

HYBRID PIEZOELECTRIC COMPOSITES WITH HIGH ELECTROMECHANICAL CHARACTERISTICS

M.A.Kurbanov, A.A.Bayramov, N.A.Safarov, F.N.Tatardar, I.S.Sultanaxmedova

Institute of Physics of Azerbaijan National Academy of Sciences, Baku, Azerbaijan
azad.bayramov@yahoo.com

ABSTRACT

In given paper we present hydride piezoelectric composite materials that are characterized by a high piezoelectric modulus, high modulus of elasticity, high piezoelectric sensitivity, improved piezoelectric coupling coefficient, excellent electromechanical properties, and a wide frequency range in radiation mode. The hybrid piezoelectric composite materials may find application in power-intensive generators of acoustic waves.

NANOSTRUCTURED BINDER FOR ACID-RESISTING BUILDING MATERIALS

O.Figovsky¹, Yu. Borisov², D.Beilin¹

¹*Polymate Ltd, International Nanotechnology Center, Migdal HaEmek, Israel,*

²*Voronezh State University of Architecture and Civil Engineering*
sital@netvision.net.il

ABSTRACT

Acid-resting building materials based on liquid glass find wide application in construction as silicate polymer concretes, filler pasties, putties, etc Significant increase in strength, heat- and fire resistance of silicate matrix was achieved by introducing into the composition the tetrafurfuryl esters of orthosilic acid (tetrafurfuryloxisilane- TFS). Introduction the TFS additive into binding medium leads to formation of nanoparticles SiO₂ which acts as nucleation centers of crystallization, and furfural alcohol which fills silicate matrix and forms a cross-linked polymer. The developed nanostructured binder provided the basis for obtaining the acid resistant silicate polymer concrete and void fillers .

**NANO SENSORY ANALYSIS OF VOLATILE COMPONENTS IN THE
DIFFERENTIATING OF ANIMAL OBJECTS**

T. Kuznetsova, I.Chernucha, A. Bogdanova¹, O.Figovsky², A. Ivankin, Yu. Evdokimov³

¹ The V.M.Gorbatov All-Russian Meat Research Institute, Moscow, Russia, ² Polymate Ltd.-Israel Nanotechnology Research Center, Migdal HaEmek, Israel, ³ Moscow Forest State University, Mitishi, Russia,

aivankin@mgul.ac.ru

ABSTRACT

The problem of the identification of meat components of an animal origin with use of multitouch system of nano sensors is considered. It is shown, that analytical system VOCmeter allows to identify various substances of different chemical structure in vapour and the gas environment in the field of concentration from 0,001 up to 5 mkg/ml, and also permit to differentiate meat raw material on breeds, kinds and periods of a storage, in particular to distinguish traditional kinds of meat pork, mutton, a beef from meat of animals of a wild origin. Researches confirmed the possibility to identify the animal components on nano sensors in an individual condition and mixes.

**EFFECT OF SKIN EFFECT FOR DISTRIBUTION
CURRENT DENSITY INSIDE THE CYLINDRICAL WIRE SUBMICRON**

E.Zavitaev¹, O. Rusakov², A.Yushkanov³

¹Moscow State Forest University, Russia, ²Moskovsky State Regional Institute for the Humanities, Russia, ³Moskovsky State Regional University, Russia

lopatnikov@mgul.ac.ru

ABSTRACT

The problem of the influence of skin effect in submicron cylindrical wire is first solved. The boundary conditions of problem are diffuse reflection of electrons from the inner surface of the wire. The limiting cases and an analysis of the results are presented.

DEPOSITION OF NANOFILMS IN HIGH DENSITY PLASMA DEVICES

Yu. Tsar'gorodsev , N. Poluektov , V. Kharchenko , I. Usatov

Moscow State Forest University, Russia,
poluekt@mgul.ac.ru

ABSTRACT

The results of experiments on deposition of metal nanostructured films in a microwave Electrone cyclotronre resonance (ECR) discharge and magnetron discharge with hollow cathode are presented. High plasma density in these devices (10^{17} m^{-3}) produced in large volumes ($5 \cdot 10^{-3} \text{ m}^3$) increases the possibility of ionization of sputtered metal atoms on the way from the target to the substrate. The deposition of the films in these devices is stimulated large flows of ions, which allows to obtain nanofilms with unique properties. In addition, the flow of metal ions can be operated by an electric field near the substrate, which allows the film to deposit on submicron relief structures with a high ratio of depth (height) to width.

