Electrochemical Properties of Hollow Spherical Na$_3$V$_2$(PO$_4$)$_3$/C Cathode Materials for Sodium-ion Batteries

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Hollow Spherical Na$_3$V$_2$(PO$_4$)$_3$/C cathode materials were successfully synthesized by a simple spray drying method. The structure and morphology of the samples were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) and transmission electron microscopy (TEM) analysis. The electrochemical properties of the samples were also tested in details by cyclic voltammetry, charge-discharge testing and AC impedance technique. The experimental results show that the Na$_3$V$_2$(PO$_4$)$_3$ can be indexed as rhombohedral structure and exhibits hollow spherical morphology. Na$_3$V$_2$(PO$_4$)$_3$/C cathode materials deliver good rate performance and relative high discharge capacity. The discharge capacities are 96.8 and 70.9 mAh g$^{-1}$ at the rate of 0.1C and 10C, respectively. And a stable capacity of 70 mAh g$^{-1}$ is retained and the capacity retention is 75.7% after 200 cycles at 1C.

Keywords: Na$_3$V$_2$(PO$_4$)$_3$/C composite; Sodium-ion batteries; Cathode; Hollow spherical structure