№ 3(27) 2011 НАНОТЕХНИКА

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№ 3(27) 2011 NANOTECHNICS

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ISSN 1816-4498

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117246, г. Москва, Научный проезд 20, стр.4

Сдано в набор 30.09.2011. Подписано в печать 20.10.2011
Формат 60x90 1/8 Бумага офсетная №1.
Уч.-изд. л. 13,5. Физ. п. 13,5. Тираж 500. Заказ № 1021

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

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

Annotation

THE USE OF COMPUTER SIMULATION IN THE DECISION OF TASKS OF COMPACTION NANOSCALE MATERIALS

Klevleev V.M., Koltunov V.V., Kuznetsova I.A.

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The paper presents the results of the compaction ultra-and nanosized powders of various substances. The data obtained are applied to the computer modeling of the process of dragging.

Key words: obtaining nanomaterials, cryochemical method, pressing, computer simulation, the algorithm.

FEATURES OF LOW-TEMPERATURE NANO-COMPOSITE SUPERCONDUCTORS PRODUCTION TECHNOLOGY

Kholmogorov G.L., Chernova T.V., Vlasova Yu.A.

Perm state technical university, Perm, Russia

Temperature conditions of nano-composite superconductors for International Thermonuclear Experimental Reactor (ITER) were considered in the article. Criterion of saving of post-deformative continuousness of low-temperature superconductive blanks for deformable block integrity retention during drawing process was offered.

Key words: nano-composite, superconductive material, multiple drawing, deformative heating, stress, thermo elastic condition, deformation.

THE INVESTIGATION OF PHYSICO-CHEMICAL PROPERTIES OF PTFE SURFACE BY IR SPECTRAL ELLIPSOMETRY

Makeev M.O., Ivanov Yu.A., Meshkov S.A., Gilman A.B., Yablokov M.Yu.

The effect of the low-temperature plasma treatment on the PTFE surface was studied by means of IR spectral ellipsometry. The thickness of plasma-modified layer and its optical constants were determined. The change of the roughness of the film surface was also tested. It was established that the thickness of the rough layer was decreased from 380 ± 19 nm to 353 ± 16 nm as a result of plasma treatment; and the thickness of the modified nanoscale layer of the PTFE film under the rough one is 732 ± 37 nm.

Key words: IR spectral ellipsometry, PTFE, low-temperature plasma modification, thickness of the modified nanoscale layer, optical constant, ellipsometric model, roughnesss.

FEATURES OF ELECTRIC PROPERTIES OF NANOCOMPOSITES ON THE BASIS OF POLYETHYLENE AND GRAPHITE NANOPLATES OBTAINED BY IN-SITU POLYMERIZATION METHOD

I.A.Chmutin *, P.N.Brevnov **, G.R.Sabirova **, O.D.Nazirova **, N.G.Ryvkina *, L.A.Novokshonova **

The electrical properties of polyethylene/graphite nanoplates nanocomposites, obtained by in situ polymerization method, have been studied in comparison with the properties of composites based on other carbon fillers, both nanoscale (carbon nanotubes, carbon black) and micron-sized ones (graphite, schungite). The polyethylene/graphite nanoplates nanocomposites are characterized by low percolation threshold of 2,7% vol. and have a considerably higher dielectric permeability compared to composites with other carbon fillers. The possible application areas for studied nanocomposites are discussed.

Key words: Nanocomposites, graphite nanoplates, polyethylene, in-situ polymerization, electro conductivity, dielectric permeability

SWELLING AND STABILITY OF EPOXY POLYMER COMPOSITES FILLED WITH NANOSILICA AND OTHER NANO/MICROFILLERS IN AGGRESSIVE ACIDIC MEDIUM

Starokadomsky D.L., Telegeyev I.G.

The influence of microfillers and silica with different surface nature on swelling in concentrated HNO3 were studied in this work. It is established that swelling increases with increasing of specific surface area of silica. Filling by alumosilica (alumoaerosil) let improve durability to sewlling in c.HNO3, while micofillers and anatase are not effective. Combination of optimal surface modification and concentration of silica let increase the durability of epoxy-composite in c.HNO3. In this case, according with RFS- and TEM-data, the appearance ordered zones and changes in composite structure.

