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ИМЕНИ А.Н. ФРУМКИНА РАН**

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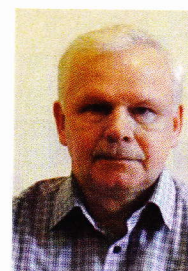


Electrochemical performance of V₂O₅ cathodes in zinc (2+)-containing aqueous electrolytes

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Aqueous Zn-ion batteries (AZIBs) are considered as one of the promising energy storage devices due to their intrinsic safety, environmental friendliness, and the Zn abundance. The main bottleneck is at the choice of acceptable cathode materials for Zn ion because of their unsatisfactory charging property, low energy density and poor cycling stability. Vanadium pentoxide has been considered as a promising cathode material for AZIBs, due to its unique layered structure with high interlayer distance providing possibility to reversibly intercalate Zn²⁺ ions, abundant resources and relatively high theoretical capacity.

In this work, the V₂O₅·nH₂O was obtained by the sol-gel method and then, vanadium pentoxide nanofibers have been manufactured by the electrospinning method followed by thermal treatment in air. The morphology and structural characterization was performed by an optical and scanning electron microscopy, energy-dispersive X-ray elemental analysis, X-ray diffraction. XRD pattern of V₂O₅ demonstrated its high purity and good crystallinity and obtained data are in agreement with card ICDD № 01-077-2418. V₂O₅ has a layered structure, where each layer of phase is built by edge- and corner-sharing VO₅ pyramids and the large interlayer distance is beneficial for Zn²⁺ ions insertion/extraction.

The electrochemical properties of V₂O₅ based electrodes were investigated by cycling voltammetry and galvanostatic charge-discharge curves both in standard three-electrode cells and CR2016-type cells with aqueous solution of 3M ZnSO₄. Cyclic voltammograms recorded for initial several cycles show the gradual redox peaks redistribution which is related to the phase transformation and it agrees with results commonly reported for V₂O₅. After first cycles of "activation" CVs in the stabilized form shows two pair of peaks at 1.0 and 0.7 V.

These peaks are attributed to formation of new Zn-containing phases of Zn_xV₂O₅. The specific capacity and rate performance of the Zn/V₂O₅ system were tested by galvanostatic charge and discharge curves at different current density. It was found that the V₂O₅ electrodes deliver of max capacity 357 mAh·g⁻¹ at currents densities of 0.05 A·g⁻¹, 303 mAh·g⁻¹ at currents densities of 0.1 A·g⁻¹ and 190 mAh·g⁻¹ at currents densities of 2 A·g⁻¹, respectively. The results showed a high reversible capacity of electrode, good rate capability and enhanced cycle performance.

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