Hydrothermal Synthesis and Electrochemical Performance of Al-doped VO₂(B) as Cathode Materials for Lithium-Ion Battery

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Al-doped VO₂(B) nanobelts have been successfully synthesized via the hydrothermal method using V₂O₅, C₆H₁₂O₆·H₂O and Al(NO₃)₃·9H₂O as reactants. XRD, FESEM, EDS and XPS were introduced to characterize the phase, morphology, compositions and chemical state of the samples. Electrochemical properties of the samples were studied by charge/discharge tests, electrochemical impedance spectra (EIS) and cyclic voltammetry (CV). The result showed that the length and width of the nanobelts were increased significantly after doping Al³⁺. When the doping molar ratio of Al to V was 1/6.9, the product was flower like particles which composed of nanobelts and exhibited the best cycling performance. The initial discharge capacity was 282 mAh·g⁻¹ and maintained 202 mAh·g⁻¹ after 50 cycles at the density of 32.4 mA·g⁻¹. The retention rate of capacity was 71.6%, which was better than that of the undoped sample (61%). The enhanced electrochemical performance was attributed to its higher total conductivity and better structure stability.

Keywords: Lithium-ion battery; VO₂(B); Hydrothermal method; doping; electrochemical performance

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