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# 리튬 이차전지용 전극재료인 $Li[Li_{1/3}Ti_{5/3}]O_4$ 에서의 전기화학적 리튬 인터칼레이션에 대한 연구

# A Study on the Electrochemical Lithium Intercalation into $Li[Li_{1/3}Ti_{5/3}]O_4$ as an Electrode Material for Rechargeable Lithium Battery


김 성 우*, 변 수 일, 최 영 민, 신 헌 철

Sung-Woo Kim*, Su-Il Pyun, Young-Min Choi and Heon-Cheol Shin

Department of Materials Science and Engineering, Korea Advanced Institute of Science and Technology, Daejon 305-701, Korea



The electrochemical lithium intercalation into porous $Li[Li_{1/3}Ti_{5/3}]O_4$ electrode has been investigated in 1M $LiClO_4$ propylene carbonate solution by using galvanostatic intermittent titration technique(GITT) in combination with electrochemical impedance spectroscopy(EIS) and potentiostatic current transient technique. $Li[Li_{1/3}Ti_{5/3}]O_4$ powder was synthesized by solid state reaction at 800 ℃ for 24 h in air, and then identified as a defect spinel-framework structure with a space group $Fd\bar{3}m$ by X-ray diffractometry. From the results of GITT, the apparent chemical diffusivity of lithium ion in the porous oxide electrode was determined to be $10^{-9} \sim 10^{-10}$ $cm^2s^{-1}$ at room temperature in the lithium content range of 1.1 to 1.5. The charge-discharge curve displayed a wide potential plateau near 1.56 $V_{Li/Li^+}$ in the $(1+\delta)$ range of 1.0 to 1.6 in $Li_{(1+\delta)}[Li_{1/3}Ti_{5/3}]O_4$ electrode. The occurrence of the plateau is due to the coexistence of two pseudo-phases of a Li-diluted phase α and a Li-concentrated phase β. The impedance spectra of the electrode consisted of two separated arcs in the high and intermediate frequency range 1 Hz to 100 kHz, and a line inclined at approximately 45° to the real axis in the low range 10 mHz to 1 Hz. The typical current transients during the lithium intercalation were divided into three stages, and the third stage disappeared below the lithium charging potential of 1.50 $V_{Li/Li^+}$. However, the third stage was not observed clearly during the lithium deintercalation over the whole potential range investigated. The lithium transport through porous $Li[Li_{1/3}Ti_{5/3}]O_4$ electrode was discussed in terms of diffusion-controlled phase boundary movement and variation of lithium ion diffusivity with lithium content.


## References


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