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EVALUATION OF THE USE NANOMATERIALS IN THE COMPOSITE

L.V. Kozyreva

Tver State Agricultural Academy, Tver, Russia

The article outlines the basic principles to solving the problem of finding the optimum composition of polymer nanocomposites with specific dimensional characteristics of the reinforcing phase. The expediency of using polymer nanocomposites in the processes of reconstruction of parts of agricultural machinery.

Keywords: polymer nanocomposites, thermoplastic, adhesive bond, nanomaterials

TO A QUESTION OF DETECTION THE SIZES OF NANOPOWDERS PARTICLES

G.G. Krushenko

Institute Computational Modeling SB RAS, Krasnoyarsk

The methods of obtaining the nanopowders of chemical compounds, the ways of detection the sizes of Nan powders particles and its use for increasing the properties of metal production

Keywords: nanopowders chemical compounds, metal production

FEATURES COMPACTION OF ULTRAFINE AND NANODISPERSED MATERIALS

V.M. Klevlev, I.A. Kuznetsova, N.S. Trutnev

Moscow State University of Environmental Engineering, Russia

This paper addresses investigation of ultrafine and nanoscale powders of various oxidants. Present the properties and their behavior under applied loads. The resived results can be useful for building the foundations of the theory of motion of a new type of continuous media – nanopowders.

Keywords: ultrafine powders, production of nanomaterials, cryochemical method, compaction, density.

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

Ph.I. Vysikaylo

*FSI «Technological Institute for Superhard and Novel Carbon Materials»
142190, Troitsk, Moscow Region., Russia, filvys@rambler.ru*

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 Schrödinger (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).

Keywords: cumulation of de Broglie waves, endo-ion, endo-electrons, quantum-size effect

ABOUT THE POSSIBILITY OF THE SUPERDISPERSED CRYSTALLINE COVALENT CARBON NITRIDE DYNAMIC SYNTHESIS

A.A. Sivkov, A.S. Saigash, A.J. Pak

TPU, Tomsk, Russian, E-mail: mpt@elti.tpu.ru

This paper describes the results of the researches on crystalline covalent carbon nitride C_3N_4 dynamic synthesis in super-sonic pulsed carbon electric-discharge plasma jet streaming to the space filled with gaseous nitrogen. The source of plasma is high-current pulsed coaxial magnetoplasma accelerator with a graphite accelerating channel. Finded data show the possibility of the superdispersed covalent carbon nitride synthesis.

Keywords: plasma stream, dynamic synthesis, ultradispersed crystalline covalent carbon nitride.

QUASI-CLASSICAL THEORY OF OPTICAL PROPERTIES OF NICKEL NANO-CLUSTERS

A.S. Shalin^{1,2}, A.V. Gorokhovskii³

¹*Ulyanovsk State University, Ulyanovsk, Russia.*

²*Ulyanovsk Branch of the Institute of Radio Engineering and Electronics
of Russian Academy of Sciences, Ulyanovsk, Russia.*

³*Saratov State Technical University, Saratov, Russia.*

In present paper we investigate radiative transitions in nickel nano-clusters in the frame of Thomas-Fermi method and quasi-classical approximation. It is shown, that cluster's volume finitness makes additional spatially parted energy levels of electrons of conduction appear. We propose new method to calculate localization zones of conductivity electrons with different orbital quantum numbers and study macroscopic optical response of nickel nano-cluster.

Keywords: nickel nano-cluster, size quantization, light scattering by small particles, Thomas-Fermi approach, zones of electrons localization.

THE RESEARCH OF PLASMODYNAMIC SYNTHESIS PRODUCT IN C–N SYSTEM AFTER HIGH TEMPERATURE ANNEALING

A.A. Sivkov, A.J. Pak, I.A. Rahmatullin

Tomsk polytechnic university, Tomsk, Russia, E-mail: mpt@elti.tpu.ru

The findings of investigations on ultradispersed product synthesized in hyperhigh jet of carbon electrodischarged plasma, flowing into nitrogen atmosphere, with using electron scanning and transmitting microscopy, FTIR-spectroscopy and thermography are shown. The research was made to clear the product from impurity carbon phases and to rate thermal stability of covalent carbon nitride.

Keywords: dynamic synthesis, ultradispersed, crystalline, covalent, carbon nitride, thermography.

INTERACTION OF ALUMINUM NITRIDE NANOPOWDER COMPOSITION WITH WATER UNDER ISOTHERMAL CONDITIONS

O.V. Bakina, E.A. Glazkova, N.V. Svarovskaya, A.S. Lozhkomoev, M.I. Lerner

Institute of Strength Physics and Material Science, Tomsk, Russia

A detailed study on the interaction kinetics of the aluminum nitride nanopowder composition with water under isothermal conditions is represented. The effect of temperature on the basic macrokinetic parameters of the reaction has been shown and the optimum temperature for the synthesis of the nanostructured aluminum oxyhydroxide has been determined. The phase composition, the texture and adsorption characteristics of the reaction products are described.

