Mediterranean Institute of Fundamental Physics
National Academy of Sciences of Ukraine
University Caddy Ayad, Marrakech
Kurdyumov Institute of Metal Physics
Institute for Information Recording NASU: Uzhgorod Scientific-Technological Center

MEDITERRANEAN – EAST-EUROPE MEETING MULTIFUNCTIONAL NANOMATERIALS: NanoEuroMed 2011

12-14 May 2011, Uzhgorod, UKRAINE

PROGRAM & MATERIALS

Uzhgorod
2011

CURRENT GENERATION PROCESSES OF LITHIUM POWER SOURCES WITH CATHODE ON THE BASE OF HYDRATATED FORM OF X-RAY AMORPHOUS TITANIUM DIOXIDE

V.L.Chelyadyn (1), V.O. Kotsyubynsky (1), R.V. Ilnytskyy (1), V.I. Mandzyuk (1), M.I. Danylenko (2), V.V. Dmytruk (1)

(1) Vasyl Stefanyk Precarpathian National University, Ivano-Franlivks, Ukraine; Frantsevich Institute for Problems of Materials Science of NASU, Kyiv, Ukraine (2)

chai_email@ukr.net

Current research to improve the electrode materials of lithium power sources (LPS) mainly deal with optimization of their composition, namely purposeful formation of nanoparicle morphology and structure. The perspective base of LPS cathode is electrode material with layered structure that will be stable after lithium insertion processes.

The focus was to explore the current generation processes of lithium power sources based on hydrated form of X-ray titanium dioxide ($TiO2 \cdot nH2O$). The five samples of $TiO2 \cdot nH2O$, as nanosized particles containing water molecules n = 2, 1.3, 1.0, 0.9 and 0.2, were obtained by controlled TiCl4 hydrochlorid-acid hydrolysis. The electrode materials were studied with testing LPS (electrochemical cell - galvanic pair Li | 1M solution of LiBF4 in γ-butyrolactone | cathode), in which nanoparticles were the base of cathode composition (88 %). To record current generation chemical reactions flow in detail, the cell discharge was carried out in galvanostatic mode at current density C/250.

With the help of the method of impedance spectroscopy, it has been shown that the kinetics of lithium ions electrochemical insertion process in the LPS cathode based on $TiO2 \cdot 2H2O$ (H4TiO4) is characterized mainly by chemisorption of Li+ to the intercalation degree value x = 4, i.e. lithium ions knit electrostatically together with oxygen of each hydroxyl of Ti(OH)4 without formation of lithium titanate phase (Li4TiO4). Synthesized $TiO2 \cdot 1.3H2O$, titanium oxyhydroxide TiO(OH)2 with layered structure showed the highest absorption capacity at electrochemical insertion of lithium atoms in the material-"master" (specific capacity of LPS into discharge up to 1,5V was 2700 $mA \cdot h \cdot g\text{-}1$). In the first stage of galvanic couples discharge, current generation occurs during Li2CO3 formation (data of electron microscopy and the energy X-ray fluorescence spectroscopy) due to the existence of carbonate and carboxil adsorbed grouping on the titanium oxyhydroxide surface followed by Li+ diffusion in the X-ray structure of TiO(OH)2 and formation of lithium titanate according to reaction: $2Li+ + H2TiO3 \rightarrow Li2TiO3 + 2H+$ (1). The second stage of LPS current generation is carried out LiOH forming, which does not coagulate fully to Li2O with water formation because of the excess protons presence in current source electrolyte, which freed at

Li2TiO3 formation: $LiBF4 + H2O \rightarrow LiF + BF3OH- + H+$ (2), $Li+ + BF3OH- \rightarrow LiOH + BF3$ (3), $BF3 + LiOH + H+ \rightarrow LiBF4 + H2O$ (4). After exhaustion of excess hydrogen ions, repeated regeneration of electrolyte salt (LiBF4) is terminated and the third stage of current generation takes place due to Li2O formation: $LiOH + LiOH \rightarrow Li2O + H2O$ (5). Chemical reaction 5 immediately and irreversibly occurs when lithium ions are electrochemically inserted in materials $TiO2 \cdot H2O$, $TiO2 \cdot 0.9H2O$ and $TiO2 \cdot 0.2H2O$ with frame structure, providing the value of the LPS specific charge of no more than 900, 800 and 400 $mA \cdot h \cdot g\text{-}1$.

The work is supported by CRDF / USAID (UKX2-9200-IF-08) and the Ministry of Education and Science of Ukraine (M/130-2009).

