

**Enhanced Electrochemical and Thermal Properties
of $\text{LiNi}_{0.9}\text{Co}_{0.1}\text{O}_2$ Cathode Materials
by AlPO_4 Coating**

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Along with the improvement of electrochemical properties in the Ni-based cathode material ($\text{LiNi}_{1-x}\text{M}_x\text{O}_2$ with M = metals), thermal instability with respect to Li_xCoO_2 has been a great concern for using it in a Li-ion cell. Ni-based cathode materials have not met the safety guidelines that require no explosion, fire, and smoke during the nail-penetration test at 4.35 V overcharged state in the Li-ion cell. In terms of thermal stability, violent exothermic reaction of the cathode with the electrolyte accompanying substantial heat generation should be avoided. Otherwise, it causes a thermal runaway showing fire, spark, and explosion. To minimize the oxygen evolution (or heat generation), cation substitution of LiNiO_2 by Mg, Ti, or Al was reported to be effective in reducing the exothermic reaction, but greatly sacrificed the discharge capacity. For instance, $\text{LiNi}_{0.7}\text{Ti}_{0.15}\text{Mg}_{0.15}\text{O}_2$ cathode showed 190 mAh/g even at the charged voltage of 5 V, but its specific capacity at 4.3 V cutoff is smaller than LiCoO_2 .

Simple AlPO_4 -nanoparticle coating on the $\text{LiNi}_{0.9}\text{Co}_{0.1}\text{O}_2$ cathodes led to high capacities over 190 mAh/g at 4.3 V cutoff and excellent cycling stability without decreasing the voltage profiles of the cathodes, depending on the AlPO_4 concentration and annealing temperature. Furthermore, this coating on the cathodes drastically improved the thermal stability at 4.5 V.

References

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