

Phase Transition of Al-doped LiMn_2O_4 cathode material at Low Temperature

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Spinel LiMn_2O_4 is attractive as a cathode material for rechargeable lithium batteries due to its low cost, higher capacity and environmental friendliness. The best-known material, LiMn_2O_4 , has space group symmetry of $\text{Fd}\bar{3}\text{m}$ at room temperature. A. Yamada et al. [1] indicates that the phase transition of LiMn_2O_4 around 280K. Al dopant will be used to replace Mn^{3+} site in order to avoid the structure distortion and then reduce the capacity fading. Understanding the phase transition of LiMn_2O_4 and $\text{LiAl}_{0.15}\text{Mn}_{1.85}\text{O}_4$ materials are helpful to overcome the capacity fading. Moreover, the phase transition of Li-Al-Mn-O cathode materials were investigated by in-situ XRD using synchrotron radiation light source in the temperature range of 25K to 300K. In this study, the sample was cooled by an APD cryostat. Patterns were collected after equilibrium of the sample for 20 min at a given temperature.

The phase transition of LiMn_2O_4 material at various temperatures was shown in figure 1 and 2. LiMn_2O_4 undergoes a structural phase transition close to 285K from cubic to orthorhombic symmetry. The transformation had been complete until 100K. In the other hand, the structure of cubic LiMn_2O_4 can not be recovered completely returning to 300K after cooling.

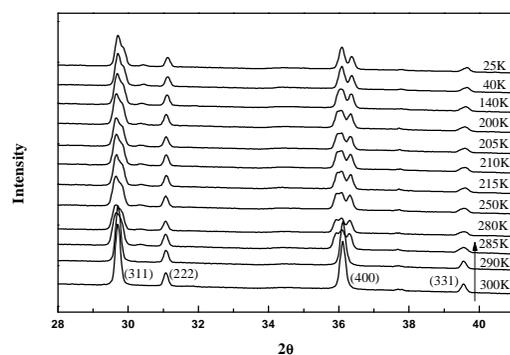


Fig. 1 Phase transition of LiMn_2O_4 material at the temperature variation of 300K to 25K.

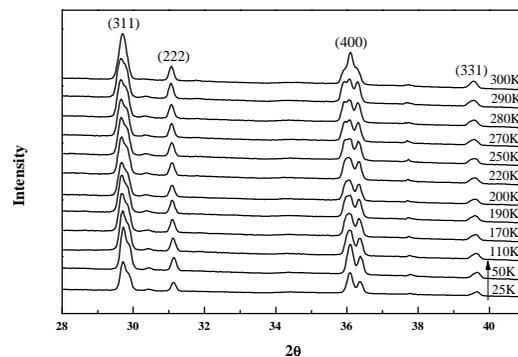


Fig. 2 Phase transition of LiMn_2O_4 material at the temperature variation of 25K to 300K.

Reference

1. A. Yamada and M. Tanaka, Mat. Res. Bull., Vol 30, No. 6, 715(1995)