The Charge/Discharge Characteristics of a Amorphous LixV2O5-y Thin Film Cathodes Deposited by r.f.-sputtering and Lithium Ion Diffusivity Determined by GITT Method.

Sang-Dong Lee, Ji-Yong Eom and Hyuk-Sang Kwon
Department of Materials Science & Engineering,
Korea Advanced Institute of Science & Technology,
Kusung-dong, Yusung-gu, Daejon 305-701, Korea

Abstract

The electrochemical properties of amorphous vanadium pentoxide films fabricated by reactive r.f.-sputtering have been investigated by galvanostatic charge/discharge cycling experiment, AC impedance spectroscopy, and Galvanostatic intermittent titration technique (GITT). As x in LixV2

O5-y increased (x = 0 ~ 2.0), the electromotive force of Li | 1 M LiClO4 - propylene carbonate | V2O5-y cells decreased gradually without potential plateau or potential step, demonstrating that an abrupt structural change did not occur in the whole lithium content. Impedance spectra of the cells consisted of a high frequency arc, a low frequency straight line, and a middle frequency Warburg impedance line. Equivalent circuit deduced from Nyquist plot suggests that lithium intercalation reaction consists of three consecutive steps of charge transfer at the electrolyte/cathode interface, diffusion into the film and charge saturation. Chemical diffusivity of Li+ in LixV2O5-y film, measured using GITT was determined to be 4×10-13 to 7×10-14 cm2/sec in the lithium content range investigated. The component diffusivity of lithium decreased linearly with lithium content from 9×10-14 to 5×10-15, owing to an decrease in number of vacant site available for jumping of lithium atom.

Keywords : amorphous, vanadium oxide, thin film, lithium batteries, charge/discharge characteristics, ac impedance response, diffusivity, GITT.