ALTERNATIVE TECHNOLOGY OF MULTIPLE INCREASING THE LEVEL OF CONSUMER PROPERTIES OF CONVENTIONAL MATERIALS ENGINEERING AND FUNCTIONAL PURPOSE

G.Volkov

Moscow State Technical University ,Moscow, Russia
recom.moscow@gmail.com

ABSTRACT

The final part of modern nanotechnologies is nanoparticles, which couldn't be used as engineering material. Complicated multistage technologies are used for its compacting, which makes production cycle much longer and incerases the cost of obtained bulk material. This calles into question its technical application. We are offering technology of one stage formation of bulk nanomaterials. This technology is experimentally proved on model system carbon-carbon. The material consists of carbon nanoparticles 10 nm in diameter, bind with nanosized carbon matrix and is producing as pips and plates with dimensions up to 200mm. Nanomaterial exceeds carbon materials of traditional technologies on consumer properties up to 300 times. Unique properties of carbon nanomaterial are supported by existance of industrial production and implemented in technical devices with above-world-level properties. The offering technology of bulk nanomaterials forming in one stage process can be modified for producing of materials with properties above achieved level from the raw material of any other chemical composition using gas-phase, liquid- and solid-phase crystallization processes.

MODIFYING OF MYCOLOGIC DESTROYED WOOD BY NANODISPERSION ELEMENT ORGANIC CONNECTIONS

V.Azarov, G.Kononov, N.Goryachev

Moscow Forest State University , Moscow region , Russia
kononov@mgul.ac.ru

ABSTRACT

Mycologically destruction of wood leads to sharp change of its physicochemical properties, a consequence of that is destruction the integrity of designs, and sometimes their full failure. This process can be interfered by purposeful modifying of wood at early stages of its biodestruction by means of introduction in its file various water nanodispersion of element organic connections having propensity to interaction with nanostructure of floccuses wood-destroying fungi.

THE FUNCTIONAL COATINGS BASED ON NANOCRYSTALLINE TITANIA

O. Galkina ^{1,2}, V. Vinogradov¹, A. Vinogradov ², A. Agafonov ¹

¹*Institute of Solution Chemistry,* ²*Ivanovo State University of Chemistry and Technology,*
Ivanovo, Russia
olgagalkina@mail.ru

ABSTRACT

In this study, titanium isopropoxide was used as TiO₂ precursor for preparing nanocrystalline titania in water media with or without various templates. In one case polyethylenimine was used as a structure-directing agent, and in another case Pluronic P123 was applied. Photocatalytic tests showed that textural properties as well as crystallite size were very important parameters of synthesized samples which affected the photocatalytic activity in the reaction of methyl orange decomposition in water solutions. Titania/Pluronic sols resulted in homogeneous and TiO₂ anatase – rutile with uniform particle size distribution after calcination (400°C). Surface studies were carried out with using Fourier Transform Infrared Spectrometry (FTIR). Crystalline structures were characterized by X-ray diffraction. The morphology of the surfaces was obtained by Atomic Force Microscope (AFM) techniques. It was found that TiO₂ prepared with Pluronic P123 had optimal crystallite size and demonstrated high photocatalytic activity. It was almost twice as high as that for powders obtained from sols with polyethylenimine.

TITANIA-BASED NANOCOMPOSITES POSSESSING HIGH PHOTOACTIVITY.

A. Vinogradov¹, V. Vinogradov¹, O. Galkina^{1,2}, A. Agafonov¹

¹*Institute of Solution Chemistry,* ² *Ivanovo State University of Chemistry and Technology,*
Ivanovo, Russia
olgalgalkina@mail.ru

ABSTRACT

This work describes the synthesis of photochromic highly photoactive titania-based nanocomposites doped with CuO or Ag₂O nanolayer particles obtained by low-temperature sol-gel method. It is shown that photoelectric properties, such as spectral activity and photoactivity, for obtained nanostructured uncalcined coatings are superior to those for initial unmodified components. Synthesized films are characterized using Atom force microscopy (AFM), UV-Vis spectroscopy and Transmission electron microscopy (TEM). Functional properties are studied using photopolarization measurements.

