

Improvement of electrochemical performance and thermal stability of lithium-ion cell with $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ cathode material coated by LiFePO_4 nanoparticles

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$\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ has attracted extensive attention because of its excellent specific capacity and cycling performance^[1], but the application for lithium ion batteries is mostly restricted by its thermal stability and potential safety hazard^[2]. In this study, a $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ - LiFePO_4 composite with nano-sized LiFePO_4 particles coated on micron-sized $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ particles was synthesized. The introduction of LiFePO_4 can not only enhance the electrochemical performance of $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$, but also lead to an improved thermal stability. The $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ - LiFePO_4 composite exhibits a higher reversible capacitance of 193.7mAh g^{-1} at 0.1C and a significantly improved cycling performance. At 55°C , after 100 cycles, the capacity retention of $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ - LiFePO_4 composite is 80.1%, while that of $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ is only 69.2%. Furthermore, the cycled $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ - LiFePO_4 cathode keeps intact, showing higher onset temperature (216.5°C) than the pristine $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ cathode (200.3°C). The improvement is totally attributed to LiFePO_4 , which acts as a protecting layer between $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ and electrolyte, and promotes more stable SEI film due to a low voltage plateau at 3.4V, as shown in Fig. 1.

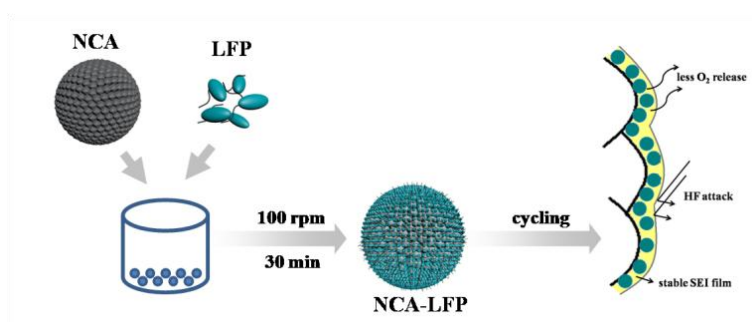


Fig.1 Schematic illustration of the preparation and the mechanism for the $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ - LiFePO_4 composite

References:

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- [2] A.M. Haregewoin, A.S. Wotangoa, B.-J. Hwang, *Energy Environ. Sci.* 9 (2016) 1955-1988.