EXOMODIFIED FULLERENES AS PROMISING ANTICANCER DRUGS TO THE PHOTODYNAMIC EFFECT

E.V. Polunkin, I.O. Lisnyak, T.M. Kameneva, P. A. Troshin, R.S. Zhyla

(1) Institute of Bioorganic Chemistry and Petrochemistry of the NAS of Ukraine, Kyiv, Ukraine

(2) R.E. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology NAS of Ukraine, Kyiv, Ukraine

(3) Institute of Problems of Chemical Physics of the RAS, Chernogolovka, Russia

polunkin@i.ua

The creation of a new photosensibilizating anticancer drugs which can be used for photodynamic therapy of tumors occupies the important place in the list of the most current and economically expedient problems of modern Chemistry and Medicine. The photodynamic therapy of tumors is the method of malignancy new growth treatment which in recent years has an active development. That is why, the functionalization of fullerenes allow to get their endo- and exohedral derivatives, which are characterized by a complex of new properties and may be useful in creating such anticancer drugs. Photodynamic activity of exomodified fullerenes in vitro on the cell culture malignant lymphocyte line «Namalva» was determined. The possible application of exomodified fullerenes in the capacity of sensitizers for photodynamic therapy of tumors was shown.

Previously, the mechanism of the inhibitory action of fullerenes was investigated on the example of chain-radical oxidation of organic compounds (benzyl alcohol, hexamethyltriamidophosphate, methyl oleate). It was found that fullerenes inhibit auto-oxidation and initiated oxidation of organic substrates. It was first identify that fullerenes can short-stop the chain of oxidation simultaneously with the participation of peroxyl and alkyl radicals.

In 2008 the authors of the project experimentally determined unique and fundamental phenomenon of inversion of antioxidant activity nanoclusters of carbon (derivatives of fullerene

A. A. Novokhatskaya, S. Yu. Prylypko, G. Ya. Akimov 184

CURRENT GENERATION PROCESSES OF LITHIUM POWER SOURCES WITH CATHODE ON THE BASE OF HYDRATATED FORM OF X-RAY AMORPHOUS TITANIUM DIOXIDE
V.L.Chelyadyn (1), V.O. Kotsyubynsky (1), R.V. Ilnytskyy (1), V.I. Mandzyuk (1), M.I. Danylenko (2), V.V. Dmytruk (1) 186

EXOMODIFIED FULLERENES AS PROMISING ANTICANCER DRUGS TO THE PHOTODYNAMIC EFFECT
E.V. Polunkin, I.O. Lisnyak, T.M. Kameneva, P. A. Troshin, R.S. Zhyla 187

STRUCTURE OF AGGREGATES OF MODIFIED MOLECULES OF FULLERENE C60 IN NEMATIC LIQUID CRYSTAL
*V. E. Vovk *(1), O. V. Kovalchuk (1), M. I. Lebovka (2).* 188

SURFACE DIFFUSION AND PHASE TRANSFORMATIONS IN THE ANISOTROPIC ADSORPTION SYSTEM
*S.A. Zaika *(1), A.T. Loburets (1), A. I. Senenko (2)* 189

PHONON STRUCTURE AND INTERATOMIC FORCE CONSTANTS OF CALCIUM AND CADMIUM APATITES
*A.P. Soroka, V.L. Karbovskiy** 190

MECHANICAL PROPERTIES OF NON-CRYSTALLINE SUPERIONIC MATERIALS IN THE SYSTEM AG2S-AS2S3 AT ULTRALOW FREQUENCIES
Bilanych V.S., Buchuk R.Y., Skubenych K.V., Makauz I.I., Studenyak I.P. 191

EXPERIMENTAL STUDYING MAGNETIC NANOCOMPLEXES WITH DOXORUBICIN FOR DRUG DELIVERY AND CANCER THERAPY
M.I. Khodakovskyi (1), M.M. Budnyk (1), V.E. Orel (2), V.M. Budnyk (1), I.D. Voitovych (1)* 192

EPR STUDY OF $(GES_2)_{100-X}(SBSI)_X$ GLASSES
P.P. Shtets[1], O.A. Mykaylo[2], A.K. Mel'nik[3], V.V.Tracevskyi[4], R.P.Pisak[1] 193

INFLUENCE OF DIAMOND-LIKE CARBON ON FUNCTION OF TUMOR CELLS IN VITRO
O. M. Perepelitsyna(1), M. V. Sydorenko(1), L. V. Garmanchouk(2), A. D. Rud(3), I. M. Kiryan(3), V. N. Uvarov(3) 194

