The SOH and the SOC assessment of $LiNi_{0.88}Co_{0.09}Al_{0.03}O_2$ cathode material for lithium-ion batteries through the entropymetry

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Lithium-ion batteries (LIB) are widely used in new energy vehicles and energy storage. That is why the user should be aware of the state of charge (SOC) and the state of health (SOH) of the battery. The SOC in Battery Management System (BMS) provides the percentage of battery capacity, while the SOH measures the battery health. LIBs are met with significant challenges in saving capacity retention, becoming increasingly necessary to achieve a sustainable model. The main goal of this research is the accurate assessment of the SOH and the SOC of the battery cell to study the main electrochemical characteristics of the cathode material and measure the entropy to estimate the remaining useful life (RUL) of the battery. The object of the study is active materials based on $LiNi_{0.88}Co_{0.09}Al_{0.03}O_2$ (NCA) cathode powders. A series of NCA cathodes were tested to characterize the capacity fading mechanism through the thermodynamic characterization - entropy.

It is a powerful method to study the cycle life and safety of batteries. For this purpose, the Universal Battery SOC equation have been used: $SOC = \alpha + \beta(K*mol)/J\ \Delta S + \gamma(mol/J)\ \Delta H$.

This paper reveals the capacity fading of NCA cathodes, largely stemmed from the anisotropic volume change, which was caused by the phase transition near the charge-end.

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