

Investigation of Lithium Transport through LiMn_2O_4 Film
Electrode in Aqueous Electrolyte

수용성 전해질에서의 LiMn_2O_4 박막 전극을 통한
리튬 이동에 관한 연구

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Lithium intercalation into and deintercalation from LiMn_2O_4 film electrode were investigated in aqueous LiNO_3 solution by using potentiostatic current transient technique and ac-impedance spectroscopy. The LiMn_2O_4 film specimens with various thicknesses ranging from 60 to 240 nm were prepared by sol-gel method. The current transients measured on the electrode hardly followed the Cottrell behaviour, and especially they exhibited the inflexion points. From the results, it was suggested that lithium transport through the electrode is exclusively controlled by the cell-impedance even in aqueous solution. However, the value of the cell-impedance in aqueous solution was found to be smaller by about two orders of magnitude than that value in non-aqueous solution such as LiClO_4 -propylene carbonate. Furthermore, the inflexion points in the current transient were linearly proportional to the film thickness in value, while the initial current remained nearly constant regardless of the film thickness. The variation of the current transient in shape and value with the film thickness was analysed based upon the dependencies of various resistive components on the film thickness obtained from the ac-impedance spectra, and subsequently the rate-controlling steps of lithium intercalation process governed by the cell-impedance were established.

References

1. W. Li, J. R. Dahn and D. S. Wainwright, *Science* 264 (1994) 1115.
2. S.-W. Kim and S.-I. Pyun, *Electrochim. Acta* 47 (2002) 2843.