STUDY OPTIMAL CONDITIONS FOR ISOLATION OF NANO-CRYSTALLINE CELLULOSE PARTICLES

M. Ioelovich

Designer Energy Ltd, , Rehovot , Israel
bd895892@zahav.net.il

ABSTRACT

Optimal conditions for preparation of nanocrystalline cellulose particles (NCP) by treatment on initial cellulose with sulfuric acid (SA) in combination with the following high-power disintegration have been studied. The experiment showed that isolation of NCP is carried out in narrow interval of the acid concentration: from 55 to about 62 wt.%. If concentration of SA was less 50 wt.% then micro-scale particles are formed. On the other hand at concentrations of SA higher than 63 wt.% the initial cellulose completely dissolves; as a result instead of nanocrystalline the amorphous particles are formed. When concentration of SA was in the range from 55 to 62 wt.%, a low decrystallization of the initial cellulose is taken place that contributes to forming of rod-like nanocrystalline cellulose particles. The following optimal conditions of the acidic treatment for isolation of NCP were found: SA concentration 57-60 wt.%, acid to cellulose ratio 8-10, temperature 45-55 °C, time 40-60 min. These optimal conditions in combination with the high-power disintegration permit obtaining rod-like nanocrystalline cellulose particles with sizes 150-200 x 10-20 nm.

**NANOLIGNIN AS AN EFFECTIVE UV BLOCKER FOR FABRICS,
NONWOVEN AND POLYMERS FOILS**

R.Kozłowski¹, J. Batog², S. Kubica, Ł. Sytniewski¹

¹Institute for Engineering of Polymers Materials and Dyes, Toruń, Poland, ²Institute of Natural Fibres and Medicinal Plants, , Poznań , Polska

*jolanta.batog@iwnirz.pl
piastow@impib.pl*

ABSTRACT

Lignin, the by-product of wood pulping process, manufactured in the amount of more than 50 million tons per year is not satisfactorily utilized in the world as yet. Three main components of lignin are p-coumaryl alcohol, coniferyl alcohol and sinapyl alcohol monomers. By exploiting laccase aided by its mediators and alternatively by using hydrogen and new nickel catalyst, now it is possible to selectively cleave aromatic C=O bonds in lignin. The authors obtained nanostructured lignin from kraft lignin by ultrasonic treatment and this nanolignin was used for covering natural fabrics and nonwovens. Linen and hemp fabrics as well as blended linen/hemp nonwovens have shown excellent UV barrier properties and also antibacterial activity.

**SUPER DEEP PENETRATION - NEW METHOD OF NANOREINFORCED
COMPOSITES PRODUCING BASED ON POLYMER MATRIXES**

O. Figovsky¹, E. Gotlib, E. Ilicheva, A. Mokeev²

*Polymate Ltd.-INRC, Migdal HaEmek,, Israel, ² Kazan National Technological University,
Kazan, Russia*

egotlib@yandex.ru

ABSTRACT

The influence of mixing method of isoprene rubber with nanofillers on the properties of nonocompositions is investigated. It is shown that (Super deep penetration) SDP method is more effective than mixing of components in melt.

**NANOSTRUCTURES:
INVESTIGATION OF THE SPECIAL PHYSICAL PROPERTIES**

**O. Figovsky¹, D. Pashin, I. Nasyrov, Z. Khalitov, E. Semenov, D. Valeeva², M.Khusainov^{2,3}
Yu.Proshin³**

¹*Polymate Ltd., International Nanotechnology Research Center, Migdal HaEmek, Israel*

²*Kazan State Technical University, ³Kazan State Technical University, Kazan, Russia*

[*pashin@addnano.ru*](mailto:pashin@addnano.ru)

Contents

1. Structure and Diffraction by Radial Cylindrical Crystals: Two-Dimensional Case
2. Simulation of the Fresnel Diffraction in a Hole of Nanotube
3. Superconducting Spintronic Devices Based on Ferromagnet / Superconductor Nanostructures

**1. STRUCTURE AND DIFFRACTION BY RADIAL CYLINDRICAL
CRYSTALS: TWO-DIMENSIONAL CASE**

ABSTRACT

The formation of radial cylindrical crystals is possible at precipitation atoms on a cylindrical substrate. The structure and diffraction by two-dimensional ideal radial crystal is considered. The specific diffraction effect – an essential dependence of position of some reflexes on the size of crystal, is found. The basic differences from a case of layer nanotube are revealed.

