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ISSN 1816-4498

АДРЕС РЕДАКЦИИ:  
117246, г. Москва, Научный проезд 20, стр.4

Сдано в набор 01.06.2012. Подписано в печать 11.06.2012  
Формат 60x90<sup>1/8</sup> Бумага офсетная <sup>1</sup> 1.  
Уч.-изд. л. 15. Физ. п. 15. Тираж 500. Заказ № 482

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

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

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## INVESTIGATION OF STRUCTURAL FEATURES OF COLD CURE EPOXY COMPOSITIONS MODIFIED COPPER/CARBON NANOCOMPOSITE

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Surfaces of films of epoxy compositions modified copper/carbon nanocomposite were explored by method of atomic force microscopy. It's installed that the introduction of ultra-low amounts of the nanocomposite effect on the supramolecular structure of the epoxy composition and leads to the formation of nanophase, uniformly distributed over the volume. Changes of the supramolecular structure of the modified epoxy composite increases the thermochemical and physical-mechanical characteristics.

*Keywords:* epoxy composition, copper/carbon nanocomposite, supramolecular structure, method of atomic force microscopy, phase contrast, relief.

## THE THERMAL ANALYSIS AND PHYSICOMECHANICAL PROPERTIES OF THE POLYVINYLCHLORIDE FILMS MODIFIED BY MESOGENES AND CARBON NANOTUBS

**Gavrilova A.O.<sup>1</sup>, Potemkina O.V.<sup>2</sup>, Syrbu E.S.<sup>1</sup>,  
Kuвшinova S.A.<sup>1</sup>, Kojfman O.I.<sup>1</sup>, Kuznetsov V.B.<sup>3</sup>**

Suspension of carbon nanotubes (CN) in liquid crystal solution was prepared. The modified PVC films were prepared by using CN and mesogenic. All samples modified PVC films and modifiers were analyzed by thermogravimetric analysis method. Temperatures beginning and ending of decomposition, energy activation of thermodestruction were determined. The results of physic-mechanical test before and after light-thermo deterioration were illustrated. The light-thermo stability of modified PVC films by mesogenic and CN were examined. Influence modification dopes on thermal and mechanical properties of PVC films are discussed.

*Key Words:* polyvinylchloride, mesogenic, carbon nanotubes, thermogravimetric analysis method, energy activation of thermodestruction, light-thermo deterioration, physic-mechanical properties.

## EXPERIMENTAL INVESTIGATION OF THE ELECTROPHYSICAL PROPERTIES OF POLYMERIC MATRIX COMPOSITES WITH NANOSTRUCTURING SEMICONDUCTORS BASED ON PP + ZNS

**Magerramov A.M., Ramazanov M.A., Karimova A.Kh.**

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Shows the results of dielectric studies of nanocomposites based on polypropylene filled with semiconductor nanoparticles of zinc sulfide by the method of matrix isolation. From the experimental results indicated that in the PP + ZnS nanocomposites changes the dielectric constant at frequencies below 100 Hz due to the low-frequency polarization. Higher values of the dielectric constant of the nature of the temperature of polymer nanocomposites with high concentrations of nanoparticles has been explained by a mechanism, involving consider nanoparticles stabilized in the bulk polymer matrix, as point sources of thermal generation of charge carriers.

*Key words:* electrophysical properties, polymer nanocomposites, semiconductor nanoparticles.

## REACTION OF ALUMINUM AND ALUMINUM NITRIDE COMPOSITE NANOPOWDERS WITH WATER

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

*Institute of Strength Physics and Material Science, Tomsk, Russia*

The regularities of reaction of aluminum and aluminum nitride composite powders with water were studied. The effect of reaction conditions on the morphology, phase composition and textural characteristics of the oxidation products was shown. It was established that during oxidation of powders in a liquid medium, the aluminum oxyhydroxide nanosheets agglomerates with high specific surface area and porosity are formed. The non-porous plates are formed in the vapor phase. The possibility of controlling the reaction to obtain the products with different morphology and phase composition was shown.

*Keywords: nanopowders, aluminium nitride composite, aluminum oxyhydroxide, the reaction with water.*

## OBTAINING BIAXIALLY TEXTURED RIBBON SUBSTRATES OF NICKEL ALLOYS FOR SECOND GENERATION SUPERCONDUCTING RIBBONS AND STUDYING THEM FROM THE POINT OF VIEW OF MATERIAL SCIENCE.

