

**Sym. J : Energy Conversion & Storage Materials****ENERGY CONVERSION & STORAGE MATERIALS- II****E-TUE-10**

**EFFECTS OF COBALT ADDITION ON ELECTROCHEMICAL BEHAVIOR IN SPUTTER DEPOSITED LITHIUM MANGANESE OXIDE THIN FILMS**, Y. S. PARK, B. I. LEE and S. K. JOO, Div. of MS. & E., College of Engineering, Seoul National University, San 56-1, Shillim-dong, Kwanak-ku, Seoul, 151-742, Korea)

To improve the cycling reversibility of spinel phase  $\text{LiMn}_2\text{O}_4$ , cobalt was added to lithium manganese oxide thin films by RF magnetron sputtering and the effects of cobalt addition were investigated. The amount of cobalt addition was controlled by the number of cobalt chips on  $\text{LiMn}_2\text{O}_4$  target. The initial discharge capacity was reduced with the addition of cobalt. But, rechargeability was greatly improved with increase of cobalt amount. And all solid state thin film batteries were fabricated with the cell structure of  $\text{Li/LiPON/Li(Mn,Co)}_2\text{O}_4$  by the sequential thin film deposition. Fabrication details on all solid state thin film batteries will be presented and the electrochemical properties depending on the addition of cobalt will be discussed.

**E-TUE-11**

**ANALYSIS OF LITHIUM INTERCALATION INTO POROUS  $\text{Li}_{1-x}\text{CoO}_2$  ELECTRODE BY USING POTENTIOSTATIC CURRENT TRANSIENT TECHNIQUE**, S. I. PYUN and H. C. SHIN (Dept. of Mat. Sci. and Eng., KAIST, Daejeon, 305-701, Korea)

The potentiostatic current build-up transient was analysed to investigate lithium intercalation into porous  $\text{Li}_{1-x}\text{CoO}_2$  electrode in 1M  $\text{LiClO}_4$  propylene carbonate solution in connection with galvanostatic intermittent titration technique (GITT). The current transients exhibited two staged behaviour at the lithium injection potentials above the quasi-equilibrium potential,  $3.93 \text{ V}_{\text{Li/Li}^+}$ , determined from the GITT during the lithium intercalation, which was transformed to three staged behaviour at the potentials below the quasi-equilibrium potential. From the first derivatives of the current transients in logarithmic scale, it was observed that lithium transport is governed by lithium ion chemical diffusivity, irrespective of the lithium injection potentials. In particular, from the appearance of the upward concave shape of the first derivatives at the lithium injection potentials below  $3.93 \text{ V}_{\text{Li/Li}^+}$ , it is suggested that lithium transport at those potentials involves the diffusion-controlled phase boundary movement. The numerical simulation was conducted for lithium transport through one dimensional electrode, based upon the quasi-equilibrium concept. The simulated results were qualitatively in good agreement with the experimental ones.

**E-TUE-12**

**ANALYSIS OF THE STRESS GENERATION AND RELAXATION DURING HYDROGEN ABSORPTION/DESORPTION INTO/FROM AND DIFFUSION IN Pd FOIL ELECTRODE**, S. I. PYUN and L. N. HAN (Dept. of Mat. Sci. and Eng., KAIST, Daejeon, 305-701, Korea)

The stresses generated and relaxed during the hydrogen absorption/desorption into/from and diffusion in Pd foil electrode in 0.1M NaOH solution have been investigated as a function of hydrogen charging potential by using a beam deflection technique combined with current transient and open-circuit potential transient techniques. From the changes in deflection with time during the hydrogen charging into Pd electrode, firstly the compressive stress was generated on the hydrogen charged surface due to the drastic hydrogen concentration gradient across the thickness and secondly the developed compressive stress was annihilated by redistribution of hydrogen concentration. Furthermore, during the hydrogen discharging from the hydrogen-charged electrode, the tensile stress was developed owing to the abrupt extraction from the hydrogen charged electrode surface and then the stress was released by the formation of homogenous phase. The generation and relaxation of stress has been discussed in terms of the concentration profile of hydrogen in single phase and the coexistence of two phases.

**Sym. C : Electroceramics & Sensors****ELECTROCERAMICS - I****E-TUE-13**

**ELECTRONIC PROPERTIES IN SINGLE GRAIN BOUNDARIES OF BARIUM TITANATE**, MAKOTO KIWABARA, HIROFUMI MATSUDA, and KOUICHI HAMAMOTO (Dept. of Mat. Sci., Univ. of Tokyo, 7-3-1 Hongo, Tokyo 113, Japan)

A systematic study has been made on the positive temperature coefficient of resistivity (PTCR) effect and the piezoresistive effect in strictly single grain boundaries of semiconducting barium titanate ceramics to clarify the mechanism of these effects. In this study, single boundaries formed in thin ceramic bars, with a diameter in the range 10-20 $\mu\text{m}$ , with a grain structure consisting of single grains joined together in series were used to be examined. Single grain boundaries in the present samples exhibited resistivity (R)-temperature (T) characteristics that can be classified into typically three categories; normal type PTCR characteristics, saw-tooth type PTCR characteristics and flat type R-T characteristics with no PTCR jump. Distinct piezoresistive effects were also observed for many of the single boundaries examined at room temperature, and furthermore, some of them exhibited extremely large piezoresistance of  $>1 \times 10^7$  in gauge factor. The obtained results suggest that spontaneous polarization plays a decisive role in the occurrence of the piezoresistive effect and the PTCR effect. A comprehensive interpretation for the grain boundary properties of semiconducting barium titanate ceramics is given based on a new model taking the role of spontaneous polarization into account.