

A Study on the Stresses Generated during Lithium Transport
through the $\text{Li}_{1-x}\text{CoO}_2$ Film Electrode for Lithium Secondary
Battery by Using Laser Beam Deflection Method

레이저 빔 반사법을 이용한 리튬 이차 전지용 $\text{Li}_{1-x}\text{CoO}_2$ 박막
전극내 리튬 이동시 발생하는 응력에 관한 연구

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Stresses generated during lithium transport through the $\text{Li}_{1-x}\text{CoO}_2$ film electrode were investigated by using laser beam deflection method, galvanostatic charge/discharge experiments and potentiostatic current transient technique. For this purpose, LiCoO_2 films were deposited on the Pt/Ti/thin glass substrate by RF magnetron sputtering method, and then annealed at 700 °C for 4 h in air. The in situ stress transient was simultaneously measured along with the galvanostatic charge/discharge curves and the current transients, obtained from the $\text{Li}_{1-x}\text{CoO}_2$ film electrode in a 1 M solution of LiClO_4 in propylene carbonate. From the in situ stress transient simultaneously measured along with the galvanostatic charge/discharge curves, it was found that compressive and tensile stresses were developed in the $\text{Li}_{1-x}\text{CoO}_2$ film during the lithium deintercalation and intercalation, respectively, and that the remarkable variation of stresses appeared in a two-phase (a lithium poor α -phase and a lithium rich β -phase) region. From these results, it is suggested that the phase transformation induces the large amount of the stress in the $\text{Li}_{1-x}\text{CoO}_2$ film during lithium transport. The stress induced by the phase transformation was quantitatively discussed in terms of the applied potential step and the cumulative charge from the comparison of the simultaneously measured in situ stress transient and current transient.

References

1. S. N. Sahu *et al.*, J. Electrochem. Soc., 137 (1990) 1150.
2. S.-I. Pyun *et al.*, J. New. Mat. Electrochem. Systems, 5 (2002) 143.