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Titania and nitrogen-doped carbon co-modification: their synergic effects on the electrochemical performance of $LiFePO_4$

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Abstract

TiO_2 and N-doped carbon co-modified $LiFePO_4$ composites (LFP-TiO_2-C-N) have been successfully synthesized by using tetrabutyl titanate (TBOT) and dopamine (DPA) as titanium and N-doped carbon sources, respectively. The $LiFePO_4$ modification is performed by dopamine polymerization in the alkaline environment supplied by the TBOT hydrolyzation process. The resulting LFP-TiO_2-C-N materials are characterized by EDS, XPS, TG, ICP and HRTEM to confirm the close adhesion of TiO_2 nanoparticles and N-doped carbon layers on the $LiFePO_4$ surfaces. The charge–discharge tests demonstrate that the LFP-TiO_2-C-N composites deliver a superior initial capacity of 165.3 $mAh \cdot g^{-1}$ at 0.1 C and high rate performance with discharge capacities of 145 $mAh \cdot g^{-1}$ at 1 C and 124 $mAh \cdot g^{-1}$ at 2 C. The LFP-TiO_2-C-N composites can retain 99.4% of the initial capacity after 50 cycles at 1 C, revealing a stable cycling stability. Therefore, the synergistic growth of TiO_2 and N-doped carbon on the LFP surface could result in the synergic improvement in the electrochemical performance of cathode.

Keywords

$LiFePO_4$; Nitrogen-doped carbon; Titania; co-modification; Lithium-ion battery

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