Synthesis and Electrochemical Properties of 0.7LiMn_{0.71}Fe_{0.29}PO₄·0.3Li₃V₂(PO₄)₃/C Composite as High- Performance Cathode Materials for Lithium-Ion Batteries

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A new polyanionic composite cathode materials, 0.7LiMn_{0.71}Fe_{0.29}PO₄·0.3Li₃V₂(PO₄)₃/C, was synthesized using a novel sol-gel method and with *N,N*-dimethyl formamide (DMF) as solvent. X-ray diffraction and transmission electron microscopy results indicated that the composite material was well-crystallized and a conductive carbon matrix surrounded the 0.7LiMn_{0.71}Fe_{0.29}PO₄·0.3Li₃V₂(PO₄)₃/C particles of grain size 20–50 nm. Elements Mn, V, and Fe in the composite were confirmed to be in +2, +3, and +2 valence states, respectively, by X-ray photoelectron spectroscopy. Electrochemical tests showed that as a cathode material, 0.7LiMn_{0.71}Fe_{0.29}PO₄·0.3Li₃V₂(PO₄)₃/C exhibited the best reversible capacities of 152.5, 130.1, 123.6, 109.5, and 83.6 mAh·g⁻¹ at charge/discharge rates of 0.05, 0.1, 0.2, 0.5, and 1 C, respectively. It also retained 147.2 mAh·g⁻¹ (91.8%) capacity in the Li-ion battery after 50 cycles at 0.05 C.

Keywords: lithium-ion cathode materials ; composite; sol-gel; nanoparticle; electrochemical properties

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