An investigation of the cathode electrolyte interphase (CEI) formation of Ni-rich layered materials by Ni ion catalyzation: monolayer CEI formation from an oligomer

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Layered $Li[Ni_xCo_yMn_z]O_2$ (NMC) materials are the most promising cathodes for current use of lithium ion battery owing to the future electronics devices application regarding to their high capacity, low cost, and good cycling. Three transition metal ions in layered materials dominate three main parameters, containing capacity (Ni ion), cycling performance (Mn ion), and good electronic conductivity (Co ion). However, recent research showed that the higher Ni ion content of layered materials suffers surface instability due to cation mixing problem between Ni^{2+} and Li^+ as well as self-reduction of Ni^{4+} leads to rapid capacity fading and gas evolution. Although some studies proposed a coating on NMC surface may overcome aforementioned problems, but surface homogenous and coating thickness become other challenges. Instead of using coating method, this study investigates Ni ion catalyzation mechanisms of NMC materials and propose a monolayer cathode electrolyte interphase (MCEI) formation by maleimide. This MCEI expects to stabilize the surface of NMC that prevents the self-reduction of Ni^{4+} at high temperature operation. The result of this work indicates the MCEI significantly decreases internal impedance of battery. In addition, a great cycling performance under higher rate capacity (195 mAh/g at 1C and 151 mAh/g at 5C) than the pristine. Investigations of the Ni ion catalyzation studies and the MCEI formation offers significant information, which improves battery performance and further design for related accessories.

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