Surface Modification for High Nickel $LiNi_xCo_yMn_zO_2$ in Lithium-Ion Battery

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As the demand for electric vehicles, portable devices and energy storage systems increases, the need for high-capacity Li-ion batteries have increased. Among various cathode materials, high nickel $LiNi_xCo_yMn_zO_2$ (NCM, $x>0.8$) can achieve high energy density, so many electric vehicle companies use high nickel NCM as a cathode material to increase the mileage.

However, high nickel NCM has many disadvantages. The phase transition from the layered structure to the spinel/rock salt structure due to cation mixing hinders the transfer of Li ions. Side reaction with electrolyte due to the high reactivity of Ni^{4+}. Moreover, oxygen is released from oxide based high nickel NCM. These problems eventually cause capacity fading.

In this presentation, I will introduce the surface modification effect of spinel structure which has low cost. Because spinel structure has high ionic/electronic conductivity, it improves ionic/electronic conductivity of cathode materials. It suppresses side reaction with electrolyte. Moreover, coating layer suppresses oxygen release during lithiation/delithiation. Therefore, the cycle stability and rate capability of the surface-modified high nickel NCM are improved.