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NANOCRYSTALLINE SILICON SYNTHESIZED FROM SiO

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I. Synthesis method, thermal stability and particle size distribution

Silicon nanocrystals (nc-Si), showing stable photoluminescence in the visible spectrum synthesized from the silicon monoxide powder in the temperature range from 25° C to 950° C. For hydrosilylation procedure used 1-octadecene, which resulted in significantly increased intensity of nc-Si particles photoluminescence and acquire the capacity to form stable sols in nonpolar solvents. The thermogravimetry and differential scanning calorimetry techniques results the stability of nanoparticles in air up to 220° C. The transmission electron microscopy data showed that the core nanoparticles are composed of crystalline silicon, the maximum size of less than 5–7 nm for all the samples. By using small-angle X-ray scattering the Size Density Functions (SDF) were evaluated for nanosilicon particles synthesized by heating the silicon monoxide up to 950° C. The maxima of the SDF correspond to the nc-Si diameter, equal to 2,15–2,60 nm for different values of the synthesis temperature. The proposed method can be used for the nc-Si, having a bright stable luminescence production, in mass quantities.

II. Spectral properties

The absorption spectra of nc-Si synthesized at different temperatures exhibited a blue shift of the fundamental absorption edge with respect to silicon single-crystals. However, the largest blue shift was observed for nc-Si isolated from SiO powder not subjected to thermal treatment (i.e., at 25° C). The concentration of defects in nc-Si synthesized at temperatures higher than 600° C was found to be substantially higher than that in nanoparticles synthesized at lower temperatures. The center of gravity of the PL peak of nc-Si shifted toward longer waves as the synthesis temperature increased and exhibited a stronger red shift with respect to the photoexcitation wavelength. An analysis of the red shift led us to conclude that surface states related to Si = O double bonds and surface silicon atom dangling bonds influences the effectiveness of PL. The nc-Si photoluminescence quantum yield increased as the annealing temperature grew and reached a maximum of 11,7% for nc-Si synthesized at 950° C. The photoluminescence of nanoparticles was stable for more than seven months from the date of the hydrosilylation of their surface. Solid samples of nc-Si grafting with 1-octadecene are quite stable in air up to 220° C.

NANOSTRUCTURES INTERACTION WITH SILICATE COMPOSITIONS

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The investigation results of carbon metal containing nanostructures influence on silicate compositions properties are discussed. The changes of optical and thermal physical parameters after the modification of silicate compositions by means of nanostructures, as well as their application in civil engineering are considered. The addition of iron containing carbon nanostructures (0,03%) to silicate composition lead to the increasing of their density and heat capacity, and the modified composition thermal conductivity is decreased.

FMR, MAGNETIC AND RESISTIVE PROPERTIES OF $\{[(\text{COFEZR})_M(\text{Al}_2\text{O}_3)_{100-M}]_X/(\alpha - \text{Si})_Y\}_{40}$ NANOSTRUCTURES WITH GRANULATED MAGNETIC LAYERS

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Resistive and magnetic static and dynamic properties of multilayer amorphous nanofilms have been comprehensively carried out. The composite $\text{Co}_5\text{Fe}_5\text{Zr}$ was used as a magnetic material with Si spacers. It was shown that the system properties were determined by competing mechanisms depending on the layers' thicknesses and Si properties.

For small x in spite of the fixed composition (below and above the percolation threshold) the metallic layer consists of non-contiguous granules which magnetic interaction changes essentially with small variations of the layer thickness.

For layer thicknesses smaller than 2 nm Al_2O_3 plays a role of dielectric barrier decreasing the creation of silicides. With increasing thickness of Si spacers an average magnetization as well as that of layers drops sharply due to formation of non-magnetic silicides.

It was also shown that formation of continuum layer of Si and non-magnetic materials was accompanied by creation of a conductivity channel which decreases the resistance of the samples by three orders of magnitude.

NANOPARTICLES MAGNETITE AS CASE OF VISUALIZATION FOR PATHOLOGY AND TREATMENT ONCOLOGY ILLNESS

A.G. Akopdzhanov, V.Yu. Naumenko, E.V. Manvelov, N.L. Shimanowsky

The use of nanoparticles magnetite in pharmacology offers many advantages due to their biomedical and physical properties. It has been change of magnetic properties of composite ferrous oxide, connected with downsizing of particles, as well as behaviors in organism.

They can be used as building for the fabrication of various functional diagnostic systems and agents of therapy. This article focuses on the application of nanoparticles magnetite in pharmacology: contrast agent for MRI (magnetic resonance imaging), nanoparticles with appropriate surface, local operated hyperthermia treatment of tumors, drug delivery.

