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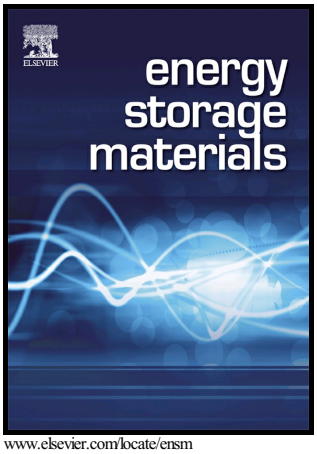

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$K_3V_2(PO_4)_2F_3$ as a Robust Cathode for Potassium-Ion Batteries

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Abstract

Potassium-ion batteries have emerged as promising candidates for low-cost and sustainable energy storage systems. The development of potassium-ion batteries is relatively slow due to the large size of potassium ions, rendering great difficulty in designing appropriate host materials. Herein, a $K_3V_2(PO_4)_2F_3$ cathode is inherited from $Na_3V_2(PO_4)_2F_3$ analog. The crystallographic structure and phase transformations are unveiled through *in-situ* X-ray diffraction, which shows only minor volume change of 6.2% during potassium ions insertion/extraction. Nearly two potassium ions could be provided by the electrode, delivering a capacity of over 100 mAh g^{-1} with a high average potential of ~3.7V vs. K^+/K. An energy density of around 400 Wh kg^{-1} together with a respectable rate capability have been obtained. Coupling with a graphite anode, a 3.4 Volt-Class battery has been demonstrated, making potassium-ion batteries promising contenders to sodium ion batteries in large-scale energy storage. This discovery also sheds insights into the quest for potential electrodes from the analogs in Li/Na-ion batteries.

Graphical Abstract

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