Investigation of the Defect Structure of Nonstoichiometric $Li_{1+x}Mn_{2-y}O_{4-\delta}$ ($0 \le x \le 1.33$) Spinel by using Thermogravimetry

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With the rapid development of electronic, information and energy industries, there has been a great demand for batteries with high energy density. As one of the promising cathode materials of lithium-ion batteries $Li_{1+x}Mn_{2-y}O_{4-\delta}$ spinel is investigated in our work by using thermogravimetry. The samples were prepared by the Pechini method [1]. Single phase conditions of the samples were confirmed by X-ray diffraction, and the composition was determined using AAS/AES analysis. It was found that the upper limit temperature, T_{c1} (Fig. 1.), of the single phase region of $Li_{1+x}Mn_{2-y}O_{4-\delta}$ spinel is not only a function of the molar ratio of Li and Mn, n_{Li}/n_{Mn} [2], but also of partial pressure of oxygen, $p(O_2)$ [3], which is described in the three-dimensional diagram in Fig. 2.. The non-stoichiometry, δ, in the $Li_{1+x}Mn_{2-y}O_{4-\delta}$ ($0 \le x \le 1.33$) spinel was measured at different temperatures for different $p(O_2)$ by using thermogravimetry in the single phase region determined previously. The experimental results for δ will be discussed in terms of defect chemical models for the $Li_{1+x}Mn_{2-y}O_{4-\delta}$ spinel.

References

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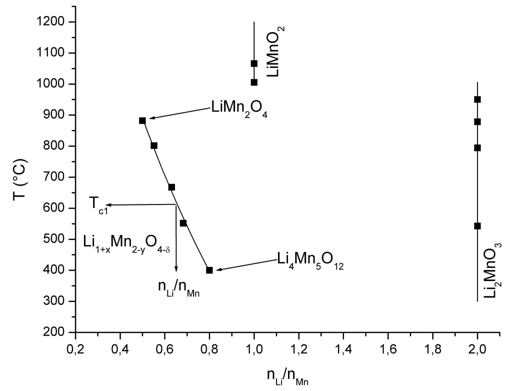

Fig. 1. Schematic description of the phase diagram of Li-Mn-O in air and definition of T_{c1} [4, 5]

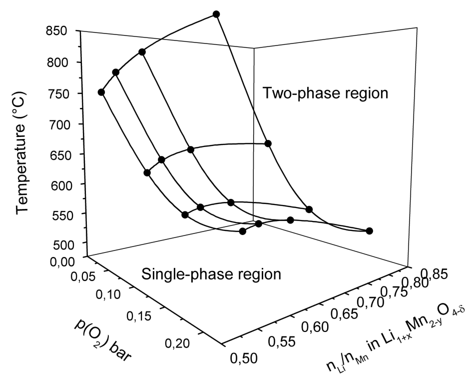

Fig. 2. Upper critical temperature, T_{c1}, as a function of $p(O_2)$ and n_{Li}/n_{Mn} determined in this study