Ultra-long Nanorods of Single-crystalline $\text{Na}_{0.44}\text{MnO}_2$ as Cathode Materials for Sodium-ion Batteries

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Rechargeable batteries composed of low-cost and abundant materials operating at room temperature are attractive for grid-scale energy storage application. Sodium-ion battery is thought of as an ideal candidate for secondary battery. Hence, ultra-long nanorods of single-crystalline $\text{Na}_{0.44}\text{MnO}_2$ have been synthesized by co-precipitation method followed by high-temperature calcination. The obtained powder is pure phase with an orthorhombic lattice structure and the morphology is regular. Their electrochemical properties were thoroughly investigated in assembled Sodium-ion cells using cyclic voltammetry, galvanostatic testing, and electrochemical impedance spectroscopy. With applying the as-prepared $\text{Na}_{0.44}\text{MnO}_2$ as a cathode material for sodium-ion batteries, it exhibits a high reversible initial capacity of 94.1 mAh g^{-1} in a voltage range of 2.0-4.0 V vs. Na^+/Na at a current density of 50 mA g^{-1} , and a satisfactory cyclability of 93.3% capacity retention after 200 cycles is performed in our work. The single-crystalline $\text{Na}_{0.44}\text{MnO}_2$ with an excellent electrochemical performance proves that it is a potential cathode material for sodium-ion battery.

Keywords: $\text{Na}_{0.44}\text{MnO}_2$, single-crystalline, co-precipitation method, cathode materials

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