Keywords: chemical durability, swelling degree, concentration, surface area, modified silica, acrylsilane A174, TEM, RFS.

FORMATION OF TIN DIOXIDE LAYERS WITH VERTICALLY ALIGNED NANOPORES

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

The possibility of application of tin oxide coverings perspective for wide using by high-frequency magnetron reactive sputtering is shown. Received layers are structured, sated by the open pores aligned perpendicularly to a substrate. The mechanism of coverings formation at which the sizes of grains is defined by density of germs is offered. It is shown that the density of germs can be controlled, changing working pressure in the vacuum chamber.

The aim of this study was to obtain nanostructured coatings. Coatings were obtained by RF reactive magnetron sputtering from pressed powder SnO_2. Sputtering was carried out on silicon wafers. Coatings were investigated by scanning electron microscopy.

It was showed that the coatings have pores. Pores are open and vertical oriented. Mechanism for the growth of the films in which the grain size depends on the density of nucleation was proposed. It was shown that the density of nucleation has a nonmonotonic dependence on the pressure. Maximum of density of nucleation observed then the length of free path equal to the distance between the target and the substrate.

Thus, the possibility of forming coatings containing open pores by RF reactive magnetron sputtering was showed and method for controlling the size of crystallites was proposed.

Key words: thin layers, tin dioxide, nanostructured layers.

DIELECTRIC PROPERTIES NANOCOMPOSITE ON THE BASIS | OF POLYVINYLDENFLUORIDE AND ZINC SULFIDE

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Results of dielectric researches nanocomposite on a basis homopolymer polyvinyldenfluoride filled semi-conductor nanoparticle sulphide of zinc by means of a method of matrix isolation are resulted. From the experimental facts followed, that in nanocomposite PVDF+ZnS change of dielectric permeability from frequency is caused by low-frequency polarization. Not monotonous change of dielectric permeability from temperature in turn had relaxation character.

Key words: nanocomposite, nanoparticle, polyvinyldenfluoride, dielectric properties

MODIFICATION OF POLYMER COMPOSITE MATERIALS WITH METAL/CARBON NANOSTRUCTURES

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The possibility of modification of polymer composite materials with supersmall quantities of metal/carbon nanostructures to increase the adhesion characteristics for breaking off and shearing is demonstrated.

Key words: metal/carbon nanocomposites, supersmall quantities, modification of polymer materials, fine suspensions.

CONCRETE NANOMODIFIERS PRODUCTION TECHNOLOGY

V.V. Panamarchuk

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Development of researches on introduction nanotechnologies in building manufacture is shown. The way and the device for manufacture nanomodificators from the mineral knitting is opened. The condition of the activated material is described. Efficiency nanomodifier concrete is estimated. The scheme of the Device for manufacture of the modifier of concrete «AIST-BRU» and a photo of a line for manufacture of this modifier is shown. Directions of the further researches in area nanotechnologies are noted.

Key words: nanotechnologies, nanomodifiers, activation, nanoconcrete, the modified cement, grinders, activators.

THE MEANS AND THE TECHNOLOGIES OF NANOPOWDERS CONTENT INCREASE IN THE ALUMINIUM MODIFICATORY RODS

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Institute Computational Modeling SB RAS, Krasnoyarsk

The means and the technologies the using of which provides the nanopowders content increase in the modificatory rods is described

Key words: nanopowders, inoculation

THE WORK-HARDENING OF CAST IRON BY THE FILTERING AND THE INOCULATION THE MELT BY MAGNESIUM AND BY THE NANOPOWDER OF THE BORON NITRIDE

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The technology of manufacturing the spheroidal graphite cast iron of the increased strength as a result of inoculation the melt by the magnesium and by the nanopowder of boron nitride with the filtering is developed

Key words: spheroidal graphite cast iron, strength, inoculation, magnesium, nanopowder of boron nitride, filtering

INTEGRAL HIGH-FREQUENCY CAPACITORS WITH NANOSTRUCTURED ANODIC OXIDE DIELECTRICS

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Integral capacitors employing nanostructured dielectrics made of anodic oxides of Al, Al–Si (1%) alloy and Al/Ta bilayer have been prepared by means of thin film technology and electrochemical anodizing. The capacitors possess high breakdown voltages (up to 270 V), low leakage currents ($< 6 \cdot 10^{-11}$ A/mm^2 at 10 V) and low dielectric losses (tgδ on the order of 10^{-3}). The revealed dispersion of dielectric constant and the features of temperature and frequency dependencies of tgδ at frequencies up to 300 MHz denote the ion-relaxation polarization, with relaxation times from 10 to 100μs depending on the dielectric type. The capacitors prepared allow for low frequency (< 10 kHz) and radiofrequency applications.

