Alleviation of Internal Microstrain in Ni-Rich NCMA Cathode through Microstructure Tailoring

류훈희, 양선모, 선양국†
한양대학교
(yksun@hanyang.ac.kr†)

Recently, $Li[Ni_xCo_yMn_zAl_{1-x-y-z}]O_2$ (NCMA), a hybrid of Ni-rich NCM and NCA cathodes, is considered as a next cathode materials owing to the announcement by automotive manufacturer to install LIBs employing NCMA cathodes in its next EV range. Although the introduction of Al into an NCM cathode stabilizes the host layered structure, Al doping alone is not enough to inhibit rapid capacity deterioration in Ni-rich NCMA cathode. To further improve the stability of Ni-rich NCMA cathodes, herein, we have tailored microstructure of cathode particle to effectively dissipate the microstrain induced by the anisotropic volume changes during cycling. The proposed cathode (NCMA90) has a hybrid structure in which $Li[Ni_{0.92}Co_{0.04}Mn_{0.03}Al_{0.01}]O_2$ in the interior of the particle is encapsulated by $Li[Ni_{0.845}Co_{0.067}Mn_{0.078}Al_{0.01}]O_2$ that acts as a buffer against the microstrain. This optimized microstructure makes differential states of stress that apply compressive stress to the particle interior, thereby delaying the propagation of microcracks toward the outer surface.