It has been determined the potential and problem application of nanoparticles magnetite in medicine.

METHOD OF SYNTHESIS NICKEL MICRO- AND NANOFIBROUS STRUCTURES WITH HIGH SURFACE AREA

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A method of synthesis nickel micro- and nanofibrous structures with different surface of fibers is presented. Control of fibers' diameter and surface is achieved by variation of physical-chemical conditions of the synthesis: application of magnetic fields, additives of complexes with surfactants. Diameter of the fibers is varied from 90 nm to several microns. Nanostructured surface of the synthesized fibers consist of acicular particles having width from several tens to several hundreds nanometers. The described possibilities of the method make it perspective for applications that need high specific surface area.

FEATURES OF FORMATION OF SILVER AND GOLD NANOBIOCOMPOSITES WITH ANTIMICROBIAL ACTIVITY

**G.P. Aleksandrova, L.A. Grishchenko,
T.V. Fadeeva, B.G. Sukhov, B.A. Trofimov**

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and Restorative Surgery SB RAMS*

Created and characterized soluble nanocomposites containing nanosized particles of silver and gold encapsulated in a biopolymer matrix arabinogalactan. It is shown that the nanobiocomposites possess high antimicrobial activity.

RESEARCH OF PLASMOACTIVATED SYNTHETIC FIBRES NANOSTRUCTURE BY X-RAY METHOD

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Research of high-strength high-modulus polyethylene fibres nanostructure, activated by nonequilibrium low-temperature plasma, by X-ray method is carried out. It is established that activation by plasma does not worsen initial unique nanocrystalline structure of fibres, in addition ordering the nanostructure in crystal domains, and promotes creation of high-strength composite materials.

ENDO-IONS AND ENDO-ELEKTRONS OF FULLERENES. CUMULATION OF DE BROGLIE WAVES OF ELECTRON CAPTURED QUANTUM RESONATOR C₆₀. NEW PROPERTIES OF NANOCOMPOSITE MATERIALS WITH LAYERS OF SPACE CHARGE

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The cumulation of de Broglie waves of electrons in the hollow molecules (for example, C_{60,70}) was investigated. The existence of negatively charged endo-ions of fullerenes with trapped electrons in the inner cavity (endo-electrons) is proved. The stationary equation Schrodinger (Helmholtz) for hollow polarized molecules is solved analytically. An endo-electron has a positive total energy, but because of the polarization forces is localized (constantly cumulating) in the center of the hollow spherically symmetric molecule (C₆₀). Analytically calculated own ψ -function and own energy, determine the probability of finding an electron in a cavity of a hollow molecule. Proper energy of a quantum cavity (C_{60,70}) is compared with experimental studies of cross sections of electron attachment to C₆₀ dependencies on electron energy. The importance of the polarization hollow molecules in the stabilization of the fullerene endo-ions with endo-electrons (with energies from 0,2 to 12 eV) is proved. The effect of the cumulation of electrons in the hollow of the molecule (the trap for electrons) can be used to control the concentration of charge carriers, their thermal, electrical properties of semiconductors and hardening of materials with free electrons. Quantum properties of polarized cavities could cause a variation of parameters of nanocomposites with the concentration of quantum modifiers (C₆₀).

FRACTAL ANALYSIS SURFACE FOR THE ASSESSMENT OF PHYSICAL AND MECHANICAL PROPERTIES OF MATERIALS SYNTHESIZED WITHIN THE GAS DISCHARGE

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The paper describes a methodic of fractal analysis to determine the surface physical and mechanical properties of the polymer according to a study of digital images. The methodic is realized with the use of computer technology and allows counting rapidly the fractal dimension of any area of the surface of the material synthesized in the gas discharge of low pressure or modified during processing. The method can be used for non-contact, non-destructive testing of the surface, in the production of coatings for various nanotechnology applications.

RESONANCE PROPERTIES OF MAGNETICALLY FUNCTIONALIZED MULTI-WALL CARBON NANOTUBES IN MILLIMETER WAVES

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This work given of the experimental results interaction of the electromagnetic radiation with different nanocomposite materials in millimeter waves range. This results is basis for design new type of nanocarbon radiomaterials and for design of new type of the microwave equipments and components.

