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## A B S T R A C T S

*A.M. ZIATDINOV***NANO-SIZED PARTICLES OF GRAPHITE, THEIR COMPOUNDS AND FILM STRUCTURES**

The most important results of synthesis and investigations of nanographenes, nanographites, their compounds and film structures obtained in recent years are presented. Perspective directions of their further examinations are designated. The conclusion was made that considered carbon systems are promising materials for element basw of new technique.

**Key words:** nano graphite, nano graphite intercalated compounds, nano graphite film structures,  $\pi$ -electronic edge states, chemical reactions

*V.S. BORMASHOV, S.A. TARELKIN, M.S. KUSNETSOV, S.A. TEREENTIEV,  
S.G. BUGA, A.N. SEMENOV*

**ELECTRICAL PROPERTIES OF SYNTHETIC SINGLE-CRYSTAL DIAMONDS  
WITH DIFFERENT CONCENTRATION OF BORON DOPANT**

The electrical properties of synthetic HPHT-grown diamonds doped with boron were studied by the Hall effect measurements over the temperature range of 77-800°K. The dependences of electrical resistivity and dopant concentration on the boron amount in the initial mixture were evaluated.

**Key words:** synthetic diamond, semiconductor, Hall effect

*A.V. KALASHNIK, A.A. SERDAN, N.A. KOSHINA, S.G. IONOV*

**SYNTHESIS AND PHISICAL-CHEMICAL PROPERTIES OF COMPOSITE MATERIALS BASED  
ON INORGANIC NANO LAMINATED MATRIXES**

The mechanical and electrical properties of the new composite material based on foam vermiculite (EV) and expanded graphite (TEG) were investigated depending on the preparation conditions, the density and the content of TEG. The percolation threshold was determined on the electrical conductivity for system EV-TEG.

**Key words:** expanded vermiculite, thermally expanded graphite, composite, tensile strength, percolation, intercalation compounds

*A.V. DMITRIEV*

**USE OF ELECTRICAL-PHYSICAL METHODS FOR CHARACTERIZATION  
OF MICROSTRUCTURE OF ARTIFICIAL GRAPHITE**

The mechanism of current flow in artificial graphite was cosidered. To take into account the aggregate structure a chain model was applied which take into account conditions of the electrical connections of plate-like crystals, their disorientation from the direction of the flow of electricity, and the porosity of the material. The estimation of size of the mosaic blocks was carried out at the prevalence of contact electric resistance in the electrical resistance of artificial graphite. The dependence of calculated sizes of mosaic blocks on the texture of artificial graphite was shown.

**Key words:** graphite, polycrystalline, chain model, conductivity, magnetoresistance, texture, mosaic blocks

*M.V. MEDVEDEVA, S.L. ZABUD'KOV, A.A. MOKROUSOV, A.I. FINAENOV, A.V. YAKOVLEV*  
**ANODE SYNTHESIS OF INTERCALATED COMPOUNDS FOR OBTAINING HIGHT-SPLIT  
THERMO EXPANDED GRAPHITE**

Conditions of graphite anode intercalation were found at thermo treatment of which high-split thermo expanded graphite having apparent density of 0.6-1.0 g/l was formed. This material can be probably used as a precursor of graphene.

**Key words:** graphite intercalated compounds, high-split thermo expanded graphite, graphene preparations

*N.I. POLUSHIN, I.Yu. KUCHINA, N.N. STEPAREVA*

#### **DIAMOND GRAPHITIZATION STUDY BY METHOD OF HIGH-TEMPERATURE DIFFRACTION**

The paper presents the results of research of the effect of temperature and exposure time on the parameters of the non-diamond carbon formed. The research was conducted using the direct method of high-temperature diffractometry. The experiments established the formation of well-structured graphite for the diamond of ASM 60/40, AM 14/10 grades and nano diamond. The suggestion was done that the formation of well-structured graphite occurs due to epitaxial impact of the substrate (diamond).

