LAYERED $LiNi_{0.5}Mn_{0.5}O_2$ ELECTRODE FOR LITHIUM-ION BATTERY

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Due to its advantages in cost, safety and environmental impact, development of cathode materials which can effectively replace the presently used and commercially available $LiCoO_2$ is crucial for Li-ion battery technology. From the viewpoint, manganese based lithium metal oxides are promising electrode materials for Li-ion battery.

Recently new lithium manganese/nickel mixed oxides with layered structures have been reported by Ohzuku [1] and Dahn's [2] groups. The electrochemical behavior seems to be very promising. In this study, $LiNi_{0.5}Mn_{0.5}O_2$ and its derivatives were prepared by the emulsion drying method, and structural and electrochemical properties are investigated.

$LiNi_{0.5}Mn_{0.5}O_2$ powder was prepared by the emulsion drying method. We previously reported details of the emulsion drying method [3]. Starting materials used for the synthesis of $LiNi_{0.5}Mn_{0.5}O_2$ were $LiNO_3$ (Kanto), $Mn(NO_3)_2{\cdot}6H_2O$ (Kanto) and $Ni(NO_3)_2{\cdot}6H_2O$ (Kanto). The pelletized emulsion-dried precursor was calcined at 950 ^oC in an Air atmosphere and cooled to room temperature in a tube furnace.

The Rietveld refinement of XRD data was performed to assess the crystal structure of the prepared $LiNi_{0.5}Mn_{0.5}O_2$. The space group of $R\bar{3}m$ was chosen as the best structural model. The resulting Rietveld refinement pattern is shown in Fig. 1. The refinement was done assuming Li atoms in 3*b* sites, Ni and Mn atoms in 3*a* sites, and O atoms in 6*c* sites. From the refinement results, we can safely conclude that Ni and Mn occupy in the 3*a* sites of hexagonal $LiNi_{0.5}Mn_{0.5}O_2$. The refined lattice parameters (a = 2.8727(6) Å and c = 14.2509 (7) Å) agree well with previous reports [1,2,4]. One different feature from the previous reports [1,2,4] is that the relative diffraction intensity of I_{003}/I_{104} in the XRD pattern is much higher than those of the previous reports, in which the ratio seems to related with cation mixing in the oxide matrix.

Fig. 2 shows typical charge and discharge curves of Li/$LiNi_{0.5}Mn_{0.5}O_2$ cell. $LiNi_{0.5}Mn_{0.5}O_2$ exhibits smooth, monotonous curves and higher capacity between 2.7 and 4.6 V vs. Li. Manganese site substitutions by other elements are currently being carried out. The details of synthesis, structure and electrochemistry of $LiNi_{0.5}Mn_{0.5-x}M_xO_2$ will be reported in the conference.

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Reference

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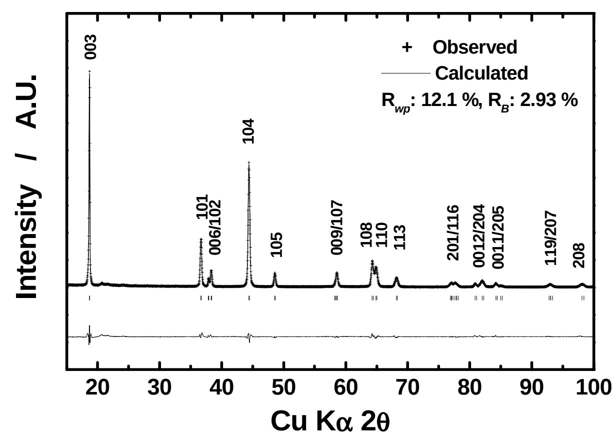

Fig. 1. Rietveld refinement results of XRD pattern of $LiNi_{0.5}Mn_{0.5}O_2$ powders.

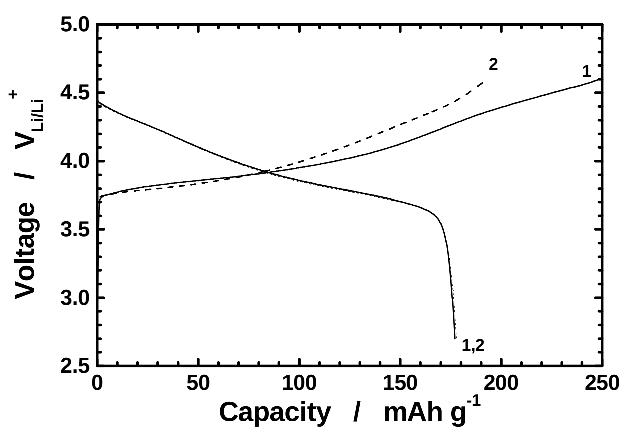

Fig. 2. Charge and discharge curves of $LiNi_{0.5}Mn_{0.5}O_2$ for initial 2 cycles. The electrode was evaluated in coin-type cell (CR2032) with a lithium foil with 1M $LiPF_6$ in EC-DEC (2:1). The applied current density was 20 mA/g at 25 ^oC.