Keywords: aluminum nitride composition, macrokinetics, hydrolysis, nanostructured aluminum oxyhydroxide, adsorption.

**CRYSTALLIZATION KINETICS OF NANOCOMPOSITES POLYETHYLENE/ORGANOCLAY:
THE FRACTAL MODEL**

B.Zh. Dzhangurazov¹, G.V. Kozlov¹, E.N. Ovcharenko², A.K. Mikitaev¹

¹ *Kabardino-Balkarian State University, Nal'chik
360004, Chernyshevskiy st., 173, Russian Federation*

² *Institute of Chemical Physics of Russian Academy of Sciences, Moscow
119334, Kosygin st., 4, Russian Federation*

The crystallization fractal model is offered for polymer nanocomposites with semicrystalline matrix. It has been shown, that the molecular mobility level is main factor, controlling the indicated process. In its turn, the last parameter is defined by nanofiller particles surface structure and interfacial regions formation mechanism.

Keywords: Nanocomposite, crystallization, molecular mobility, interfacial regions, fractal analysis.

**THE INFLUENCE OF SYNTHESIS CONDITIONS OF GOLD NANOPARTICLES
ON THE PROPERTIES OF COLLOIDAL DISPERSIONS AND BUILD
ON THEIR BASIS OF METAL-POLYMER NANOCOMPOSITIONS**

A.I. Loskutov, O.Ya. Uryupina, V.V. Vysotskii, A.V. Guselnikova, V.I. Roldugin

The formation of gold nanoparticles (NP) in aqueous solutions of cellulose derivatives (carboxymethyl cellulose (CMC), methylhydroxyethyl cellulose (MHEC)) and subsequent nanocomposite layers was studied by IR and UV-vis spectroscopy, dynamic light scattering and scanning tunnel microscopy techniques. For the first time, it was established that the stable gold nanodispersions can be obtained using the different derivatives of the cellulose not only as a stabilizer, but also as a reducing agent. IR spectral studies showed that gold reduction is due to the ability to oxidation of cellulose primary alcohol groups. However, stabilization with MHEC and CMC went by different mechanisms. In nanosystems Au-MHEC the new functional polymer groups, resulting from the gold reduction, formed with a gold surface several different bond types. Stabilization in the Au-CMC occurred in two stages. At the first stage the gold NP were stabilized by the ionized carboxyl groups of the polymer and thus formed only one bond type with the NP surface. The second stage was a reorganization of the stabilizing environment of the NP, and formation of the new, more complex polymer-gold NP bonds. Biopolymer layers based on MHEC and CMC formed the tightly packed globular structures. The size of the globules depended upon the temperature of the formation of nanocomposite layers. Formation of Au+CMC metal-polymer system did not alter significantly the structure of the surface layers. In the case of the Au+MHEC layers the formation of fibrillar structure was found. The relationship between the processes of gold reducing in solutions, the stabilization of the NP surfaces and structures of nanocomposite layers was established. The mechanism of electron conduction in the MHEC and CMC polymer layers and the role of gold NP in the tunneling processes in the nanocomposite layers was discussed.

Keywords: nanoparticles, nanocomposite materials

PLASMA ETCHING NANOSIZED GAAS IN CHLORINE AND CHLORIDE

S.A. Pivovarenok, A.V. Dunayev, A.M. Efremov, V.I. Svetsov

Ivanovo State University of Chemical Technology, Ivanovo

Nonequilibrium low-temperature plasma of chlorine and hydrogen chloride is used in the technology of micro- and nanoelectronics for clean and dry etching the surface of semiconductor wafers and the functional layers of IC. One of the important processes here is the formation of topological relief on the surface of GaAs, which is one of the most promising materials for the electronics of the future. It is due to a combination of the width of the band gap and high mobility of charge carriers, which allows you to create a wide range of GaAs-based high-speed devices. In addition, GaAs is the main material of quantum nanoelectronics based on heterojunctions in the system of AlGaAs [1].

Keywords: plasma, etching, gallium arsenide, chlorine, hydrogen chloride

CREATING NANOSTRUCTURIZED COMPOSITE MATERIALS BASED ON MULTIWALL CARBON NANOTUBES WITH THE HELP OF MOCVD-TECHNOLOGY

A.I. Kirillov, A.M. Obyedkov, V.A. Yegorov, G.A. Domrachyov, B.S. Kaverin, N.M. Semyonov, T.I. Lopatina, S.A. Gusev, A.D. Mansfeld

New equipment and MOCVD-technology for preparation and isolation of free macrocylinders with uniform thickness with walls made of radially oriented MWCNT's were developed. It was found that MWCNT deposition rate practically does not change during deposition time. Samples of nanostructured composites were prepared on the base of the macrocylinders with walls made of radially oriented MWCNT's with pyrolytic chromium and pyrolytic tungsten films, carbides and oxides, on their base. High temperature annealing of the obtained composites results in the formation of nanostructured metal oxides retaining the form of the template.

