

An Investigation of Intercalation-Induced Stresses Generated
during Lithium Transport through the $\text{Li}_{1-\delta}\text{CoO}_2$ Film Electrode
by Using Laser Beam Deflection Method

레이저 빔 반사법을 이용한 $\text{Li}_{1-\delta}\text{CoO}_2$ 박막 전극내
리튬 이동시 유발되는 응력에 관한 연구

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Intercalation-induced stresses generated during lithium transport through the $\text{Li}_{1-\delta}\text{CoO}_2$ film electrode were investigated by using laser beam deflection method, galvanostatic intermittent titration technique and potentiostatic current transient technique. For this purpose, LiCoO_2 film was deposited on the Pt/Ti/glass substrate by *rf* magnetron sputtering method, and then annealed at 550 °C for 24 h in air. From the in situ stress transients simultaneously measured along with the galvanostatic intermittent titration charge/discharge curves, it was noted that the stresses were remarkably generated in a single- α -phase region as well as in a two-phase (α phase and β phase) region. From the comparison of the variation of the stresses with the molar volume of the $\text{Li}_{1-\delta}\text{CoO}_2$ electrode during lithium transport, it is suggested that the molar volume change within the α phase and the difference in the molar volume between the α and β phases are responsible for the generation of the stresses in the single- α -phase and two-phase regions, respectively. In addition, from the quantitative analysis of in situ stress transients simultaneously measured along with the potentiostatic current transients, it was found that the amount of the stresses generated during the phase transformation remained constant irrespective of the potential steps. This result indicates that the amount of the stresses generated during lithium transport can be theoretically evaluated from the stress transient curve measured as a function of lithium stoichiometry.

References

1. J.N. Reimers and J.R. Dahn, J. Electrochem. Soc., 139 (1992) 2091.
2. J.-Y. Go, S.-I. Pyun, and H.-C. Shin, J. Electroanal. Chem., 527 (2002) 93.