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ISSN 1816-4498

АДРЕС РЕДАКЦИИ:

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Сдано в набор 20.12.2013. Подписано в печать 25.12.2013
Формат 60x90^{1/8} Бумага офсетная №1.
Уч.-изд. л. 15. Физ. п. 15. Тираж 500. Заказ № 854

ООО Издательство «Янус-К».
127411, Москва, ул. Учинская, д.1

Отпечатано в ООО «Крайф»
127106, Москва, ул.Ботаническая, д.41, п.7

Редакционный совет

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THE BASIC METHODS OF OBTAINING METAL/CARBON NANOCOMPOSITES OF DIFFERENT MORPHOLOGY AND COMPOSITION

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A review of the existing methods of obtaining and the possibility to obtain the different types of metal/carbon nanocomposites at changing the obtaining conditions is carried out. The structure features of metal/carbon nanocomposites have been studied.

Key words: metal/carbon nanocomposite, polymer matrix nanoreactors, phase and structural transformations.

NANOCOMPOSITES POLYMER/ORGANOCLAY WITH SEMICRYSTALLINE MATRIX: BEHAVIOUR SIMULATION ON FRACTAL LATTICES

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It has been shown that forming from melt crystalline structure of semicrystalline polymer forms the analog of fractal lattice, defining both polymer structure as a whole and its deformational behaviour. The similar behaviour for nanocomposites polymer/organoclay with semicrystalline matrix is controlled by the indicated matrix structure only.

Key words: semicrystalline polymer, nanocomposite, organoclay, deformational behaviour, fractal analysis.

LASER MODIFICATION OF PHOTOSENSITIVE SILVER-PALLADIUM RESISTIVE FILM

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The results of studies on laser modification of the surface of photosensitive silver-palladium resistive film by powerful nanosecond duration pulse laser radiation with aim to extend its photosensitivity in UV range – were presented. Manufactured from resistive mark LPR-50 Ohm paste at burning-in temperature 878 K the silver-palladium film was repeatedly exposed by 266 nm laser radiation and average power density per pulse about 800 kW/cm². It is shown that after 480 laser pulses the photovoltaic conversion coefficient for this wavelength has increased more than 2,5 times. The obtained result is explained by the evaporation from the surface of photosensitive film of glass layer strongly absorbing the laser radiation in shortwave region.

Key words: photosensitivity, laser radiation, photovoltaic effect, scanning electron microscope (SEM), resistive film, pulse laser vaporization.

CERAMICS FORMATIVE HETEROORGANIC OLIGOMERS FOR CREATION OF MODERN NANOCERAMOCOMPOSITES

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The article describes the competitive products – the ceramic formative heteroorganic oligomers (polymers) – the typical representatives of high tech chemical compounds needed for development of new critical technologies for obtaining highly crush proof high temperature and oxidation resistant nanostructural ceramics in forms of ceramic fibers, matrices, complex protective and barrier coatings, powders. Getting of ceramocomposites from ceramics formative poly(oligo)mers belongs to the breakthrough technologies determining the level of modern and prospective technology development. The most effective and promising application area for such materials is the critical parts of gas turbine engines, high-temperature loaded units and components of power installation in aviation and missile technology, etc.

Key words: oligomers, organoaluminumoxans, organoaluminumoxansiloxans, organoaluminumoxansiloxans, organoaluminumoxansiloxans, polycarbosilans, nanometalcarbocilans, oxides, carbides, ceramocomposites.

ON INFLUENCE OF GOLD NANOPARTICLES ON MORPHOMETRIC AND ELECTROKINETIC INDICATORS OF ERYTHROCYTES AND LIMPLOCYTES IN PERIPHERAL BLOOD OF MICE

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The article has been studying morphometric and electrokinetic blood cell performance with long-term oral introduction experimental animals gold nanoparticles of a spherical shape and a diameter of 2 nm. Solutions of nanoparticles in the final concentrations of 10, 50 and 100 mg/ml was given instead of drinking water. Conducted analysis of morphometric and electrokinetic performance of blood cells. Toxic effect of nanoparticles were determined by the reaction of living test cells in their incubation with nanoparticles of gold. The results show that the study of the biological activity of gold nanoparticles in vivo has a stimulating effect on peripheral blood lymphocytes and erythrocytes, researched methods of IEF and CFM. The results of living cells suggest that the incentive effect of nanoparticles of gold relative to red blood cells may result from direct contact is extremely low concentration of the nanoparticles in the blood, erythrocyte membranes with different sectors, with an increase of negative charge cells, as well as the possible indirect effect gold nanoparticles on the activity of erythropoiesis.

