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Improving the Electrochemical Performance of $LiNi_{0.5}Mn_{1.5}O_4$ Cathode Materials by Surface Coating with Cyclized Polyacrylonitrile for Lithium-Ion Batteries

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The spinel $LiNi_{0.5}Mn_{1.5}O_4$ (LNMO) is a promising cathode material for lithium-ion batteries due to its high working voltage. However, the capacity fading is a major problem of LNMO, especially at elevated temperatures. Surface coating is an effective method to solve this problem. In this paper, a conducting polymer, the cyclized polyacrylonitrile (cPAN), is applied to coat on the surface of LNMO by a simple heat-treatment method in air. The cPAN coating layer can prohibit the electrode materials from direct contacting with the electrolyte therefore reduce the amount of transition metal ions dissolved into the electrolyte. In addition, the cPAN coating layer can increase the conductivity of cPAN-LNMO. Compared to pristine LNMO, the electrochemical properties of cPAN-LNMO are significantly improved, especially at elevated temperatures. After 100 cycles at 55℃, the discharge capacity of cPAN-LNMO is 112.9 mAh g^{-1} with the 95.2% retention, while that of pristine LNMO is only 104.7 mAh g^{-1} with the 87.8% retention. These results indicate that the cPAN-LNMO composite is a competitive cathode material for practical application in high-voltage lithium-ion batteries.

Keywords: Cathode materials; Coating; $LiNi_{0.5}Mn_{1.5}O_4$; Lithium-ion battery; Polyacrylonitrile

FULL TEXT