

기계적 합금법을 이용한 리튬 2차 전지용 층상 양극물질
 $\text{Li}[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{O}_2$ 의 합성 및 전기화학적 특성에 관한 연구
Synthesis and electrochemical properties of layered $\text{Li}[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{O}_2$
materials for lithium secondary batteries prepared by mechanical alloying

박상호, 신선식, 선양국*
한양대학교 응용화학공학과
(email: shpark92@ihanyang.ac.kr)

The presently commercialized lithium-ion batteries use layer structured LiCoO_2 cathodes. Because of the high cost and toxicity of cobalt, an intensive search for new cathode materials has been underway in recent years. Recently, a concept of a one-to-one solid state mixture of LiNiO_2 and LiMnO_2 , *i.e.*, $\text{Li}[\text{Ni}_{0.5}\text{Mn}_{0.5}]\text{O}_2$, was adopted by Ohzuku and Makimura to overcome the disadvantage of LiNiO_2 and LiMnO_2 . $\text{Li}[\text{Ni}_{0.5}\text{Mn}_{0.5}]\text{O}_2$ has the $-\text{NaFeO}_2$ structure, which is characteristic of the layered LiCoO_2 and LiNiO_2 structures and shows excellent cycleability with no indication of spinel formation during electrochemical cycling.

Layered $\text{Li}[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{O}_2$ ($x = 0.5$ and 0.475) materials with high homogeneity and crystallinity were synthesized using a mechanical alloying method. The $\text{Li}[\text{Ni}_{0.475}\text{Co}_{0.05}\text{Mn}_{0.475}]\text{O}_2$ electrode delivers a high discharge capacity of 187 mAh/g between 2.8 and 4.6 V at a high current density of 0.3 mA/cm² (30 mA/g) with excellent cycleability. The charge/discharge and differential capacity vs. voltage studies of the $\text{Li}[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{O}_2$ ($x = 0.5$ and 0.475) materials showed only one redox peak up to 50 cycles, which indicates that structural phase transitions are not occurred during electrochemical cycling. The magnitude of the diffusion coefficients of lithium ions for $\text{Li}[\text{Ni}_x\text{Co}_{1-2x}\text{Mn}_x]\text{O}_2$ ($x = 0.5$ and 0.475) are around 10^{-9} cm²/s measured by the galvanostatic intermittent titration technique (GITT).