Key words: blood cell indices, gold nanoparticles, eritrocytes, limfocytes, cell charge, biological activity.

FORMATION OF THE CD, IN, SN CRYSTAL NANOWIRES AND ITS OXIDES INTO POROUS ANODIC ALUMINIUM OXIDE TEMPLATE BY PULSED ELECTROCHEMICAL DEPOSITION

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This paper describes the features of the cadmium, indium, and tin oxides nanowires formation by pulsed electrochemical deposition with further thermal oxidation. Formed structures allow to increase the effective surface area of chalcogenide solar cells heterojunction to enhance their efficiency.

Key words: porous anodic alumina, pulsed electrochemical deposition, metal oxide nanowires.

THE DEPENDENCE OF SIZE OF SILICA COLLOID NANOPARTICLES FROM THEIR SYNTHESIS PARAMETERS

Daudova A.I., Mezhidov V.H., Abdullaev A.M., Elmurzaev M.B.

Results of an experimental research of sizes nanoparticles of silicon oxide, depending on concentration of components in a reaction mixture, pH, temperatures, conditions and duration of mixing are presented. The ultra-disperse silicon dioxide gained from a soluble silicate solution. Sizes of sols particles defined the particle size analyzer Horiba LB 550 and scanning electron microscope Quanta 3D. The presented results of researches allow to size up a role of each of the factors usually accompanying laboratory experiment of reception of colloidal particles of silicon dioxide, and to operate their size.

Key words: nanoparticles, silicon oxide, colloidal silica, sol, gel, soluble silicate, silicate, concentration of components, pH, temperature, mixing, particle size.

THE STRUCTURES BASED ON GRAPHITIZED NANOTUBULES WITH COMMON ELECTRODE IN PAAO-MATRIX FOR THE PROBLEM OF SWITCHED BY ELECTRIC FIELD MEMBRANES FORMATION

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The structure on the basis of anodic porous alumina with a through pores which can be of interest to realization of membranes switched by electric field is synthesized. Nanotubules are located in the pores of structure and connected to the general entrance electrode. It is suggested that growth of heterogeneity of the electric field, connected with the specified morphology of structure, will promote increase in degree of ionic selectivity of a membrane and expansion of range of admissible concentration of ions in processed solution. It is also suggested about synthesized nanotubules structure from the point of view of the task of weakening of physical ions sorption on the pores surface and growth of hydrogen and oxygen restoration potential corresponding to switched by a field membranes of existing level.

TO THE THEORY OF LIQUID DISPLACEMENT BY SURFACE-ACTIVE SUBSTANCES

Titova I.I., Titov A.O., Titov O.P., Tanganov V.V.

Discusses theoretical questions concerning the structure of water. It is shown that water has 63% of the spaces between the molecules, it may causes its solvent power and placement of molecules coming through the surface layer between the water molecules. The results of studies of fluid movement surfactants. The mechanism of moving the fluid based on the above theoretical approach to the structure of water and the physical parameters of surfactants. The possibility to preserve the structure of the labile water and embedded into the surface layer of a surfactant for a long time (about 20 seconds). Suggested that the movement of the water layer on the surface of the material on which this layer is due to electrical forces. It is shown that the intensive interaction of the water layer with the substrate layer transfer of water occurs in two stages, first moves the surface layer of «free» water and then the water layer associated with the substrate.

Key words: water, surface, surface tension, structure of water, water layer displacement.

WATER STRUCTURAL MODELS DESCRIBING CYCLIC NANOCLUSTERS

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The information on last researches of nanostructure of intermolecular water associates (nanoclusters with the general formula $(\text{H}_2\text{O})_n$ and cluster ions $[(\text{H}_2\text{O})_n]^+$ and $[(\text{H}_2\text{O})_n]^-$ by means of computer modelling and spectroscopy methods ¹H-NMR, IR-spectroscopy, Raman, Kompton dispersion, EXAFS-spectroscopy, diffraction of X-rays and neutrons on water crystals. Theoretical calculations of polihedral nanoclusters $(\text{H}_2\text{O})_n$, where $n = 3-20$ are given. The basic mathematical models describing the structure of water are considered. The average energy of hydrogen bonding between H_2O molecules in the process of cluster formation was measured by the DNES method compiles $-0,1067 \pm 0,0011$ eV. It was shown that water clusters formed from $^2\text{H}_2\text{O}$ were more stable, than those ones from H_2O due to isotopic effects of deuterium.

