INTERNATIONAL RESEARCH AND PRACTICE CONFERENCE "NANOTECHNOLOGY AND NANOMATERIALS" (NANO-2017)

23-26 August 2017
Chernivtsi, UKRAINE

BOOK OF ABSTRACTS

High-Themperature Electrochemical Synthesis of Nanopowders of Molybdenum (Tungsten)–Nickel (Cobalt) Alloys and Intermetallic Compounds

Malyshev V.V.[1,2], **Uskova N.M.**[2], **Shakhnin D.B.**[1,2], **Antsibor V.S.**[1], **Ustundag Z.**[3]

[1] *Institute of Engineering & Technology, University "Ukraine", 23 Lvivska St., Kyiv-03115, Ukraine.*
E-mail: victor_malyshev@mail.ru
[2] *V.I. Vernadsky Institute of General and Inorganic Chemistry of the NAS of Ukraine. 32/34 Palladina Pr., Kyiv-03142, Ukraine.*
[3] *Dumlupinar University, 43270, Kutahya, Turkey.*

For the cathodic codeposition of metals, the correspondence of their crystalline lattices and the difference in their standard electrode potentials are of great importance. It seems significant from a practical point of view to study the electrodeposition of alloys whose components have crystalline lattices of different types but similar electrode potentials.

The analysis of the experimental data suggests that reversible equilibria and processes involving nickel and cobalt (II) can occur in the sodium tungstate melt. The addition of molybdenum (VI) oxide to the nickel-containing tungstate melt induces the dimolybdate-ion reduction wave. The difference in the potentials of nickel and molybdenum deposition is 0.09–0.115 V at 1173 K. Electrolysis was carried out at cathodic current densities of 0.05 and 0.1 A/cm^2 in the same temperature range (1123–1173 K). The concentration of MoO_3 was maintained at 1.0–2.5 mol %, and the NiO concentration was varied from 0.1 to 1.0 mol %. Intermetallics MoNi, $MoNi_3$, and $MoNi_4$ are sequentially deposited on the cathode at 1123–1173 K from the melts containing 0.1–1.0 mol % NiO. The same results were otained for systems Na_2WO_4–MoO_3–CoO, Na_2WO_4–WO_3–NiO, and Na_2WO_4–WO_3–CoO.

It was shown that molybdenum (tungsten) – nickel (cobalt) alloys and inter-metallics can be deposited as nanopowders from oxide melts. The composition and structure of the deposits can be controlled by varying the concentration of the corresponding components in the melt, the temperature, and the cathodic current density.

Template synthesis of mesoporous carbon material

Mandzyuk V.I., **Myronyuk I.F.**, **Sachko V.M.**, **Mykytyn I.M.**

Vasyl Stefanyk Precarpathian National University, Shevchenko Street, 57, Ivano-Frankivsk-76018, Ukraine.
E-mail: mandzyuk_vova@ukr.net

The paper studied the effect of inorganic endotemplate on morphological state and porous structure of carbon materials (CM) derived by thermolytic destruction of disaccharides. The content of endotemplate method of porous CM synthesis is that the volume of carbon precursor is filled with nanoparticles of inorganic material-template (KOH, K_2CO_3, $ZnCl_2$, SiO_2, Al_2O_3), than oxide material (K_2O, ZnO, SiO_2, Al_2O_3) is washed out from CM by water, hydrochloric or hydrofluoric acid after carbonization of precursor.

The porous structure of CM derived using as template KOH, K_2CO_3, $ZnCl_2$ is formed mainly of pore 2-6 nm in size [1]. However, the total pore volume in the material does not exceed 1.2 cm^3/g when the weight ratio of template: precursor is 3:1 and 5:1. Use aerodispersive metal oxides, particularly SiO_2 and Al_2O_3 with an average particle size of 7-15 nm, for filling of disaccharide precursors not provides CM with a specific surface area more than 800 m^2/g.

The authors found that aluminum nitrate nonahydrate $Al(NO_3)_3 \cdot 9H_2O$ with an average pore size of 4.6 nm is an effective inorganic reagent to produce mesoporous CM. Composite material C-AlOOH, in which the volume of carbon matrix is filled by globules of boehmite phase of 3-5 nm in diameter, is formed at thermolytic destruction of disaccharide precursor that contains aluminum nitrate molecules in volume. Removing this phase from CM volume by leaching method allows to obtain mesoporous carbon with a large pore volume. In particular, synthesized mesoporous carbon has a total pore volume ~ 1.6 cm^3/g and specific surface area of 1707 m^2/g when the weight ratio saccharose: AlOOH is 1:1.

Mesoporous CM obtained in such way can be used in medical practice. They also should be used as electrode materials in the manufacture of electrochemical supercapacitors.

1 *Myronyuk I.F., Mandzyuk V.I., Sachko V.M., Lisovsky R.P., Rachiy B.I.* Morphological and electrochemical properties of the lactose-derived carbon electrode materials // J. Nano- Electron. Phys. – 2016.-8(4). – P. 04006-1 – 04006-7.