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Electrochemical and structural properties of layered $Li_{0.7}Mn_{1-y}Ni_yO_{2-z}S_z$ cathode materials for lithium secondary batteries

리튬이차전지용 $Li_{0.7}Mn_{1-y}Ni_yO_{2-z}S_z$ 양극활물질의 구조와 전기화학적 특성 연구

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Lithiated transition metal oxides $LiMO_2$ (M = Co, Ni, Mn) have been extensively studied as cathode materials for commercial rechargeable lithium ion batteries. The layered $LiMnO_2$ are promising candidates as cathodes material because of their high theoretical capacity (285 mAh/g), low cost, abundance and nontoxic. Unfortunately, solid-state reaction at high temperature to prepare layered $LiMnO_2$ has been unsuccessful due to the non-layered structure such as spinel $LiMn_2O_4$, orthorhombic $LiMnO_2$, or rock salt Li_2MnO_3. In order to obtain layered Li_xMnO_2 structure are required soft chemistry methods. But layered manganese oxides are transform to the spinel phases upon electrochemical cycling and this problems are associated with the Jahn-Teller distortion.

In this work, a sol-gel method was employed to prepare $Na_{0.7}Mn_{1-y}Ni_yO_{2-z}S_z$ powders using glycolic acid as a chelating agent. The $Li_{0.7}Mn_{1-y}Ni_yO_{2-z}S_z$ powder was prepared by ion exchange of Na for Li with LiBr in ethanol. We have investigated a range of y= 0 ~ 0.2 and z = 0 ~ 0.4. Both undoped $Li_{0.7}MnO_2$ and a various doping content samples have been considered and their electrochemical property investigated over a range of cut-off voltage at room temperature (25 °C) and high temperature (55 °C). The undoped and doped materials are show high initial discharge capacity (over 200 mAh/g) and good cycling property. Although, all the materials undergo transformation to a spinel-like phase on cycling.