Key words: hydrogen bond, water, nanostructure, nanoclusters.

THE STRUCTURE OF THE LIQUID LAYER (WATER)

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Investigating the movement of liquid surface-active agents (surfactants), we focus on the ability of surfactants to open the layer thickness. Using this method allows you to visually observe the structure of the layer. At the movie clearly visible surface on which the liquid is, the adjacent layer is related to fluid and fiber-free liquid.

THE STUDY OF PROPERTIES AND ACUTE TOXICITY OF PROMISING NANOSCALE SILICON-CONTAINING DRUG CARRIERS

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The study describes the techniques of synthesis of polyorganosiloxane with different size of the nanoparticles and sulfonated silica as well as the technique of the preparation of silica nanoparticle suspension. Physical properties of the nanoparticles are also presented. The hemodynamic effects of the aqueous suspensions of the nanoparticles were studies after intravenous administration; administration of nanoparticles was not associated with acute toxicity.

Key words: polyorganosiloxane, sulfonated silica, silicon, nanoparticles, carriers, toxicity.

THE POSSIBILITIES OF INTERACTION OF LEATHER FABRIC COLLAGEN POLYPEPTIDES WITH CHEMICAL MATERIALS

Titova I.I., Titov A.O., Goncharova N.V., Titov O.P.

We consider a mechanism for calculating the amount of material that can be contacted with the surface layers of collagen fibrils glycosaminoglycans. It is shown that the glycosaminoglycans surface fibrils can bind, to 4,3% of chromium based on the oxide, and 3,2% salt based on the calcium oxide and about 8% of hydrophobic material on the bone dry weight of collagen. It is almost the amount that is used in the manufacturing processes of leather and fur production.

Key words: collagen, fibril, structure, molecular volume, fibrillar volume, fiber volume, hyaluronic acid, chondroitin sulfate, polyamide, polypeptide.

NANO-POWDERS USAGE AS A MICRO-FERTILIZER FOR OIL-BEARING CROP

**Polishchuk S.D., Nazarova A.A., Kutskir M.V.,
Churilov D.G., Churilov G.I., Ivanycheva Y.N.**

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FSBEI HPE «Ryazan State Medical University Named after I.P.Pavlov»*

The article presents data concerning possibilities to use ferrum and cuprum nano-powders as micro-fertilizers for oil-bearing crops such as colza and white mustard. They have shown that the seeds' pre-plant treatment with ferrum and cuprum nano-powders suspensions in concentration of 0,01–0,1 gr per hectare does not promote these metals accumulation in neither plants nor soil but influences the growth, development and accumulation of carotin, vitamin C, protein and water-soluble polysaccharides in plants' green material. Nano-crystal metals have great potential in inorganic nutrition and energy deposition that causes their long-term exposure on carbohydrate metabolism regulation, photosynthesis and cell respiration.

Key words: nano-powders, micro-fertilizers, yield, product quality, ecological safety.

ANALYSIS OF TUNGSTEN OXIDE NANOSTRUCTURES BY X-RAY PHOTOELECTRON SPECTROSCOPY

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The technique of quantitative and qualitative analysis of Tungsten oxide nanostructures by X-ray photoelectron spectroscopy developed. Accounting of low intensity line of W $5p_{3/2}$ to improve the quality of approximation of complex spectral line W $4f$ proposed. Using the developed methodology conducted a series of spectra deconvolution the Tungsten oxidation process and determined the dose dependence of oxides concentration. For the oxidation of Tungsten by O_2^+ , analysis of X-ray photoelectron spectra showed the presence of oxide forms W (IV), W (V), W (VI). The quantity of oxides increases monotonically from zero with increasing doses of O_2^+ with energy of 3 keV.

Key words: X-ray photoelectron spectroscopy, tungsten oxide nanostructures, thin films, ion-beam surface treatment.

