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Kinetics of Lithium Transport through the Carbonaceous Electrodes : Theoretical Analysis of Current Transient

탄소전극내로의 리튬이온 이동에 관한 속도론적 연구
: 전류 추이 곡선의 이론적 해석

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Lithium transport through carbonaceous electrode was investigated in a 1 M LiPF_6 - ethylene carbonate (EC) / diethylene carbonate (DEC) (50:50 vol.%) electrolyte. For this purpose, the cathodic and anodic current transients were obtained from the electrodes as functions of applied potential step and the degree of crystallinity of the carbon. All the experimental current transients did not follow Cottrell behaviour throughout the whole lithium intercalation/deintercalation time. From the ohmic relationship between initial current level and applied potential step, it is suggested that the lithium transport through carbonaceous electrode is exclusively governed by 'cell-impedance'. In order to investigate the effect of the structural change of carbon on lithium transport, we employed graphite with high degree of crystallinity and hard carbon with very low degree of crystallinity. In the case of the graphite electrode, the current transients were numerically simulated under the 'cell-impedance-controlled' constraint. In hard carbon, there are two different intercalation sites of normal site and extra site. Moreover, it was reported that the site energy of extra site is lower than that of normal site. This leads to the difference in the kinetics of lithium intercalation into normal site and extra site. Thus, lithium transport through hard carbon was investigated by employing McNabb-Foster equation in combination with 'cell-impedance-controlled' constraint.

References

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