*Akimov I.I., Katsai A.V., Kryukov D.A., Luchkin S.Yu., Mitin V.S., Titov A.O.*

The results of the work on the production and investigation of metallic tape substrates with sharp cubic type texture for 2G HTSC are presented in the given paper. The influence of alloying elements on grain size and texture parameters of tape substrate had been studied. The interconnection of various regimes of thermo mechanical treatment and substrate morphological and texture peculiarities had been also investigated. It has been shown that the increase of tungsten content from 11 to 14 wt.% leads to grain size decrease from 40–50 to 20–30 mcm. The additional introduction of 0,1 wt.% of yttrium into the alloy leads to grain size decrease up to 10–15 mcm, in this case maximal texture sharpness takes place – up to (5,8–6°). The results obtained show the possibility of the usage of the tape from ternary Ni-W-Y alloy as substrate for further production of modern 2G HTSC.

*Key words: biaxially-textured substrate, HTSC, thermo mechanical treatment*

## INVESTIGATION OF THE SURFACE ROUGHNESS FOR THE NICKEL FIBERS SYNTHESIZED UNDER AN APPLIED MAGNETIC FIELD

*Morozov M.V., Batalin G.A., Gareev B.I.,  
Gilmutdinov A.Kh., Tagirov M.S., Salakhov M.Kh.*

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Nickel fibrous structures with roughened surface were synthesized via the reduction of nickel chloride with hydrazine under the influence of magnetic fields. Fibrous structures consist of submicro- or microfibers with surface covered by nanocones. A method to control the surface morphology and structure of nickel wires is developed. Studies show that magnetic fields result in increase of roughness of the fibers surface and in increase of specific surface area. X-ray diffraction and electron microscopy studies reveal that fibers consist of nanocrystallites. The obtained material may have potential and wide applications in batteries, electrochemical sensors, catalysis, magnetic recording, electromagnetic radiation shielding.

*Key words: hydrazine reduction, micro- and nanofibers, high surface area, electrochemical activity.*

## THE RELATION OF LATERAL AND ADHESION FORCES IN NANOSTRUCTURED MOLYBDENUM DISELENIDE-CARBON ANTIFRICTIONAL COATINGS STUDIED BY SPM

*Lanovoy O.V., Loskutov A.I., Mandel A.M., Oshurko V.B.,  
Solomakho G.I., Fominskii V.Y., Falin A.V.*

The complex multi-component composite coatings, produced by pulsed laser deposition, were studied by methods of classical tribology and scanning probe microscopy (AFM). Two types of coatings – containing and not containing the inclusion of MoSe<sub>2</sub> large spheroidal particles were studied. The coefficients of friction and average values of lateral and adhesion forces were determined for both types of coatings. Correlation parameter is relatively stable as the surface wear, which is offered as an upper limit of the macroscopic coefficient of friction at microsized measurements.

*Key words: nanotribology, antifrictional coatings, AFM*

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## STRUCTURE AND TRIBOLOGICAL PROPERTIES OF NEW PEPTIDE BIOCOMPOSITE FUNCTIONAL MATERIALS WITH GOLD NANOPARTICLES

**Loskutov A.I., Oshurko V.B., Karpova E.E., Kosheleva N.V., Urupina O.Y., Falin A.V.**

AFM and STM-probe microscopy were used to study the structure and tribological properties of new peptide functional composite material with gold nanoparticles (NP), deposited on the aluminum, gold, silver, steel, glass and mica surfaces. The distribution of local surface friction and adhesion forces was measured. Composite layers formed dendritic microstructures. It depended on the substrate nature and the distance between selected for measurements site and the center of the drop surface. The incorporation of gold NP into peptide matrix increased the particle size, the fractal dimension and roughness of the surface layers, but had little effect on friction and adhesion forces, compared to the original peptide layer. The measured coefficients of friction did not depend on the surface roughness. The peptide materials had nonlinear current-voltage characteristics. The main mechanism of charge transport in nanocomposite peptide layers was found to be Schottky-barrier emission. It was concluded that the main effect on the friction forces was not the presence or absence of gold NP, but the microstructure of the peptide layer, depending on the nature of the substrate significantly.

