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Effects of Cation Mixing and Electric Field on the Lithium Intercalation into Porous Li1-δAlyNi1-yO2 (0≤y≤0.25) Electrodes
다공성 Li1-δAl1-yNiyO2 (0≤y≤0.25) 전극으로의 전기화학적 리튬 인터칼레이션시 Cation mixing 및 Electric field의 영향

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The electrochemical lithium intercalation into porous $Li_{1-\delta}Al_yNi_{1-y}O_2$ ($0 \le y \le 0.25$) electrodes was investigated in 1M $LiClO_4$ propylene carbonate solution by using galvanostatic intermittent titration technique(GITT), electrochemical impedance spectroscopy(EIS) and potentiostatic current transient technique. $LiAl_yNi_{1-y}O_2$ powders were prepared by calcinating a mixture of $LiNO_3$, $Al(OH)_3$ and $NiCO_3$ in stoichiometric proportions at 600℃ for 5 h in air, followed by heating it at 750℃ for 10 h under oxygen stream. From the XRD patterns of synthesized powders, the crystal structure of $LiAl_yNi_{1-y}O_2$ was identified as a rhombohedral one with $R\bar{3}m$ space group. The galvanostatic intermittent titration curve for the $Li_{1-\delta}NiO_2$ electrode showed a potential plateau causing the irreversible capacity over the 4.2 V_{Li/Li^+}. From the result, it was suggested that the irreversible capacity of the $Li_{1-\delta}NiO_2$ electrode is due to the destruction of the layered structure by cation mixing effect. The irreversible capacity of the $LiAl_yNi_{1-y}O_2$ electrodes decreased with increasing aluminium content, y, indicating that the layered structure is stabilised by the addition of aluminium. The cation mixing was also investigated by using EIS in combination with XRD. From the analysis of the potentiostatic current build-up and decay transients, it was suggested that the ratio of the transferred charge (Q_{int}/Q_{deint}) is closely related to cation mixing effect in the $LiAl_yNi_{1-y}O_2$ electrodes. In addition, it was reported from our laboratory that the effects of electric field and diffusivity of lithium ion on the lithium transport were explored from the analysis of the current build-up and decay transients. The lithium intercalation into the $Li_{1-\delta}Al_yNi_{1-y}O_2$ electrodes with various aluminium content, y, was well discussed in terms of the cation mixing effect and electric field effect.

References

1. Y.-M. Choi, S.-I. Pyun and S.-I. Moon, Solid State Ionics 89 (1996) 43/52.
2. Y.-M. Choi, S.-I. Pyun and J. M. Paulsen, press in Electrochim. Acta (1998).