A High Performance LiFePO_4 Cathode Material with 3D Conduction Network Connected by 1D helix-like Ag Nano-chains

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In this article, the original $\text{LiFePO}_4/(\text{C}+\text{RGO})$ cathode material with a uniform distribution of cuboid morphology was synthesized by hydrothermal method, and then 3 wt% nano silver was coated on the surface of the original material by a simple chemical deposition method. The surface structure and electrochemical performance of the original and modified cathode materials were characterized by XRD, SEM, TEM, and constant current charge/discharge tests. The results showed that the one-dimensional silver nano-chains with spiral structure and the two-dimensional graphene plane structure formed a uniform three-dimensional network coating layer, and the structure of the original material has not been changed. The cathode electrode material after coating had the best cycle and rate performance. The modified material had an initial charge-discharge capacity of $150.7 \text{ mAh}\cdot\text{g}^{-1}$ at 0.2C, which is 25.4% higher than the original material (LiFePO_4/C). Secondly, the cycle performance is improved. After the coated material was cycled at 0.2C for 100 cycles, the discharge capacity is 157 mAh/g , and the capacity retention rate was 104.2%, while the original material (LiFePO_4/C) is only 79.6%. The rate performance was also greatly improved. The coated material could still reach $107.1 \text{ mAh}\cdot\text{g}^{-1}$ at 5C, which is 39.3% higher than the original material (LiFePO_4/C). The significant improvement in electrochemical performance was attributed to the three-dimensional conductive network formed by the composite coating layer, which increased the conductivity of the material and the migration rate of lithium ions.

Keywords: Lithium ion battery, LiFePO_4 , Graphene, nano silver, Cathode material

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