

Recent Progress in Li- and Na- Phosphate-Based Electrodes for High-Efficiency Li- & Na-Ion Batteries

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Summary:

With the rapid expansion of renewable energy sources like solar and wind, developing energy storage devices with high energy density, safety, affordability, and environmental compatibility has become essential. For more than three decades, lithium-ion batteries have dominated as power sources for portable electronics. However, their application in smart grids and electric vehicles faces significant challenges, especially concerning safety and the scarcity of key materials.

Metal phosphates like LiFePO_4 (LFP) have garnered significant attention as electrode materials for next-generation rechargeable metal-ion batteries (MIBs), owing to their high theoretical capacity, excellent chemical stability, long cycle life, safety and natural abundance. This contribution provides an overview of recent advances in the design and engineering of metal phosphate-based electrode materials for MIBs. A variety of experimental factors are analyzed in depth, including synthesis techniques, crystal structure, and electrochemical reaction mechanisms. The presentation will also explore the applications of these materials as electrodes in various MIB systems, such as lithium-ion, sodium-ion.

We conclude with a perspective on the opportunities and challenges facing phosphate-based electrodes for MIBs, along with proposed directions for future research.

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