**Key words:** diamond, graphitization, structure

*A.V. DMITRIEV, I.A. BASHARIN*

#### **FRACTURE SURFACE OF GRAPHITE ORE**

The SEM analysis was carried out of surface of the plate like particles of powder produced with destruction at heating of moistened pieces of cryptocrystalline graphite ore. The flat surfaces of the particles were formed by splitting along the schistosity of thickness of 2 - 4 mm. The end surfaces were formed with chips across the layers. Crystals of clearly identified crystal graphite and inter layer stratification on separate sheets of nano scale thickness were revealed in surface layer. The sheets layer forms non-dense pack along the schistosity. Thin pores between sheets impede the water vapor withdrawal from ore pieces at destruction with rupture.

**Key words:** cryptocrystalline graphite ore, fracture surface, bedding, graphite leaves, aggregation, mineral layers, scanning electron microscope

*Yu.A. KVASHNINA, A.G. KVASHNIN, L.Yu. ANTIPINA, T.P. SOROKINA, P.B. SOROKIN*

#### **INVESTIGATION OF MECHANICAL AND ELECTRONIC PROPERTIES OF NEW CARBON ALLOTROPE**

The new allotropic carbon forms were proposed and investigated. Their elastic properties were determined: Vickers hardness and bulk modulus of elasticity. The pressures of phase transitions from graphite to new carbon phases were found.

**Key words:** DFT, carbon, phase transitions, bulk modulus

*I.G. LEMESH, V.N. DENISOV, S.Yu. MARTYUSHOV, S.N. POLYAKOV*

#### **LABORATORY REAL-TIME AUTOMATED SYSTEM FOR STRUCTURE CONTROL OF DIAMOND CRYSTALS**

The laboratory automated system operating in real scale of time was developed for recognizing crystal orientation, determining the angles of the surface misorientation relative to crystallographic planes. The system was developed for the diamond crystals but it has sufficiently versatile, and it is suitable for the study of any single crystals including crystals with complex surface profile. The system can operate in both transmission and reflection modes. High system sensitivity allows to conduct experiments with time resolution up to 10 ms.

**Key words:** Laue method, X-ray diffraction, lauegram, Laue image

*T.F. YUDINA, I.V. BRATKOV, N.N. SMIRNOV, T.V. ERSHOVA, N.Yu. BEIYLINA, E.P. MAYANOV, P.G. ELIZAROV*

#### **INFLUENCE OF MECHANOCHEMICAL ACTIVATION ON SURFACE GROUPS COMPOSITION OF CARBON GRAPHITE MATERIALS**

The effect of the duration of mechanochemical activation of coke of KP trade on its structure and composition of the surface functional groups was investigated. It is found that the change in these parameters occurs wave-like. The findings give evidence of occurring of competing processes of elastic and plastic deformations and oxidation-reduction processes on the surface of coke.

**Key words:** mechanochemical activation, surface functional groups

*L.L. BUIYLOV, A.A. BOTEV*

#### **EFFECT OF DIAMOND POLYTYPE ON PROFILE OF X-RAY DIFFRACTION PATTERNS OF DIAMOND-CONTAINING MATERIALS**

The literature data on X-ray diffraction patterns of samples obtained at static compression of graphite were analyzed. All peculiarities of the diffraction patterns can be explained by presence in samples the diamond polytypes with different number of the layers. The mathematical simulation of the diffraction pattern was carried out.

**Key words:** diamond, lonsdaleite, polytypism, X-ray diffraction pattern, mathematical simulation, crystals synthesis

*N.S. SAENKO, A.M. ZIATDINOV*

**ESTIMATION OF SIZE OF GRAPHITE NANOPARTICLES – STRUCTURAL BLOCKS OF ACTIVATED CARBON FIBERS BY SIMULATION OF X-RAY DIFFRACTION PROFILE**

The sizes of nanographites – the structural blocks of activated carbon fibers were estimated without Scherrer equation by computer simulation of experimental X-ray diffraction profile using the diffraction curves for the model nanographites. The calculation of X-ray diffraction curves for nanographites was carried out within the framework of Warren-Bodenstein theory taking into account the dependence of nanographene interatomic distances on its size. The results of the structure motive investigations of nanographites and ACFs by Raman spectroscopy and low-angle X-ray scattering were also presented.

