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Multi-Walled Carbon Nanotubes Modified $Li_3V_2(PO_4)_3$/Carbon Composites with Enhanced Electrochemical Performances as Cathode Materials for Li-Ion Batteries

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The multi-walled carbon nanotubes (MWCNTs) modified $Li_3V_2(PO_4)_3$/carbon composites (MWCNTs-LVPCs) are synthesized through the rheological phase reaction method using MWCNTs as a highly conductive agent. MWCNTs-LVPCs are characterized by X-ray diffraction, scanning electron microscopy, and transmission electron microscope. Charge-discharge cycling performance is also used to characterize the electrochemical properties. X-ray diffraction result reveals that the added MWCNTs do not have a significant effect on the crystal structure of MWCNTs-LVPCs, however, crystal particles growth of MWCNTs-LVPCs are dramatically inhibited by MWCNTs in scanning electron microscopy test. The electrochemical measurements show that the 1.0 wt.%-MWCNTs-LVPC composite yields the highest discharge specific capacity of 182.38 and 163.93 mAh g^{-1} at current rate of 15 and 90 mA g^{-1} among all the MWCNTs-LVPCs, which are much higher than those of $Li_3V_2(PO_4)_3$/carbon composite. After 100 cycles, the 1.0 wt.%-MWCNTs-LVPC composite still maintains a stable capacity of 125.37 mAh g^{-1}. Therefore, construction of MWCNTs modified $Li_3V_2(PO_4)_3$/carbon composites offers an effective and convenient technique to improve the conductivity and electrochemical performances of $Li_3V_2(PO_4)_3$/carbon composites.

Keywords: $Li_3V_2(PO_4)_3$/carbon composites, MWCNTs modification, rheological phase reaction, cathode materials, lithium ion batteries, electrochemical performances

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