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## ANTIFRICTION PROPERTIES OF BIOPOLYMER NANOCOMPOSITES BASED ON PEPTIDES AND SILVER NANOPARTICLES

***Loskutov A.I., Grigoriev S.N., Oshurko V.B., Kosheleva N.V., Falin A.V.***

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 MoSe<sub>2</sub> coatings. It has been shown that in presence of silver nanoparticles, the value pH of solution during precipitation can control mean values of local adhesional 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.

## ADSORBENT ON THE BASIS OF POLYVINYLCHLORIDE (PVC)

***Gutkovich S.A.<sup>1</sup>, Mikhalenko M.G.<sup>2</sup>***

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Is shown the application of the adsorbent on the basis of PVC, which is a porous nanostructure for catching organic compounds from gas emissions.

*Keywords:* PVC, adsorbent, porous nanostructure, gas emissions.

## EFFECT OF DISPERSION OF PLASTIC METALS AT EXTREME EXTRUSION

***Fyodorov V.T., Ivanisenko Yu.V., Horst Han***

The fine dispersing of the ductile metals and some other materials was discovered during the experiments with so called extreme extrusion. This effect appears when the extrusion rate and pressure are one or two orders of magnitude larger than these at conventional extrusion. The resulting metallic powders have a very high chemical activity, especially in the first few milliseconds after the dispersion. The process of extreme extrusion of metals and of Teflon® is accompanied by the apparent photoemission. New methods for production of chemically clean and active materials, oxides, nitrides, hydrides, are being developed on the basis of this effect. The fine dispersing during extreme extrusion could be of substantial interest for the further study in the field of materials science, mechanics of solid state fracture and development of new technologies.

*Keywords:* extreme extrusion; powder processing; high strain rate deformation.

## OPTIMIZATION OF THE PROCESS ORGANIZATION OF A SCIENTIFIC AND TECHNICAL EXPERTISE FOR INVESTMENT PROJECT IN NANOBIO MEDICINE TECHNOLOGIES

***A.N. Tikhomirova, E.V. Sidorenko***

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One of the main components of effective nanotechnology projects investment is organization of a scientific and technical expertise. High quality system of examination means that appropriate criteria of project estimation are used and competent experts in accordance with their specialization are invited, along with that it is necessary to take into account peculiarities of project field.

*Key words:* scientific and technical expertise; criteria of project estimation; nanotechnology; selection of expert; qualification coefficient.

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## THE LIGHT AND MAGNETICALLY OPERATED OPTICAL SWITCH BASED ON THE SUSPENSION OF ONION-LIKE CARBON NANOPARTICLES

**Mikheev K.G.<sup>1</sup>, Mogileva T.N.<sup>1</sup>, Mikheev G.M.<sup>1</sup>, Kuznetsov V.L.<sup>2</sup>, Bulatov D.L.<sup>1</sup>**

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The light and magnetically operated optical switch based on the phenomena of optical power limiting and laser-induced bleaching and diamagnetism of the onion-like carbon (OLC) suspension in dimethylformamide (DMF) is developed. The main elements of the switch are optical cuvette filled with the OLC suspension, the laser radiation source, and electromagnet. The principle of operation is the following. The powerful laser radiation is focused on the cuvette with the suspension, which results in the suspension bleaching in the interaction area of laser radiation and suspension, with the bleached fraction having pronounced diamagnetic properties. After the bleaching the electromagnet turns on. The inhomogeneous magnetic field pushes the bleached fraction out of the interaction area of laser radiation with suspension, which results in the increasing of the suspension absorption to initial level. The optical switch operates at the optical limiting, «multivibrator» and «waiting multivibrator» regimes.

*Keywords:* power optical limiting, laser radiation, transmittance, diamagnetism, suspension, onion-like carbon, optical shutter.

## THE STUDY OF THE PHOTOELECTRIC PROPERTIES OF POLYIMIDES BASED ON N, N', N'', N'''-SUBSTITUTED PARAFENILENDIAMINE DIANHYDRIDE AND AROMATIC TETRACARBOXYLIC ACIDS AND THEIR COMPOSITES WITH NANOCRYSTALLINE SILICON

**Rumyantsev B.M.<sup>1</sup>, Der-Jang Liaw<sup>2</sup>, Ying-Chi Huang<sup>2</sup>, Berendyev V.I.<sup>3</sup>, Dorofeev S.G.<sup>4</sup>, Kononov N.N.<sup>5</sup>, Zubov V.P.<sup>6</sup>, Olkhov A.A.<sup>6</sup>, Fetisov G.V.<sup>4</sup>, Ischenko A.A.<sup>6</sup>**

