Symp B5

Synthesis and Electrochemical Properties of Layered Manganese Oxide a Positive Materials for Lithium Secondary Batteries
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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. Manganese oxides are lower cost, abundance, nontoxicity, and safer on overcharge compared with $LiCoO_2$. One of the most attractive cathode materials is the spinel $LiMn_2O_4$ and its derivatives [1-5]. However, the spinel $LiMn_2O_4$ and its derivatives demonstrate smaller discharge capacity than layer structured materials and a slow capacity loss at elevated temperature.

Recently, some research groups have studied to stabilize layered structure by using solid solution between Li_2MnO_3 and $LiMO_2$ (M = Cr, Ni, Co) such as $Li[Li_{(1-2x)/3}NixMn_{(2-x)/3}]O_2$ and $Li[Li_{(1-x)/3}Co(Cr)_xMn_{(2-2x)/3}]O_2$. Li_2MnO_3 has a layered structure similar to $LiCoO_2$, $LiNiO_2$, and $LiCrO_2$. In Li_2MnO_3 and $LiMO_2$ solid solution, M is the redox-active species, while tetravalent manganese in $Li_{1/3}Mn_{2/3}$ clusters is electrochemically inactive. Ohzuku et al. reported that a concept of a one-to-one solid solution of $LiNiO_2$, $LiCoO_2$, and $LiMnO_2$, i.e., $Li[Ni_{1/2}Mn_{1/2}]O_2$ and $Li[Ni_{1/3}Co_{1/3}Mn_{1/3}]O_2$. $Li[Ni_{1/2}Mn_{1/2}]O_2$ and $Li[Ni_{1/3}Co_{1/3}Mn_{1/3}]O_2$ have the á-NaFeO2 structure with space group Rm, which is characteristic of the layered LiCoO2 and LiNiO2 structures and shows excellent cycleability with no indication of spinel formation during electrochemical cycling.

In this presentation, layered $Li[Li_{(1-2x)/3}Ni_xMn_{(2-x)/3}]O_2$ and $Li[Ni_xCo_{1-2x}Mn_x]O_2$ materials were prepared using a various method. The structural and electrochemical properties of the materials are investigated using various analytical techniques and correlated to explain the electrochemical properties of the materials.