OPTICAL NANOCERAMICS BASED ON ALUMINUM AND ZIRCONIUM OXIDES
*A. A. Shul'zhenko (1), V. N. Uvarov (2), V. G. Gargin (1), A. N. Sokolov *(1), A. D. Shevchenko (2), N. N. Belyavina (3), V. N. Yashchuk (3), N. I. Berezovskaya (3), A. I. Zelenskii (3), and A. P. Naumenko (3)*

DEFORMATION OF $AS(GE)_2SE_3$ THIN CHALCOGENIDE FILMS BY QUASI-STATIC NANOINDENTATION
S.Kikemezey(1,3), V. Bilanich(1), V. Rizak(1), I. Rizak(2) 196

THE STUDY OF THE SUPRAMOLECULAR CHROMOPHORE SYSTEMS' FLUORESCENT PROPERTIES BY QUANTUM CHEMISTRY METHODS
T.V. Sakhno (1), N.N. Barashkov (2), I.S. Irgibaeva (3), A.I Mantel (3) 197

CVD DIAMOND FOR IONIZING RADIATION DETECTORS
A.A. Veryovkin, V.I.Gritsina, S.F. Dudnik, A.A. Zakharchenko, V.E. Kutny, A.V. Rybka, O.A. Opalev, V.E. Strel'nitskij, I.I.Vyrovets* 198

THE EFFECT OF THERMAL TREATMENT ON ENERGY CHARACTERISTICS OF LITHIUM POWER SOURCES ON NANOPOROUS CARBON BASE
N.I. Nagirna (1), V.I. Mandzyuk (1), B.I. Rachiy (1)* 198

2D MACROPOROUS SILICON STRUCTURES WITH SURFACE NANOCRYSTALS: ELECTRO-OPTICAL PROPERTIES
L. A. Karachevtseva (1), S. Ya. Kuchmii (2), O. A. Lytvynenko (1), F. F. Sizov (1), O. J. Stronska (1), A. L. Stroyuk (2) 199

SUSPENSION OF MULTIWALLED CARBON NANOTUBES IN ORGANIC SOLVENTS
V. A. Gigiberiya, I. A. Ar'ev, N. I. Lebovka 200

EFFECT OF SMALL AMOUNT OF GOLD NANOPARTICLES ON THE CONDUCTIVITY OF NEMATIC LIQUID CRYSTAL 6CHBT
O.V. Kovalchuk(1,3), P. Kopčanský(2), M. Timko(2), Z.Mitrova(2), V. Zavisova(2), M. Koneracká(2), N. Tomašovičová(2), L. Tomčo(2), S.S. Semenko(3), N.M.Kostenchuk(3) V.M. Bykov(1), T.M. Kovalchuk(4), I.P. Studenyak(5)* 201

THE INFLUENCE OF STRUCTURE OF THE SURFACE OF TITANIUM AND ZIRCONIUM MODIFIED BY CALCIUM PHOSPHATE COMPOSITES ON THE CYTOLOGICAL PECULIARITIES OF OSTEOBLASTS
Potapchuk A., Rusyn V., Sharkan Y., Kryvanych V., Rivis O. 202

ENHANCEMENT OF SURFACE RELIEF GRATING FORMATION IN AMORPHOUS CHALCOHENIDE FILMS THROUGH THE EXCITATION OF PLASMONIC MODES IN AU PARTICLES
Trunov M.L.(1), Lytvyn P. M.(2), Oberemok O.S.(2), Gera E.V.(3), Shpyrko G.M.(3), Rubish V.M.(3) 203

THE SINGLE-PARTICLE SPECTERS OF NANOSTRUCTURES IN THE SUPERSPACE SYMMETRY CONCEPT
I.I.Nebola, OV Bokotey, A. Ya. Shteyfan 204

PHYSICAL PROPERTIES OF NONTOXIC HALLOYSITE NANOTUBES
I.B.Yanchuk(1,2), S.Ya. Brychka (3), A.V. Yefanov (2) A.V. Brychka (3)* 205

MATHEMATICAL BASIS OF HELICAL RISE OF THE DNA B-FORM DOUBLE HELIX
Goncharenko V.V., Goncharenko M.V., Rudometov S.V., Fedoseeva A.E. 205

ELECTROCONDUCTION PROPERTIES OF THE NANOSIZE THIN THIN FILMS COMPOSITION COSB(3-3.5)(30 HM)/SIO_2(100 HM)/SI(001) – FUNCTIONAL ELEMENTS OF THE THERMOELECTRICITY
Makogon Yu.M.(1), Pavlova O.P.(1), Sidorenko S.I.(1), Beddis G.(2), Daniel M.(2), Verbitska T.I.(1), Shkarban R.A.(1) 206

CONTENT 207