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The photoelectric characteristics of the films of newly synthesized polyimides (PI) based on N, N', N'', N'''-parafenilendiamin substituted dianhydrides and aromatic tetracarboxylic acids and their composites with nanocrystalline silicon (nc-Si) were investigated by Electrophotographic method. The photoelectric sensitivity (PES) of the films was observed in both visible and UV spectral regions. The analyses of experimental results demonstrate that the observed PES is due to the EDA charge-transfer interaction between donor and acceptor fragments of the PI chains, i. e. electronic D-A charge-transfer complexes (CTC). Main mechanism of photogeneration consists of a thermal field dissociation of the ion-radical pairs, kinetically coupled with the excited charge-transfer complexes. The second mechanism is photogeneration of long-lived photostimulated stabilized cation radicals of the donor fragments of the PI, which are holes (majority carriers) captured by deep centers (photostimulated currents). A sharp increase in the effective quantum yield of photogeneration at low field strengths ( $E < 10^5$  V/cm) was observed for PI-containing nc-Si, which may explain the decrease in collection efficiency of charge carriers due to a decrease in the length of the migration of holes. Reducing the length of the migration of charge carriers by adding nc-Si indicates that the nanoparticles are scavengers of holes in the composite material. Nc-Si exhibit electron-donor properties and, as a more effective trapping centers of holes contribute to the stabilization and accumulation of radical cations.

*Key words:* polymer nanocomposites, nanosilicon, electrophotographic technique, charge transfer complex, photogeneration quantum yield, cation-radicals, anion-radicals.

## OBTENING OF POLYMERIC NANOCOMPOSITES BY EXPLOSIVE TREATMENT

**Adamenko N.A., Agafonova G.V., Kazurov A.V., Sedov E.V., Sergeev I.V.**

Volgograd State Technical University, Volgograd, Russia

Researchers are devoted to the explosive processing of nanostructures in the compositions of PTFE with polioksibenzoilom and different disperse metal fillings. It is shown that the creation of special conditions of loading provides flow a processes jet stream, localized severe plastic deformation, breaking and of the active turbulent mixing structural components, accompanied by destructive-recombination reactions in polymers and adhesive interaction of the components.

*Keywords:* polytetrafluoroethylene, polioksibenzoil, dispersed metallic fillers, explosive treatment, nanostructure.

**STUDY OF THE MAGNETIC PROPERTIES  
OF THE COLLOIDAL SOLUTION CONTAINING SUPERPARAMAGNETIC IRON  
OXIDE NANOPARTICLES WHEN INJECTED LABORATORY ANIMALS**

***Babich A.V., Mironova A.A., Naumenko V.Yu., Yurkov G.Yu., Reznikov I.I.***

Micrographs and size distribution of nanoparticles of iron oxide were investigated by the method of the transmission electron microscope. The resulting colloidal solution based on superparamagnetic iron oxide nanoparticles can be used as MRKS. EPR spectroscopy allowed to determine magnetic properties of various blood and liver tissue samples of laboratory animals, depending on the time of injection of colloidal solutions of nanoparticles. It is shown that after the introduction of nanoparticles, they are present in the liver and circulate in the bloodstream for more than 24 hours.

*Key words:* Super paramagnetic iron oxide nanoparticles, magnetic-resonance contrast media.

**PHYSICAL- MATHEMATICAL MODELING OF THE FORMATION PROCESS  
THE NANOPOROUS STRUCTURE IN PLASMA COATINGS**

***Taran V.M., Lyasnikova A.V., Protasova N.V., Dudareva O.A.***

*Saratov State Technical University of Gagarin Y.A., Saratov, Russia*

The model representation and estimated calculations of some parameters of the process interaction between sprayed particle and solid substrate is shown, that allows us to determine the physical laws of the formation nanostructured plasma coatings and use the results for improve their quality specifications.

*Keywords:* physical-mathematical modeling, nano-structured coating, plasma spraying

**DYNAMIC HALL EFFECT IN NANOSTRUCTURED AG–PD THICK-FIL  
BY PULSE LASER ACTION**

***Aleksandrov V.A., Mikheev G.M.***

*Institute of Mechanics, Ural Branch, Russian Academy of Sciences, Izhevsk, Russia*

The photogalvanic effect in nanostructured argentums-palladium thick-films by the circularly polarized pulse laser action are considered a possibility of the dynamic Hall effect.

*Key word:* thick-film, photovoltaic effect, circular polarization, ac Hall effect

**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. Введение

*Key words:* fluorescent labels, biomarkers, biodegradable nanoparticles, nanocrystalline silicon quantum dots, surface hydrophilization.

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## DUST PLASMA IN SOLVING PROBLEMS OF POWDER METALLURGY NANOTECHNOLOGIES.

