

LiNi_{0.5}Mn_{1.5}O₄||Li₄Ti₅O₁₂ Full Battery—An in-operando Neutron Powder Diffraction Study

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Abstract

The LiNi_{0.5}Mn_{1.5}O₄ ||Li₄Ti₅O₁₂ (LMNO||LTO) battery possesses a relatively-high energy density and cycle performance, with further enhancement possible by application of an AlF₃ coating on the LTO electrode particles. We measure the performance enhancement to the LMNO||LTO battery achieved by a AlF₃ coating on the LTO particles through electrochemical testing and use in-operando neutron powder diffraction to study the changes to the evolution of the bulk crystal structure during battery cycling. We find that the AlF₃ coating along with parasitic Al doping slightly increases capacity and greatly increases rate capability of the LTO electrode, as well as significantly reducing capacity loss on cycling, facilitating a gradual increase in capacity during the first 50 cycles. Neutron powder diffraction reveals a structural response of the LTO and LNMO electrodes consistent with a greater availability of lithium in the battery containing AlF₃-coated LTO. Further, the coating increases the rate of structural response of the LNMO electrode during charge, suggesting faster delithiation, and enhanced Li diffusion. This work demonstrates the importance of studying such battery performance effects within full configuration batteries.

Keywords : *lithium ion battery, in-operando, neutron powder diffraction, protective coating.*

References

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