-p bond in the same plane whose bond length is L p-p = 0.2224 nm and whose bond angle is 96.3° and the other is a p-p bond in a different plane whose bond length is L p-p = 0.2244 nm and whose ...

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