**2. SIMULATION OF THE FRESNEL DIFFRACTION IN A HOLE OF
NANOTUBE**

ABSTRACT

Spectral dependences and distributions of diffraction intensity of short-wave radiation (X-ray, particles of corresponding energies) by non-chiral, chiral, spiral and radial lattices in internal hole of nanotube are calculated. The significant increase of intensity, diffracted by some kinds of nanotubes at characteristic lengths of waves, is shown. Differences and abnormal character of radiation propagation through the hole are determined.

3. SUPERCONDUCTING SPINTRONIC DEVICES BASED ON FERROMAGNET / SUPERCONDUCTOR NANOSTRUCTURES

ABSTRACT

The layered nanostructures ferromagnet / superconductor (F/S) due to combination of incompatible in homogeneous materials properties are the most perspective materials for use in the new field of electronics – a superconducting spintronics. A new type of logical devices based on the layered F/S nanostructures and combining the advantages of the superconducting and magnetic recording channels in one sample is offered. Each channel can be separately controlled by weak magnetic field or current pulse and the switching time is of order of 10^{-10} – 10^{-11} s. The realization of such devices on base of high-temperature superconductors will allow using cheap nitrogen instead of expensive helium for cooling.

INNOVATIVE NANOTECHNOLOGY FOR AGRICULTURE

**N. Voropaeva¹, O. Figovsky², A. Ibraliu, I. Shehu, N. Kadiasi³, V. Varlamov,
V. Karpachev⁴,**

¹State Research Institute All-Russian Rapeseed Research Institute (ARRI), Lipetsk, Russia, ² Polymate Ltd.-INRC, Migdal HaEmek, Israel, ³Agriculture University of Tirana, Albania, ⁴ «Bioengineering» center RAS, Moscow, Russia

bionanotex.1@mail.ru

Contents

1. Research of Processing Presowing Seeds by Nanochips and Study the Effects of Nanotechnology on Growth, Development and Crop Capacity
2. Innovative Technologies for Application of Promising Macro- and Microfertilizers together with Novel (Nano)Materials

1. RESEARCH OF PROCESSING PRESOWING SEEDS BY NANOCIPS AND STUDY THE EFFECTS OF NANOTECHNOLOGY ON GROWTH, DEVELOPMENT AND CROP CAPACITY

ABSTRACT

Nanotechnology processing seeds different agricultural cultures is offered with use physiological active complex (nano)sistem different composition and is revealed their efficiency

2. INNOVATIVE TECHNOLOGIES FOR APPLICATION OF PROMISING MACRO- AND MICROFERTILIZERS TOGETHER WITH NOVEL (NANO) MATERIALS.

ABSTRACT

Nanotechnology processing seeds different agricultural cultures is offered with use physiological active complex (nano)sistem different composition and is revealed their efficiency.

DYNAMICS OF MOLECULAR SELF-ASSEMBLY OF DRYING LIQUID DROP COMPONENTS: UTILIZATION OF THE PHENOMENON

R.Ilyazov¹, A.Khilko², A.Khobotov², V.Yakhno², A.Sanin², O.Sanina², N.Sidorovskaia³, O.Figovsky⁴, T.Yakhno²

¹Kazan State Technological University, ASRT, Russia, ²Institute of Applied Physics RAS, Russia, ³University of Louisiana at Lafayette, USA, ⁴Polymate Ltd- International Nanotechnology Research Center, Migdal HaEmek, Israel
R230@mail.ru; Tanya-yakhno@rambler.ru

ABSTRACT

This article summarizes the results of the 10 - year research on a new physical – chemical phenomenon: dynamics of self-assembly of components of liquids, which dry in a form of sessile drops on a hydrophilic support. The extracted dynamical characteristics can provide the information about liquid content and structure. The mechanisms of structure formation in sessile desiccated drops on nano- to micro-size level were proposed based on physical modeling, optical microscopy, and Atomic Force Microscope (AFM) data. A new methodological approach and device prototype were developed for registering the dynamics of mechanical properties of drying drops. The special software allows visualization and quantitative comparison this dynamics with the etalon one in real time. It has been shown that the comparison gives information about liquid contamination, as well as the influence of irradiation factors. Fake drinks, juices, drugs, etc can be easily identified. The use in rapid medical diagnostics is also feasible. Establishing liquid identification internet-based database is discussed. The approach can be utilized in developing a novel sensor unit for smart phones for widespread use.