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ENERGY CONVERSION & STORAGE MATERIALS- I

E-TUE-06

FABRICATION OF $LiNiVO_4$ THIN FILM CATHODE FOR HIGH-VOLTAGE Li SECONDARY MICROBATTERY. TAE SEOK HA, HONG KOO BAIK(Dept. of Metallurgical Eng., Yonsei Univ., 120-749, Korea), SUNG MAN LEE(Dept. of Materials Eng., Kangwon National Univ., Chuncheon, 200-701, Korea)

As a novel high-voltage cathode material, $LiNiVO_4$ powder-based electrode has recently been investigated. Its discharge capacity is a lower bound on the actual achievable capacity of the material in view of the liquid electrolyte oxidation at high voltage range. However, a solid electrolyte, lithium phosphorous oxynitride (LIPON) has the electrochemical stability window between 0 and 5.5V, which also enables the fabrication of all solid state microbattery possible. The cathode and the solid electrolyte were deposited by rf magnetron sputtering of $LiNiVO_4$ and Li_3PO_4 in N_2, respectively. For the anode, Lithium was deposited by thermal evaporation. The electrochmical properies of the cathode were evaluated by charge-discharge and voltametric experiments above 4.8V.

E-TUE-07

ON THE PERSPECTIVES FOR APPLICATION OF GRAPHITE AND QUINOID COMPOUNDS AS ENERGY STORAGE MATERIALS, T. MOTRONYUK **(Dept. of Electrochemistry, NTUU,** 37, Prosp. Pobedy, 252056, Kiev-56, Ukraine), V. BARSUKOV, V. DROZDIK, I. BARSUKOV, O. RADCHENKO **((Dept. of Chemistry, SALIU, 2, N-Danchenko str., Kiev 252011, Ukraine. E-mail: chemi@mail.kar.net)**

The problem of developing metal-free energy storage devices (MF accumulators) has become urgent in recent years due to the increasing scarcity of Pb, Ag, Cd, Zn and other nonferrous metals used for manufacturing batteries, and to environmental pollution with nonferrous waste.

We proposed a novel available and cheap system for developing a **MF accumulator** with a fairly large potential difference of ca 1.5V. This system is based on the use of graphite intercalation compounds (GIC) as the active material of the positive electrode. Anthrahydroquinone -9,10 (AQH_2) serves as an active material of the negative electrode in the charged state.

It should be noted that MF accumulators with a voltage $U_0 \sim$ 1.5V, specific energy values ca 20 - 25 W•h/ kg and more than 200-300 charge - discharge cycles can be developed. It is also possible to further increase the discharge voltage and specific energy by using such more negative anthraquinone - 9,10 derivatives as 1,4- or 1,5- dimethylanthraquinone-9,10 or 1,2,4,5- tetramethylanthraquinone- 9,10

E-TUE-08

FABRICATION TEMPERATURE EFFECT ON PROPERTIES OF $LiCoO_2$ FILM PREPARED BY HYDROTHERMAL REACTION, S. W. SONG, K. S. HAN and M. YOSHIMURA (Center for Materials Design, Materials and Structures Lab., Tokyo Inst. Tech., 4259 Nagatsuta, Midori, Yokohama 226, Japan)

Electrochemically active $LiCoO_2$ films are directly fabricated by hydrothermal treatment of cobalt metal substrate with 4 M LiOH solution between room temperature and 200 °C. $LiCoO_2$ films fabricated at higher temperature exhibit more crystalline surface morphology in the SEM surface micrographs. The film thickness as function of fabrication temperature eventually decreases from 20 to 10 μm despite of the increase of the average crystal size. The cyclic voltammograms of these $LiCoO_2$ film electrodes show a good reversibility, indicating an applicability of these $LiCoO_2$ films to the lithium rechargeable microbatteries. Two anodic peaks around 3.6 and 4.0 V, corresponding to the removal of lithium ions from $LiCoO_2$ structure, gradually shift to higher voltage region with an increase of reaction temperature, which is consistent with a structural transformation from spinel to hexagonal. It is, therefore, found that a change of reaction temperature in hydrothermal reaction gives rise to a variation in $LiCoO_2$ film properties like structure, surface morphology, film thickness and electrochemical properties.

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E-TUE-09

HIGH ENERGY DENSITY LITHIUM-ION BATTERIES, SELF-ASSEMBLED FROM POLYELECTROLYTES, NANOPARTICLES AND NANOPLATELETS, Janos H. Fendler, (Clarkson University Box 5814 Potsdam, NY 13699-5814 U.S.A.)

Using our general method for the preparation of ultrathin films by the layer-by-layer self-assembly of polyelectrolytes, nanoparticles and nanoplatelets we have constructed a high energy lithium ion battery. The working electrode consisted a transparent indium tin oxide, ITO, substrate onto which nanoplatelets of graphite oxide (GO), and nanolayers of poly(diallyldimethyl-ammonium) chloride, PDDA and polyethylene oxide, PEO, were self-assembled. Positively charged PDDAhas been chosen as the "building-polymer"since it is known to interact strongly with negatively charged GO nanoplatelets by electrostatic forces and thus it facilitates the quantitative self-assembly of these nanolayers onto a conductive substrate. PEO, an ion-conducting polymer, have synergized the "building"function of the polyelectrolyte by allowing further layer-by-layer growth of the films. The structure of the working electrode were characterized by a large variety of techniques. Lithium wires have served as the anode and the counter electrode. The cell has contained LiASF6 as a supporting electrolyte and methyl formate and ethylene carbonate as solvent. The specific capacity of this cell (1232 mAh per gram of graphitic carbon) is substantially greater than that currently available.