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Performance of Phosphorus Storage Lithium Batteries

Overview

Is phosphorus a good anode material for lithium ion batteries?

Phosphorus is an ideal anode material for high-rate lithium-ion batteries due to its high theoretical specific capacity and moderate operating potential. However, phosphorus undergoes tremendous volume expansion and low electrical conductivity during lithium storage, affecting its actual lithium storage performance.

Why is phosphorus a promising anode material for fast-charging lithium-ion batteries?

Phosphorus is a promising anode material for fast-charging in lithium-ion batteries because of the combined advantages of high theoretical mass and volume specific capacity as well as a relatively low, yet safe lithiation potential to avoid Li metal dendrite formation.

How does phosphorus affect lithium storage performance?

However, phosphorus undergoes tremendous volume expansion and low electrical conductivity during lithium storage, affecting its actual lithium storage performance. The formation of P–C bonds is an effective strategy to inhibit the volume expansion and maintain stable electrical contact between phosphorus and the current collector.

Are lithium-ion batteries a high-performance energy storage system?

The increasing demand for high-performance energy storage systems has driven a significant focus on developing electrolytes for lithium-ion batteries (LIBs), known for their high energy density and cycle stability.

What is a high-rate lithium ion battery?

High-rate lithium (Li) ion batteries that can be charged in minutes and store enough energy for a 350-mile driving range are highly desired for all-electric vehicles. A high charging rate usually leads to sacrifices in capacity and

cycling stability. We report use of black phosphorus (BP) as the active anode for high-rate, high-capacity Li storage.

Why is phosphorus a promising anode material?

Phosphorus has emerged as a promising anode material due to its high specific capacity of 2594 mA h g −1 and medium redox potential of about 0.7 V (vs. Li + /Li). However, large volume changes and low ion reaction kinetics are still the dominant challenges that affect the long-term cycle stability and high-rate performance of phosphorus anodes.

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