

Non-destructive Battery Diagnosis of High Capacity Ni-rich Cathodes using Entropymetry

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As increasing the demand for high energy density lithium-ion batteries for consumer electronics and electric vehicles, the nickel-rich layered cathode materials are attracting attention. However, nickel-rich cathode materials are vulnerable to cycle performance and safety issues. Here, we introduced the thermodynamic entropy concept to the battery analysis and observed the entropy change characteristics of the $\text{Li}(\text{Ni}_{0.8}\text{Mn}_{0.1}\text{Co}_{0.1})\text{O}_2$ (NMC811) material. Moreover, we analyzed the cycling-induced entropy changes to diagnose the battery condition in a non-destructive way. We also demonstrated the smart charging technique that changes the charging current density according to each entropy change characteristic. It was confirmed that the smart charging technique could reduce charging time and improve cycle life simultaneously by reducing thermal stress of the materials.