Optimized Ni-Rich $Li[Ni_{0.90}Co_{0.045}Mn_{0.045}Al_{0.01}]$ Cathode for Electric Vehicles via Microstructure Control

박남영, 이수빈, 선양국†
한양대학교
(yksun@hanyang.ac.kr†)

Currently, Ni-rich layered LiMO2 (M = Ni, Co, Mn, and/or Al) compounds are considered suitable cathode materials for EV batteries. However, Ni-rich cathodes suffer from inherent chemical and structural instabilities, which shorten their service life. The highly delithiated cathode is damaged by destructive strains that generate severe microcracks, when charged to a high potential. Here, the structural and electrochemical stabilities of a core–shell with concentration gradien $Li[Ni_{0.90}Co_{0.045}Mn_{0.045}Al_{0.01}]O_2$ (CSG-NCMA90) cathode is evaluated by cycling the cathodes at different depths of discharge. The CSG-NCMA90 cathode consists of radially aligned and elongated primary particles. This unique microstructure suppresses microcrack formation and propagation in the highly charged state. Moreover, microstructural analysis reveals that the thin elongated primary particles, largely featuring (001) facets on their lateral sides, are tolerant of electrolyte attack, thus suppressing surface degradation. The proposed CSG-NCMA90 cathode can be cycled at full capacity, thus facilitating higher electrochemical performance and realizing the development of economical Li-ion batteries.