A Flower-like $VO_2(B)/V_2CT_x$ Heterojunction as High Kinetic Rechargeable Anode for Sodium-Ion Batteries

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Abstract

VO2(B) is considered as a promising anode material for the next-generation sodium-ion batteries (SIBs) due to its accessible raw materials and considerable theoretical capacity. However, the VO2(B) electrode has inherent defects such as low conductivity and serious volume expansion, which hinder their practical application. Herein, a flower-like VO2(B)/V2CTx (VO@VC) heterojunction was prepared by a simple hydrothermal synthesis method with in situ growth. The flower-like structure composed of thin nanosheets alleviates the volume expansion, as well as the rapid Na+ transport pathways are built by the heterojunction structure, resulting in long-term cycling stability and superior rate performance. At a current density of 100 mA g-1, VO@VC anode can maintain a specific capacity of 276 mAh g-1 with an average coulombic efficiency of 98.7% after 100 cycles. Additionally, even at a current density of 2 A g-1, the VO@VC anode still exhibited a capacity of 132.9 mAh g-1 for 1000 cycles. The enhanced reaction kinetics can be attribute to the fast Na+ adsorption and storage at interfaces, which has been confirmed by the experimental and theoretical methods. These results demonstrate that the tailored nanoarchitecture design and additional surface engineering are effective strategies for optimizing vanadium-based anode.

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