

## Structural Stability of Mn Based Oxide for Lithium Secondary Battery

리튬 2차전지용 망간계 산화물의 구조 안정성

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Recently, solid solution series between  $\text{Li}_2\text{MnO}_3$  ( $\text{Li}[\text{Li}_{1/3}\text{Mn}_{2/3}]\text{O}_2$ ) and  $\text{LiMO}_2$  ( $\text{M}=\text{Cr}, \text{Ni}, \text{Co}..$ ) have received significant attention as an alternative cathode material for  $\text{LiCoO}_2$  due to their high discharge capacity.  $\text{Li}_2\text{MnO}_3$  was considered electrochemically inactive for  $\text{Mn}^{4+}$  in  $\text{Li}_2\text{MnO}_3$  normally could not be oxidized beyond 4+ oxidation state in order to extract Li from its lattice. However, it is interesting that substantial charge can be removed from, and, to some extent, reinserted into the  $\text{Li}_2\text{MnO}_3$  structure. Moreover, the solid solution series between  $\text{Li}_2\text{MnO}_3$  and  $\text{LiMO}_2$  ( $\text{M}=\text{Cr}, \text{Ni}, \text{Co}..$ ) showed very high discharge capacity over 200mAh/g when they cycled with an upper cut-off voltage of about 4.6 ~ 4.8 V.

We have investigated the electrochemical properties of  $\text{Li}[\text{Ni}_x\text{Li}_{(1/3-2x/3)}\text{Mn}_{(2/3-x/3)}]\text{O}_2$  and  $\text{Li}[\text{Co}_x\text{Li}_{(1/3-x/3)}\text{Mn}_{(2/3-2x/3)}]\text{O}_2$  compound prepared by a simple combustion method. The  $\text{Li}[\text{Ni}_x\text{Li}_{(1/3-2x/3)}\text{Mn}_{(2/3-x/3)}]\text{O}_2$  compound with low Ni content ( $X < 0.25$ ) showed stable cycle performance and sustained high discharge capacity of about 200 mAh/g after several cycles. On the contrary, the  $\text{Li}[\text{Co}_x\text{Li}_{(1/3-x/3)}\text{Mn}_{(2/3-2x/3)}]\text{O}_2$  compound displayed phase conversion to spinel-like phase during cycling. In this study, we characterized the electrochemical properties of  $\text{Li}[\text{Ni}_x\text{Li}_{(1/3-2x/3)}\text{Mn}_{(2/3-x/3)}]\text{O}_2$  and  $\text{Li}[\text{Co}_x\text{Li}_{(1/3-x/3)}\text{Mn}_{(2/3-2x/3)}]\text{O}_2$  compound. And, the cycling performance is compared by XRD and XANES. Specially, we tried to understand the origin of the difference of phase stability for two kinds of compound during cycling.