Key words: temperature and frequency dependences, ion-relaxation mechanism

EFFECTS OF DIAMOND-LIKE CARBON FILMS AND NANO PARTICLES OF HYDROXYAPATITE ON OSTEOINTEGRATION OF POROUS TITANIUM IMPLANTS

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There is investigated the effect of diamond-like carbon films (a-C) and nanoparticles of hydroxyapatite (NHA) on osteointegration of porous titanium implants. Diamond-like (a-C) films (20–50) nm thick were deposited by the method of pulsed arc sputtering of graphite. NHA have been received by the mechanical activation method. After in vivo experiment the

tensile strength of bone-implant system and the number of a mature bone formed in internal pores for three implants types (porous titanium PTi, PTi(a-C) and PTi (a-C+NHA)) are defined. It is found that a-C films accelerate formation of strong bonding between implant and bone. Additional treatment of PTi(a-C) by NGA doesn't lead to improvement of the tensile strength of bone-implant system. Diamond-like a-C films < 50 nm thick is advanced material for application in medicine in particular traumatology and orthopedy.

Key words: porous titanium, diamond-like carbon, nanohydroxyapatite, osteointegration.

STUDY PHYTOTOXICITY OF NANOPARTICLES OF BINARY COMPOUNDS OF ALUMINUM AND SILICON

Astafurova T.P., Morgalev Yu.N., Borovikova G.V., Zotikova A.P., Verkhoturova G.S., Zaytseva T.A., Postovalova V.M., Tsytsareva L.K.

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The effects of water disperse systems of nanoparticles of binary compounds of aluminum oxide (fused, Δ50 = 70 nm, alpha-form, Δ50 = 70 nm) and silicon (carbide, SiC, Δ50 = 200 nm; nitride, Si_3N_4, Δ50 = 80 nm) at concentrations 1,0; 0,01 and 0,0001 mg/l for mono – and dicotyledonous agricultural crops – oats, barley, wheat, beans, radish and tomato were studied. Phytotoxicity was assessed by the change in energy of germination, germination and growth parameters (height of shoots, the length of the embryonic root). Revealed different sensitivity to the effects of the studied cultures of nanoparticles, but the explicit system response and its concentration dependence has not been established. Phytotoxicity of nanoparticles was shown to inhibit the processes of germination and seedling root growth in plants beans, oats, wheat, barley, but abnormally developing seedlings were detected. Most phytotoxicity was found in nanoparticles of silicon carbide to plants of oats, barley and wheat.

Key words: nanoparticles of aluminum oxide (fused, alpha-form) and silicon (carbide and nitride); Avena sativa L., Hordeum vulgare L., Triticum aestivum L., Phaseolus vulgaris L., Raphanus sativus L.; Licopersicon esculentum L., morphometry.

NEW NATURAL NANOTECHNOLOGICAL MINERAL SHUNGIT

Mosin O.V.

Searching of new inexpensive filtering minerals of natural origin is the important stage on a way towards creation of new Russian filters of water purification and nanomaterials of future. Among the most known domestic natural minerals the big prospects in nanotechnology bears extracted in Karelia (Russian Federation) shungit - amorphous, not crystallized, fullerен analogious (the contents of fullerens compose 0,001 mass. %) carbon containing mineral possessing high absorptional, catalitic and bactericidal activity. These unique properties of shungit allow to use it in various processes; in manufacture of high carbonated pig-iron and ferroalloys, fine-dispersion paints and powders, e. g. water treating. In given article the data are cited on prospects of using of shungit as a sorbent in water-preparation and water purification technique.

Key words: nanotechnoloji, schungite, fullerene, waterpreparation