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NANODISPERSED MAGNETIC MATERIALS: PRODUCTION AND APPLICATION PROBLEMS

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In the present article, results of works on studying of natural magnetite properties and its dissolution in inorganic acids, with regard to the conditions of stabilization of settled highly-disperse particles of magnetite with the use of various stabilizers on structure are described. In the prepared samples of kerosene-based magnetic liquids, the estimation of the size of particles of a disperse phase on rheological characteristics is carried out. High stability of samples in gradient magnetic field is confirmed. The method is recommended for wide use.

Keywords: magnetic liquid, synthesis, highly-disperse particles, stabilization, oleic acid, viscosity, stability in gradient magnetic field.

ELECTROCHEMICAL REACTOR FOR POROUS ANODIC OXIDES OF METALS AND SEMICONDUCTORS

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This paper provides information about the electrochemical reactor designed to produce porous anodic oxides of metals and semiconductors described features of a electrochemical reactor, which provides increased reproducibility, controllability, uniformity of the formation of porous nanostructures of metal oxides and semiconductors.

Keywords: electrochemical reactor, porous anodic oxide, nanostructure

SYNTHESIS OF NICKEL FIBERS WITH THE ROUGHENED SURFACE WITHOUT INFLUENCE OF MAGNETIC FIELD AND SURFACTANTS AND INVESTIGATION ELECTROCHEMICAL ACTIVITY OF THEM

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Formation and properties of nickel fibers with the roughened surface consist of acicular nanoparticles were investigated. It is shown that method of reducing nickel salts without influence of magnetic field and surfactants is effective for synthesis of nickel microfibers with the roughened surface. Electrochemical activity of nickel fibers in alkaline electrolyte was investigated. The received results can find application for chemical current sources, catalysis, systems of magnetic recording and information storage, electromagnetic radiation shielding.

Keywords: chemical deposition, micro- and nanofibers, high surface area, electrochemical activity.

ANTIFRICTION PROPERTIES OF BIOPOLYMER NANOCOMPOSITES BASED ON PEPTIDES AND SILVER NANOPARTICLES

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A new nanocomposite material based on peptide Asp–Glu–Val–Asp–Trp–Thr–Asp and silver nanoparticles has been prepared and studied by atomic force and scanning tunnel microscopies. During preparation, composite layers have been deposited by precipitation from aqueous solutions on gold, silver, steel, glass and mica surfaces at room temperature. Lateral (friction) and adhesion forces have been measured in experiments. It was found that the presence of peptide can decrease mean values of lateral force comparable and less than, e.g., for MoSe₂ coatings. It has been shown that in presence of silver nanoparticles, the value pH of solution during precipitation can control mean values of local adhesion forces. It has been shown that the value of friction depends on peptide surface structure rather than on silver nanoparticles concentration. As a result, obtained nanocomposite materials can be considered as promising ecologically clean and low-cost solid state antifriction lubrication coatings.

Keywords: peptides, nanoparticles, nanocomposite materials, nanotribology

PHLUORESCENCE PROPERTIES OF NANOCOMPOSITES BASED ON ZINC SULFIDE AND POLYPROPYLENE

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By method of matrix isolation by means of chemical reactions are received nanocomposites with adjustable concentration nanoparticle zinc sulphide, in a polymeric matrix polypropylene. Concentration influence nanoparticle on phluorescence properties of samples is investigated. It is established, that intensity of a luminescence of investigated structures increases in process of concentration reduction nanoparticle zinc sulphide. It was found, that an increase γ -radiation nanocomposites PP+ZnS leads to a decrease of the amplitude in the phluorescence spectrum. It was caused for disintegration of the structure polymer, increase of the volume conductivity and badly forming of the ZnS nanoparticles.

STUDYING SURFACE CRYSTALLOGRAPHIC TEXTURE AND MORPHOLOGY OF BUFFER LAYERS FOR SECOND GENERATION HIGH TEMPERATURE SUPER CONDUCTORS DEPOSITED BY DUAL THERMO REACTIVE MAGNETRON SPUTTERING.

Luchkin S.Yu., Akimov I.I., Katsai A.V., Krasnobayev N.N., Mitin A.V., Mitin V.S., Orlov V.K., Titov A.O.

A number of the experiments of the deposition of buffer thin film coatings of MgO and YSZ has been carried out varying technological parameters. Method of magnetron thermal reactive sputtering with dual scheme and « Ion-Beam-Assisted-Deposition » (IBAD) has been used for the deposition on nichrome tape substrate. The results show that crystalline stoichiometric MgO film (100 nm), deposited on the substrate is morphologically homogeneous and possesses preferentially bi-axial texture (200) with half-width of texture maximum of 5–10°, the intensity of the diffraction peak significantly increases for IBAD case. The texture of YSZ crystalline film (200 nm) corresponds to the substrate one. The results obtained show the possibility of the application of these tapes with buffers as the base of the further deposition of oxide compositions for 2G HTSC tapes

SELECTION OF CONDITIONS AND EQUIPMENT FOR REGENERATION OF MAGNETIC LIQUID

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The article describes different processes of separation of nonmagnetic materials using magnetic liquids for which the possibility of regeneration and re-usage of process liquid can have a significant effect on their profitability. The known methods of regeneration of magnetic liquids are analyzed and experimental research of different regeneration process stages has resulted in a noticeable improvement of this process without using of expensive imported equipment.

Keywords: magnetic liquid, magnetic field, particles, oleic acid, regeneration, viscosity, density, stability in gradient magnetic field.

UNIVERSAL VACUUM EQUIPMENT HPMS-MESH FOR DRAWING COVERINGS FROM MULTICOMPONENT MATERIALS, INCLUDING NANOCOVERINGS, AND FOR MANUFACTURING NANOPOWDERS.

The innovative equipment for high-power magnetron sputtering HPMS-MESH providing sputtering with power density of plasma discharge up to 500 W/sm² in planar and up to 1500 W/sm² in coaxial (tubular) systems is offered. This equipment allows obtaining various types of nanocoverings, including multilayered ones and nanopowders at an industrial level. The effect of an equal rate of sputtering of diverse materials with the use of mosaic targets during high-power magnetron sputtering (HPMS) was discovered. It promotes obtaining multicomponent nanocoverings and nanopowders with wishful properties and provides the essential technical and economic advantages over other methods of PVD. Examples of nanopowders are presented.

Keywords: high power magnetron sputtering (HPMS), equipment for magnetron sputtering, nanocoverings, multicomponent nanocoverings, nanopowders.

A NEW METHOD FOR PRODUCING THE FLUORESCENT HYDROPHILIC SILICON – BASED NANOPARTICLES

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A new method for producing hydrophilic nanosilicon particles enabling to get massive amounts of nanomaterial, which opens up the possibility of its application in medicine and biology for fluorescence diagnosis and photodynamic and photothermal therapy. Nanoparticles are obtained, giving sols in water, having sustained a bright luminescence with maximum intensity at 650 nm and 730 nm, the average size of 2-3 nm and narrow size distribution function - from 1.3 to 4.0 nm, without the use of toxic substances in their hydrophilization procedure.

Keywords: fluorescent labels, biomarkers, biodegradable nanoparticles, nanocrystalline silicon quantum dots, surface hydrophilization.