

Synthesis and lithium battery applications of few-layer black phosphorous nanosheets

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Atomically thin black phosphorous (BP) has recently attracted a lot of interest because of its unique electronic and optical properties and a wide range of potential applications such as electronics, optoelectronics and lithium batteries. However, scalable synthesis of high-quality bulk BP and defect-free atomically thin BP in a processable form are very challenging. In this presentation, we will first introduce the synthesis of centimeter-size high-quality bulk BP crystals by a scalable mineralizer-assisted gas-phase transformation method, and large-scale clean production of few-layer BP nanosheets by directly exfoliating these BP crystals in water utilizing the hydrophilic nature of BP [1]. Then, we will demonstrate the use of these BP nanosheets for high-performance flexible paper-like lithium ion battery cathode by combining them with highly conductive graphene [1]. Finally, we will demonstrate their applications in carbon nanofibre lithium sulfur battery anode where they act as electrocatalyst and polysulfide immobilizer, giving much better overall performance [2].

- [1] Chen L., Zhou G.M., Cheng H.M., Ren W.C., et al. Scalable Clean Exfoliation of High-Quality Few-Layer Black Phosphorus for a Flexible Lithium Ion Battery. *Advanced Materials*, 2016, 28(3): 510-517.
- [2] Li L., Chen L., Ren W.C., Koratkar N., et al. Phosphorene as a Polysulfide Immobilizer and Catalyst in High-Performance Lithium-Sulfur Batteries. *Advanced Materials*, 2016, DOI: 10.1002/adma.201602734.

Figures

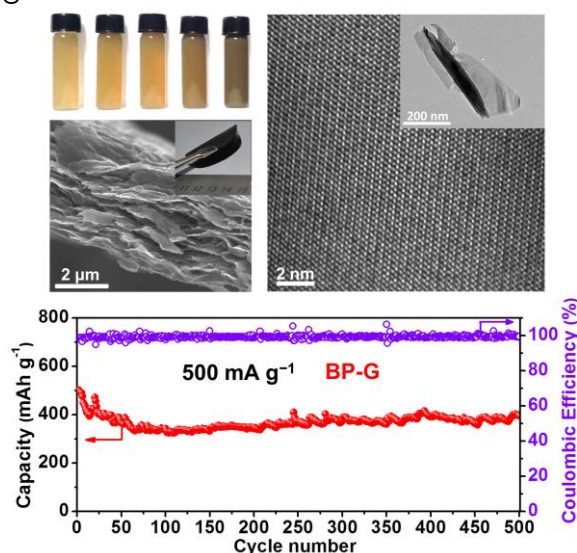


Figure 1: Exfoliation of high-quality few-layer BP nanosheets for lithium ion battery.

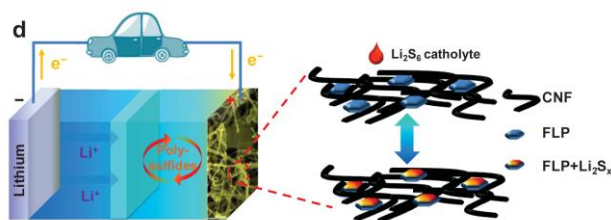


Figure 2: Few-layer BP nanosheets act as polysulfide immobilizer in carbon nanofibre lithium sulfur battery.

References