Synthesis of Hierarchical V_2O_5 Hydrate Composite Micronanostructures as Cathode Materials for Aqueous Zinc-ion Batteries with Good Performance

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It is important to discover novel electrode materials and optimize the performance of existing cathode materials for aqueous zinc-ion batteries. Here, two $V_2O_5 \cdot 3H_2O$ composites are achieved via a facile hydrothermal route. One is flake-like $V_2O_5 \cdot 3H_2O$ built up with multiple platelets with surface defects in parallel or normal positions, and the other is $V_2O_5 \cdot 3H_2O$ composite microflowers built up with multilayered microplatelets in a radial position without surface defects. Both can be used as cathode materials for aqueous zinc-ion batteries. The former showed higher discharge capacity and better rate performance. The electrode of $V_2O_5 \cdot 3H_2O$ flakes exhibits stable discharge capacity at current densities of 50, 100, 250, 500, 750, 1000, 1500 and 50 $mA g^{-1}$. The capacity retention is 90.3% after 80 cycles from 237.2 $mAh g^{-1}$ to 214.1 $mAh g^{-1}$. While $V_2O_5 \cdot 3H_2O$ microflowers do not exhibit stable discharge capacity at current densities of 50, 100, 250, 500, 750, 1000, 1500 and 50 $mA g^{-1}$. The capacity retention is 47.96% after 80 cycles from 223.9 $mAh g^{-1}$ to 107.4 $mAh g^{-1}$. The difference in cycling performance can be ascribed to surface defects and different compositions.

Keywords: Paramontroseite VO_2 ; Hollow microspheres; Anode; Lithium-ion battery; Cathode

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