LIQUID INFORMATION CARRIER

V.S. Ashikhmin

The article discusses the approach to the problem of writing in the fluid useful information, for example, about the composition of the liquid itself, about the producer, production date, period of storage, etc. The essence of the proposed method is to use as an impurity additives («nanocode»), that carry information about the main parameters of the marked liquid, composition of fractions of chemically stable nanoparticles. In this case, the information contained in this nanocode, encoded using absolute and relative characteristics of the nanocode.

Keywords: nanocode, bar code, size of nanoparticles, concentration of nanoparticles, identification of the liquid.

COMPUTER NANOENGINEERING OF FUNCTIONAL BIOMIMETIC MATERIALS AND DEVICES

M.S. Zhukovsky¹, S.A. Beznosyuk¹, Yu.I. Ladigin²

¹ Altai state university, Barnaul, Russia

² FNPC «Altai», Biisk, Russia

Ways of development of a fundamental triad for the real nanoindustry: «a nanoscience – a nanoengineering – a nanotechnology» on the basis of interactive imitating computer experiments are discussed. The general theoretical representations about mechanisms femtosecond and attosecond genesis and processing of adaptive nanosystems of biomimetic devices and materials as a result of occurrence quantum dissipative nanostructures are stated. The analysis of results of imitating modeling activated by the Uf-laser femtosecond-impulse relaxation quantum dissipative nanostructures of graphene nanosheet and the activated biradicals of hydrogen accumulated in a nanotube of carbon is given. Computer experiments are executed by means of a program complex «Computer Nanoengineering», which resources allow to create the unified platform for investigative and creative activities in bionics areas, computing and hydrogen nanotechnologies of new generation.

Keywords: biomimetic nanosystems, subfemtosecond processing, graphene nanosheet, carbon nanotube, accumulator for biradicals of hydrogen, computer nanoengineering

IN VITRO AND IN VIVO BIODEGRADATION OF SILICA NANOCARRIERS FOR TARGETED DRUG DELIVERY

M.M. Galagudza^{1,2}, D.V. Korolev^{1,2}, N.V. Evreinova¹, D.V. Fedorov², V.N. Postnov^{1,3}, E.B. Kirpicheva^{1,3}, E.V. Baidyuk⁴

¹ V.A. Almazov Federal Center of Heart, Blood and Endocrinology, Saint-Petersburg, Russia

² I.P. Pavlov State Medical University, Saint-Petersburg, Russia

³ St.-Petersburg State University, Saint-Petersburg, Russia

⁴ Research Institute of Cytology, Saint-Petersburg, Russia

The present study was aimed at investigation of silica nanoparticles (SNP) biodegradation both *in vitro* and *in vivo*.

According to an *in vitro* biodegradation experiments, 95% of SNP are degraded within 41 day. *In vivo* biodegradation is characterized by the formation of hardly degradable (presumably, intracellular) pool of silicon in the rat liver at 20-30 days after SNP administration.

Accumulation of SNP in the hepatocytes at 1 hour after intravenous administration was further verified with scanning electron microscopy. No sign of cellular ultrastructural damage was observed.

**SPIN-INJECTION RADIATION IN TERAHERTZ RANGE
IN MAGNETIC TRANSITIONS AT ROOM TEMPERATURE**

***Yu.V. Gulyayev, P.Ye. Zilberman, I.V. Malkov, G.M. Mikhailov,
A.I. Panas, S.G. Chigaryov, E.M. Epshtein***

The investigation results are presented of spin – injection radiator containing a conductive ferromagnetic film and adjusted metal magnetic rod. The investigations are carried out at room temperatures in the frequency range 1 – 10 THz. The maximum observed power of the registered signal was 10 mW.

Key words: magnetic junction, spin injection, terahertz radiation.

ELECTROHYDRAULIC MANIPULATOR OF MICROMOVINGS

D.G. Kalyuzhnyi

Institute of Applied Mechanical of Ural Division of Russian Academy of Sciences, Izhevsk, Russia

The device allowing to make remote micromoving of objects is developed. The installation is developed on the basis of the оптико-mechanical device of scanning. The universal way of moving of objects allows to change a complete course of moving over a wide range, saving thus the minimal step. In the developed design the complete course exceeds 6 mm minimal step of 0,0025 mm.

Keywords: manipulator, microdisplacement, nanofilm, deposition, scanning, hydraulic drive