Solid Electrolyte $\text{Li}_{1.4}\text{Al}_{0.4}\text{Ti}_{1.6}(\text{PO}_4)_3$ as Coating for High Voltage Spinel $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ Cathode Material

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A high voltage spinel lithium manganese oxide $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ (LNMO) was coated with solid electrolyte $\text{Li}_{1.4}\text{Al}_{0.4}\text{Ti}_{1.6}(\text{PO}_4)_3$ by a sol-gel method. The experimental samples were characterized by scanning electron microscopy, transmission electron microscopy, X-ray diffraction, charge-discharge analysis, and electrochemical impedance analysis. The experimental results show that coating improves the cyclic performance of LNMO. The capacity retention ratio of the sample coated with 0.50 wt% $\text{Li}_{1.4}\text{Al}_{0.4}\text{Ti}_{1.6}(\text{PO}_4)_3$ was 98.1% and 96.1% at temperatures of 25 °C and 55 °C, respectively, after 100 cycles and a 1 C rate. Compared with the research results of a TiO_2 coating agent, $\text{Li}_{1.4}\text{Al}_{0.4}\text{Ti}_{1.6}(\text{PO}_4)_3$ can promote the diffusion of lithium ions on the surface of the LNMO electrode, reduce the migratory impedance of lithium ions on the surface of the electrode, and improve the rate capability. In contrast, TiO_2 increases the transport resistance of the lithium ion on the electrode surface and the rate capability decreases. Under the condition of a 20 C rate, the sample coated with $\text{Li}_{1.4}\text{Al}_{0.4}\text{Ti}_{1.6}(\text{PO}_4)_3$ exhibits 81.3% of its initial capacity, while the sample coated with TiO_2 only exhibits 74.5% of its initial capacity.

Keywords: Lithium-ion battery, Cathode material, High voltage spinel lithium manganese oxide, Surface coating, Solid electrolyte

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