*Keywords:* peptides, nanoparticles, nanocomposite materials, nanotribology

## TECHNOLOGY AND EFFICACY OF MODIFYING CARBON PLASTICS WITH NANOPARTICLES OF DETONATION DIAMONDS.

**Ananyeva Ye.S., Novikovskiy Ye.A., Markin V.B.**

The efficiency of applying of the various nanopowders (diamond, diamond-graphite) as structural nano-modifiers of CFRP. The combined use of epoxy modified with nanoparticles and carbon fibers reinforcement plastics (CFRP) lead to increase: tensile strength 1, 5 – 2 times as much (content of ND to 1 mass %), tensile strength on 18 % (content of NDG to 1 mass %), inter laminar shear strength on 11-40 %. Dynamic shear modulus, structural homogeneity, dissipative characteristics simultaneously increase. Glass-forming zone does not change at all variants of filling.

*Key words:* carbon fibers reinforcement plastics, carbon nanoparticles, composites, binder, matrix, modification of structure.

## INCREASING THE WORK PERIOD OF TROLLEY BUS CURRENT COLLECTORS AS A RESULT OF INTRODUCING THE DETONATION SYNTHESIS DIAMOND-GRAPHITE NANOPOWDER INTO ITS COMPOSITION

**Krushenko G.G.**

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Introducing the detonation synthesis diamond-graphite Nan powder into trolley bus current collectors composition increases its work period at the extreme ecological-climatic conditions.

## DESIGN AND PROPERTIES OF NANOCOMPOSITES CONSISTING OF TiO<sub>2</sub>-NANOPARTICLES AND DNA FRAGMENTS

**Ismagilov Z.R.<sup>1,4</sup>, Shikina N.V.<sup>1</sup>, Bessudnova E.V.<sup>1</sup>, Levina A.S.<sup>2</sup>, Repkova M.N.<sup>2</sup>, Ryabchikova E.I.<sup>2</sup>, Tuzikov F.V.<sup>1</sup>, Vladimirova A.V.<sup>2</sup>, Zagrebel'nyi S.N.<sup>3</sup>, Zarytova V.F.<sup>2</sup>**

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The influence of the structure of titanium dioxide nanoparticles on their physico-chemical and biological properties (dispersion, cytotoxicity, ability to penetrate into cells and to form nanocomposites with oligonucleotides) was studied. Methods of chemical processing of sols were elaborated, which increased dispersion and biosafety of titanium dioxide nanoparticles. Several methods of the efficient immobilization of oligonucleotides onto nanoparticles were developed. The resulted TiO<sub>2</sub>-DNA nanocomposites independently on the designing method and the form of the particles (amorphous, brookite, anatase) were shown to preserve the ability of constituent oligonucleotides to complementary interactions and be capable of penetrating into eukaryotic cells without any transfection agents or physical impact.

## **NANOSENSORS FOR MATRIX TRANSDUCERS OF NON-DESTRUCTIVE TESTING DEVICES**

***Matveev V.I., Pugachev S.V.***

In article is discussed the level of development of the sensor transducers, made on a basis of the modern nanotechnologies, which can use for production of new generation devices for non-destructive testing and technical diagnostics. The application of nanosensors in matrix transducers increase the main technical data: sensitivity, resolution and monitoring productivity.

## **FOUNDRY NANOPAINTS**

***Krushenko G.G.***

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Introducing the nanopowders of refractory chemical compounds into the composition of foundry «nanopaints» decreases the burn of cast irons and steel castings made in sand forms and also increases the surface quality of aluminum alloys castings made in metallic forms in the time of increasing of its capability.

## **MATHEMATICAL MODELLING THE AUTOMATED SYSTEM OF TECHNOLOGICAL PRECONDITIONING OF MANUFACTURE AT ADAPTIVE MANAGEMENT IN INTERDEPENDENT PARAMETERS OF DEPENDABILITY OF CONTACT ELEMENTS FROM NANO STRUCTURED SUPERCONDUCTING SUBSTANCES**

***Emeljanov V.M., Pimneva L.A., Emeljanov V.V.,  
Shuklin I.I., Moiseev A.A., Alpeeva T.V., Nesterova E.L.***

Mathematical modelling in the technological preconditioning of manufacture automated system durability, temperature and time parameters for carrying out of a procedure of reception of a highly reliable interconnection wiring with application of management nano superficial thermodiffusion for maintenance of requirements to dependability to the characteristics shown to space MEA come to light durability, at the decision of a return problem of management durability in parameters multilayered superconducting nano the reticulated interconnection wiring and the account of multivariate correlation and autocorrelation.

*Keywords:* dependability, mathematical model, a multilayered interconnection wiring, superconducting substances, nano structurization, durability, nano the superficial thermodiffusion, the automated system of technological preconditioning of manufacture.