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Lithium Transport through Vanadium Pentoxide Xerogel Film Electrode by Ac-impedance Analysis

교류 임피던스 해석을 통한 V_2O_5 제로겔 박막 전극 내로의 리튬 이동에 관한 연구

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Lithium transport through vanadium pentoxide xerogel film electrode was investigated by using ac-impedance spectroscopy, galvanostatic intermittent titration technique (GITT) and cyclic voltammetry. For this purpose, xerogel film electrodes were prepared by spin-coating a viscous gel on an indium tin oxide substrate, and then dried either at 110 ℃ for 3 h or at 270 ℃ for 3 h. From the analysis of cyclic voltammograms obtained from the film electrodes, it was found that the film electrode dried at 270 ℃ had more crystalline character than that electrode dried at 110 ℃. The Nyquist plot of ac-impedance spectra exhibited a depressed arc associated with lithium absorption at the electrode/electrolyte interface in the high frequency range, and a straight line due to lithium diffusion in the low frequency range. The size of the high frequency arc for the electrode dried at 110 ℃ was smaller than that for the electrode dried at 270 ℃, and the value of chemical diffusivity determined from the electrode dried at 110 ℃ by using GITT was larger as compared with that value for the electrode dried at 270 ℃. From these results, it is suggested that the water molecules incorporated into the xerogel film facilitate lithium absorption into and diffusion through the film electrode. Moreover, the ac-impedance spectra for the electrode dried at 110 ℃ showed the straight line with the slope smaller than 45° in the low frequency range. This anomalous bahaviour of diffusion impedance was discussed in terms of lithium transport through the disordered oxide lattice induced by the water molecules incorporated into the xerogel film electrode.

References

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