*Raynish V.A., Shurupov A.V., Shurupov M.A.*

The problems, arising during the work with ultra dispersed powders and nano powders (UDP&NP) in powder metallurgy, were considered in this paper. It was shown that the competitive technologies and great advances in quality of products are not impossible without taking into account the factor of the absorbent contamination (pollution) of the surfaces of particles and quality of the mixture. It was shown also that application of results of basic physics investigations «dusty plasma» allows to perform the approach to resource-saving and competitive technologies. The paper says that the future belongs to vacuum production lines where the first operations have to be made in the plasma reactor with use non-equilibrium plasma.

*Key words:* ultra dispersed and nano powders, inter-particles boundaries, non-equilibrium plasma, absorbent contamination (pollution), surfaces of particles, mixing, volume defects.

## SYNTHESIS AND CHARACTERIZATION OF RED PHOTOLUMINESCENT HYDROPHILIC SILICON – BASED NANOPARTICLES

*Dorofeev S.G., Bagratashvili V.N., Dyadchenko V.P., Kononov N.N.,  
Rybaltozskii A.O., Sviridov A.P., Fetisov G.V., Tsypina C.I., Ischenko A.A.*

The article presents the results of the synthesis and physico-chemical characterization of hydrophilic biocompatible photoluminescent (PL) particles based on nanocrystalline silicon. A method of producing is simple to perform and does not require the use of toxic substances under the nanosilicon surface hydrophilization. The resulting nanoparticles exhibit bright PL with maximum intensity in the region 700–800 nm, the average size of 2,0–2,5 nm and a fairly narrow size distribution – from 1,3 to 4,0 nm. PL quantum yield reaches 15%. The degradation of the PL properties of the synthesized nanoparticles in water was studied. Revealed the presence of two spectroscopically different types of PL centers (with the concentration ratio of 2:1) with a stable PL, band maximum at 700 nm, and degraded in water PL (during about 100 hours) with a maximum near 780 nm. The possible structure of the silicon-based nanoparticles, as well as models of two types of PL centers is considered.

*Key words:* nanocrystalline Silicon, photoluminescent particles, surface hydrophilization, physico-chemical characterization.

## THE POSSIBILITY OF NANO-EFFECT IN THE SOLUTION OF POLYVINYL CHLORIDE (PVC)

*Gutkovich S.A.<sup>1</sup>, Grishin A.N.<sup>1</sup>, Mikhailenko M.G.<sup>2</sup>*

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The possibility of creating a sustainable solution of polyvinyl chloride in an organic solvent due to reduction of the sizes of the molecules to nano-scale values.

*Key words:* PVC, solution, viscosity.

## STUDYING MECHANISMS OF DEPOSITION AND FIXATION OF SILVER NANOPARTICLES IN THE STRUCTURE OF COLLAGEN- AND KERATIN-CONTAINING HIGH MOLECULAR MATERIALS (HMM).

*Pankova Ye.A., Usenko V.A., Zenitova L.A.*

It is installed that as a result of processing material containing collagen and keratin nanoparticle silver in condition of the plasma actuated particles of the metal get into structure of the material and firmly in she is fixed to account reaction with squirrel.

*Key words:* fur, structure, nanoparticles silver, plasma, modification.

## **ISOTOPETRONICS IS A NEW BRANCH OF THE NANOSCIENCE**

***Plekhanov V.G.<sup>1</sup>, Zhuravleva L.M.<sup>2</sup>***

Isotopetronics is a new branch of the nanoscience. The present paper is devoted to brief description the fundamentals and the main applications this new direction: isotope memory information and solid state processor for quantum computers.

*Key words:* isotopetronics, isotope engineered materials, excitons, low-structures, semiconductors, quantum computers.

## **SPECTRAL CONTROL OF GALLIUM ARSENIDE ETCHING PROCESS IN CHLORHYDROGENE.**

***Dunayev A.V., Pivovarenok S.A., Kapinos S.P., Yefremov A.M., Svetsov V.I.***

Spectrum investigation of GaAs plasma chemical etching in HCl was carried out. On review plasma emission spectrums control lines and stripes were chosen. On time dependences of etch product radiation intensity (particularly, atomic line of Ga) we have transient zone in beginning of etch process with duration about 1 min. The correlations of product radiation intensity with etch rate were in direct proportion. It argues about realtime spectra control ability of etch process.

*Keywords:* spectrum, control, etching, plasma etching, hydrogen chloride, gallium arsenide.

## **SPECTRAL VISUALIZATION IS A METHOD OF STUDYING FORMATION AND DISSIPATION DYNAMICS OF GAS PHASE NANOSTRUCTURES**

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f cross-section spatial distributions of atoms is shown. It is demonstrated that the method described above is informative for studying both the gas-phase nanostructures and the spatial dynamics of their raising and dissipation.

*Keywords:* shadow spectral imaging, gas-phase condensation, spatial distribution of nanoclusters, electrothermal vaporizer