STUDY OF PROCESSES OF SELF-ASSEMBLY AND SELF-ORGANIZING AT FORMATION METAL-POLYMERIC COMPOSITIONS

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The processes of gold and silver nanoparticles (NP) preparation in colloid solutions, its self-assembling and self-organization during metal-biopolymer material formation on solid surfaces were studied by scanning probe microscopy. Microdomains (MD) of NP growth were found on early stages of nanocomposite material formation process. These MD were the structural building elements of the metal-polymer layers. The size and shape of MD depended upon the polymer-stabilizer and NP nature. In the case of compositions, based on gold NP, obtained experimental results agreed qualitatively with the computer model of the dynamics and package of NP, which predicted the formation of the MD of NP. In the case of silver NP formation of three-dimensional nucleus of submicron size was not consistent with the theoretical model, available in the literature. The decoration by gold NP of mechanical defects on substrate surface was found.

FORMATION OF METAL FILM ELECTRODES ON NANOGRAFITE FILM SURFACE FOR THE FAST-RESPONSE HIGH-TEMPERATURE PHOTODETECTOR

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Porous nanographite films grown by plasma-chemical vapor deposition on silicon substrates have optoelectronic response, which can be used to create a high-speed detector of pulse laser radiation operating in a wide temperature range. The simple nanographite detector consists of nanographite film and two measuring electrodes attached to the film surface. The thin film electrodes of copper and gold were deposited on the surface of film by vacuum-thermal method for high temperature testing of the sensor. We show that such nanographite film photodetector can work stably on the air without changing its properties under cyclic heating up to 530 K.

NANO-, BIOTECHNOLOGIES – SYNERGIC UNION IN MANUFACTURING FIBERS, TEXTILES AND PRODUCTS FROM THEM

G.E. Krichevsky

Review of advantage, problems and risks of usage nanotechnology and biomimetic for production new generation of functional smart fibers, textile and materials from them. There are classification of nature and synthetic nanofibres as nanoscale by diameter, nanoporosity and by content nanoparticles in fibres. There are basic methods of nanotechnology and biomimetic, which are used in production of nanofibres, nanometallic and classical and new fields of their usage: composites, medicine, cosmetic, protective cloth, architectonic etc.

MODEL OF NANOSTRUCTURED COATINGS ON MEDICAL ENDOPROSTHESES BY STATISTICAL TESTS

V.M. Taran, A.V. Lyasnikova

We offer a model structure of the coating on medical endoprostheses, including the base of solid particles structured nanopores and macropores, which can be previewed before installing the implant into the body, to fill the medicinal substance necessary to improve the biocompatibility of tissue with implant materials. We made mathematical model for research the hydrodynamic characteristics of the nanostructured coating by statistical tests method (Monte Carlo).

FEATURES OF MOVEMENT OF A DROP OF A MAGNETIC LIQUID IN A ROTATING MAGNETIC FIELD

O.V. Borisenko, R.G. Zakinyan, M.A. Bedzanyan, O.V. Lotova, YU.I. Dikanski

The Stavropol State University. Stavropol, Russia

The results of experimental investigations of falling magnetic fluid drop under the action of a rotating uniform magnetic field are presented in the paper. Analyzing the obtained results theoretically, it has been deduced that the observed peculiarities of such motion can be related to the Magnus effect. The observed peculiarities can be used for study of deformation of drops in magnetic fields and internal rotations in magnetic colloids.

ESTIMATE OF ACCURACY OF PARAMETERS OF A PROCESS THE NANO-SURFACE LOW TEMPERATURE THERMODIFFUSION AT THE REGISTRATION OF MULTIVARIATE AUTOCORRECTING INTERDEPENDENT PERFORMANCES INTERCONNECTINGS MICRO AND THE NANOELECTRONIC INSTALLATION

V.M. Emelyanov, V.V. Emelyanov

Kursk state engineering university, Centre of science-educational «Nanoelectronics»

Possibilities of manufacture of highly high-reliable interconnectings with application of control the **nano-surface** thermodiffusion for provision of the demands shown to powered micro and of the **nanoelectronic** installation are displayed, at control in strength parameters of the multilayered communication structures with the subsequent optimization by measure of accuracy of a delay time of low temperature thermal diffusion process at each cycle of temperature rise with minimization of duration of process of manufacture and provision of the preset reliability.

ROLE OF GENERALISED MODEL IN BUILDING AN ANALYTICAL PLATFORM OF INNOVATIVE ECONOMY BASED ON NANOTECHNOLOGY

J.P. Firstov, S.V. Elkin V.G. Tsyganov

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The economy of a giant country can not tolerate any experiments targeted at testing various hypotheses or a search of a development model. Under the conditions of time pressure and a significant lack of finances it is necessary to develop such development model, which would appear from obvious historical tendencies and at the same time has been already successfully tested in the economy of other countries. Such model must also reveal the development mechanisms to a greater extent and suggest new effective ways of thinking and some tools for taking administrative decisions.