Synthesis and Performance of Nb⁵⁺-Doped LiFePO₄/C as Cathode Material in Lithium-Ion Battery

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Nb⁵⁺-doped LiFePO₄/C was synthesized as the cathode material by carbon-thermal reduction method in lithium-ion battery. The XRD, SEM, charge and discharge cycles and cycling performance tests were used to study the crystal structure, surface morphology and electrochemical properties of LiFe_{1-x}Nb_xPO₄/C. The effects of different synthesis conditions on LiFe_{1-x}Nb_xPO₄/C cathode materials were discussed systematically. Finally, the optimal raw materials and process parameters were determined to synthesize LiFe_{1-x}Nb_xPO₄/C cathode material with better performance. The electrochemical properties results showed that LiFe_{1-x}Nb_xPO₄/C (x=0.02) had good electrochemical capacity at 0.1C rate, which also had the highest charge-discharge capacity, good high-rate performance and small attenuation. And the discharge specific capacity reached 146.881 mAh·g⁻¹ at 0.1C rate, which was increased by 11.18% than 132.108 mAh·g⁻¹ of the initial discharge specific capacity without doping Nb⁵⁺. After 20 cycles, the charge-discharge specific capacity was almost unchanged and charge and discharge at different rates also showed good stability.

Keywords: LiFePO₄; Cathode material; Lithium-ion Battery; Doping; Performance

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