

Understanding the effect of the Succinonitrile additive and the electrode processing to enhance the performance of high voltage lithium-ion batteries using $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ cathode

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Abstract

The progressive improvement of lithium-ion batteries (LIBs) leads to subsequent electrolyte design and electrode modification processes. The spinel lithium nickel manganese oxide ($\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$, LNMO) is one of the potential candidates for the next generation of LIBs applied for electric vehicles due to its high working potential (4.75 V vs. Li^+/Li), reasonable price, and environmental friendliness. Nevertheless, the degradation of cycling performance at high potential induces massive challenges for LNMO-based batteries commercialization. This study investigated the impact of Succinonitrile (SN) and electrode processing to strengthen and maximize the LNMO electrode and graphite||LNMO full-cell performance. According to the performance in half-cell, the sample contained 85 wt.% LNMO: 7.5 wt.% C65: 7.5 wt.% PVDF/NMP combining with the electrolyte 1.5 M LiPF₆ in EC: EMC: DMC (2:1:7 – v/v) at 0.5 wt.% SN seems to be the optimal condition for further full-cell. Indeed, the promising full-cell with N/P=1.3 displays a remarkable initial capacity of 118.75 mAh.g⁻¹ with a Coulombic efficiency of 91.64%. Moreover, it maintains a capacity retention of around 58% at the current density of 0.1C after 100 cycles.

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