Preparation and electrochemical properties of $LiCo_xNi_{1-x}O_2$-Li_2MnO_3 solid solution by spray dry method

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Recently, layered $LiNi_{1/2}Mn_{1/2}O_2$ has been proposed to be a promising cathode material for Li-ion battery application. Ohzuku [1] initially reported its electrochemical property and Dahn et al.[2] have reported the electrochemical properties of $LiNi_{1/2}Mn_{1/2}O_2$-Li_2MnO_3 solid solution. We have proposed the formation of solid solution type compound in the study of Li $Co_{1/3}Ni_{1/3}Mn_{1/3}O_2$. [3]

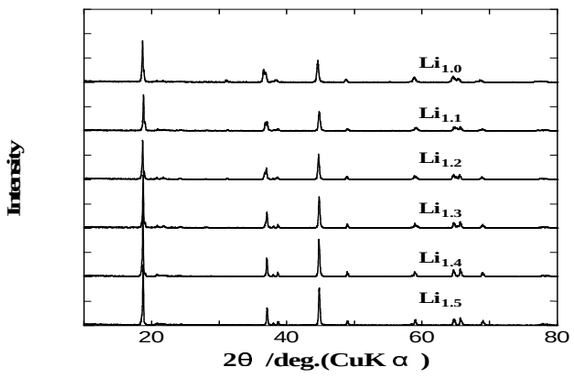
We have found that two types of layered active material forms in Li-Co-Ni-Mn-O system, where Li rich phase would be corresponding to $LiCo_xNi_{1-x}O_2$-Li_2MnO_3 solid solution.

Fig. 1 shows XRD patterns of $Li_{1+x}Co_{0.36}Ni_{0.1}Mn_{0.54}O_2$ prepared at 950 °C in air. Separated (101) peaks at ca. 36 °C are clearly observed and intensity of lower angle peak become weak as the increase in x. Sample with x=0.4 gives symmetrical (101) peak, so it would have high purity. Such clear evidence in (101) peak is not found for the samples prepared less than 850 °C, however, its (101) peak shows lower symmetry for x = 0 – 0.2.

The initial charge/discharge curves of $Li_{1+x}Co_{0.36}Ni_{0.1}Mn_{0.54}O_2$ prepared at 850 °C are shown in Fig. 2. All samples have resemble shapes of charge and discharge curves. Charge curves are divided into two parts. Voltage increases continuously in the range of 3.8 – 4.3(region I) as the increase in the charge depth. Further charge does not influence on the charge voltage.
Charge capacity of region I is lowest for x=0.1, and such trend is observed for all samples prepared at 750 – 950 °C. Further increase in x causes the increase in charge capacity, which leads to higher discharge capacity.

The samples with x=0.4 give highest capacities of more than 120 mAh/g. Now, further studies are going on.

Fig. 1 XRD patterns of $Li_{1+x}Co_{0.36}Ni_{0.1}Mn_{0.54}O_2$ prepared at 950 °C in air.



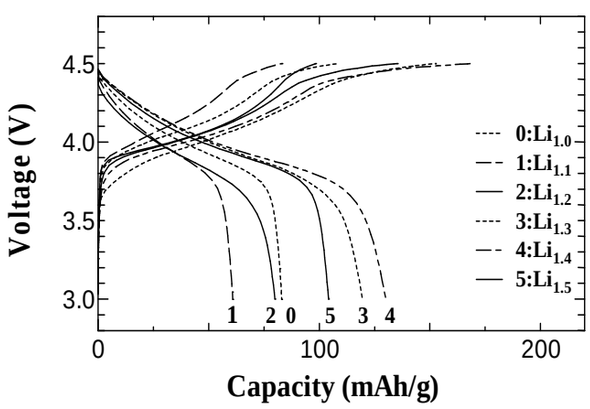


Fig. 2 Initial charge/discharge curves of $Li_{1+x}Co_{0.36}Ni_{0.1}Mn_{0.54}O_2$ prepared at 850 °C in air.

Reference

[1] T. Ohzuku et al., Chem. Lett., **2001** 642.

[2] J.R. Dahn et al., J. Electrochem. Soc., **149**, A815 (2002)

[3] D. Li et al., J. Power Sources, 132, 150 (2004)