CAPACITY AND THE TEMPERATURE DEPENDENCE OF THERMAL CONDUCTIVITY MECHANICALLY ALLOYED NANOSTRUKTURIRUEMYH BINARY SYSTEMS FE-SP (*sp* = C, SI, GE, SN)

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The heat capacity and temperature dependence of thermal conduction of mechanically activated nanocrystalline Fe with C, Si, Ge and Sn *sp*-elements alloys in over the temperature range from 298 K to 423 K were determined by dynamic method by IT-s-400 and IT-λ-400 calorimetric devices. The dependence of influence of *sp*-elements on Fe thermophysical properties was established.

Key words: capacity, thermal conductivity, thermal physics, nanocrystal, mechanical alloying, *sp*-element.

THE REGULARITIES OF CERTAIN MATERIALS HARDENING NANOMODIFICATION

Trukhina M.V., Mokochunina (Gnatyuk) T.V., Provotorov M.V.

Modification effect by nonagglomerated dispersion of carbon nanoparticles (nanodiamonds and carbon nanotubes) such a materials as oil I-20A, bitumen BND 60/90, rubber compound Elastosil R401/60 and formvar was researched. It was shown that nanoparticles introduction of small concentration (units of ppm) leads to materials structuring and hardening. It was found that concentration of nanomodification depends on nature of matrix. The formvar nanomodification gave to visualize-the moment of complete structuring of matrix-by transmission electron microscopy.

Key words: nanomodificator, hardening nanomodification, carbon nanoparticles, nanodiamonds, oil I-20A, bitumen BND 60/90, rubber compound Elastosil R401/60, formvar.

BORON NANOTUBES ARE NEW ELEMENTS FOR NANOELECTRONIC DEVICES

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This article presents the results of theoretical research of the influence of structural modifications of boron nanotubes on their electronic structure and conductive characteristics as well as the results of calculations of the sorption properties of single-walled boron nanotubes to atomic hydrogen. Features of external adsorption mechanisms of H atom on the surfaces of small diameter boron nanotubes with various configuration and the changes of a carrying-out and charging condition of the hydrogenated nanotube systems caused by these process are discussed. The calculations were performed using the models of ionic-built covalent cyclic cluster and molecular cluster using semi-empirical scheme MNDO.

Key words: boron nanotubes, structural modifications, conductivity state, electron-energy structure, adsorption of atomic hydrogen.

NANOSTRUCTURED METALLIC COATINGS FOR SUB-PICOMOLAR CONCENTRATION OF ORGANIC VAPORS DETECTION IN SURFACE ENHANCED RAMAN SPECTROSCOPY

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The development of physical and technological principals enabling enhancement of Raman signal became possible because of rising of nanotechnology and needs in high sensitive sensors in safety and medical applications. We suggested the method for ultra thin silver films development with thickness from 2 to 5 nm and cluster size from 5 to 50 nm. We analysis the conditions for maximum enhancement in Raman signal from adsorbed molecules and the optimal film parameters was revealed. The estimated maximum enhancement for CTAB molecules is about $\sim 10^5$ while sensitivity is about $1 \text{ amol}/\mu\text{m}^2$.

Key words: silver films, plasma sputtering, cetyltrimethylammonium bromide, Raman spectroscopy.

THE STUDY OF NONLINEAR PROPERTIES OF DISPERSE MEDIA ON CARBON NANOTUBE BASE

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The characteristics of nonlinear transmission of disperse media, based on single-layer and multilayer carbon nanotubes usable as active materials for instruments of protection of human vision, optical elements, and sensors from unapproved excess powerful laser radiation – have been studied.

Key words: limiting, laser radiation, carbon nanotube, non-linear disperse medium, Z-scan.

ПРАВИЛА ДЛЯ АВТОРОВ

1. Статью в редакцию следует предоставлять в электронном виде или на бумажном носителе с диском с электронной версией. Объем статьи – не более 15 машинописных страниц (в том числе таблицы и список литературы), 3–4 рисунка. Название статьи и фамилии авторов должны быть приведены на русском и английском языках. Статья должна содержать адреса авторов, аннотацию и ключевые слова на русском и английском языках, УДК.

2. Иллюстрации должны прилагаться к статье отдельно. Их следует пронумеровать (рис.1, рис.2, рис.3), снабдить подрисовочными подписями и перечислить в отдельной описи. Размеры рисунков не должны превышать 14×20 см.

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