Enhanced High-Rate and Low-Temperature Electrochemical Properties of LiFePO₄/Polypyrrole Cathode Materials for Lithium-ion Batteries

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Uniformly coated LiFePO₄/polypyrrole (LiFePO₄/PPy) composites were successfully prepared by in situ chemical oxidative polymerization. The structure and morphology of the composites were characterized by XRD, TG, FE-SEM and HRTEM. The results showed that the PPy layer coated on the LiFePO₄ particles is approximately 5 nm thick and forms a regular strip on the surface. The well-coated PPy can enhance the electronic conductivity and Li⁺ diffusion velocity of LiFePO₄, resulting in improvement of the electrochemical performance of cathode materials. The charge/discharge test results showed that the optimized 2.95% PPy-coated LiFePO₄/PPy composites exhibited excellent specific capacity, rate capability and low-temperature performance. The LiFePO₄/PPy cathodes showed initial specific capacities of 153 mAh/g, 138 mAh/g and 118 mAh/g at 0.1 C, 1 C and 5 C, respectively. Moreover, the initial discharge capacities at 0.1 C, 0.5 C, and 1 C were 128, 106.5 and 85.7 mAh/g, respectively, at -20 °C.

Keywords: Lithium-ion battery; Lithium iron phosphate; Coating; Polypyrrole; Low temperature

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