**Key words:** activated carbon fibers, nanographite, nanographene, X-ray diffraction, Raman spectroscopy, low-angle X-ray scattering

*B.P. SOROKIN, G.M. KVASHNIN, A.V. TELICHKO, M.S. KUZNETSOV, G.I. GORDEEV*  
**ELASTIC PROPERTIES OF SYNTHETIC DIAMOND SINGLE CRYSTAL**

The results of experimental studies on the propagation of bulk acoustic waves (10-200MHz) in a synthetic diamond single crystal were presented. Data were used to calculate the elastic moduluses and other elastic constants of diamond, as well as to define the anisotropy of the propagation characteristics of acoustic waves. Peculiarities of wave propagation in the neighborhood of the degeneracy points were analyzed.

**Key words:** synthetic diamond single crystal, bulk acoustic waves, elastic properties, elastic constants, anisotropy of bulk acoustic waves propagation

*A.I. SAVVATIMSKIY, A.M. KONDRATYEV, S.V. ONUFRIENKO*  
**EXPERIMENTS ON GRAPHITE MELTING UNDER HEATING BY ELECTRICAL CURRENT PULSE**

The results of experiments on the pulse electric heating anisotropic and isotropic graphite in water are given. The estimation of the "pinch" pressure caused by the current flow in a specimen was performed. The influence of the initial electrical resistance of graphite on the possibility of its melting and some issues of the experimental method ("pinch effect" and skin effect) are discussed.

**Key words:** graphite, pulse heating, electro-explosion, pinch-effect, melting, sublimation, resistance

*V.S. BORMASHOV, A.V. GOLOVANOV, A.P. VOLKOV, S.A. TARELKIN, S.G. BUGA, V.D. BLANK*  
**FORMATION OF RELIEF STRUCTURES ON MONOCRYSTALLINE SYNTHETIC DIAMOND SURFACE USING REACTIVE ION ETCHING**

Relief surface structures by the height up to 2 microns on the synthetic monocrystalline diamond were obtained by means of laser lithography and reactive ion etching. Etching rates and selectivities to aluminum and chromium in plasmas with various gas compositions were evaluated. The highest rate of reactive ion etching (70 nm/min) was achieved with sulfur hexafluoride-based plasma, with the largest etch selectivity (14) to chromium.

**Key words:** reactive ion etching, synthetic diamond, laser lithography

*S.Yu. SUZDAL'TSEV, A.V. MARKIN, D.V. NEFEDOV, Yu.A. FILIMONOV*  
**ANISOTROPIC GROWTH OF GRAPHITE-DIAMOND COMPOSITE IN MICROWAVE PLASMA OF LOW PRESSURE**

Possibility of selective deposition of carbonic material on parts of substrate with different electroconductivity at conditions of potential applying to more electroconductivity part was shown. The graphite-diamond films under study have negative thermal coefficient of resistance. At the same time the activation energy of conductivity changing over the range of 0.26–1.45 eV depending on thickness of film. It was connected with achievement of the percolation threshold.

**Key words:** graphite-diamond composite, activation energy, percolation, low-pressure microwave plasma

*D.A. OVSYANNIKOV, M.Yu. POPOV, S.G. BUGA, A.N. KIRICHENKO, S.A. TARELKIN, V.V. AKSENENKOV*

**INFLUENCE OF NANOSCALING AND MODIFICATION OF GERMANIUM BY FULLERENE ON TRANSPORT PROPERTIES OF NANOCOMPOSITE Ge-C<sub>60</sub>**

In this work the transport properties of nanoscaled and modified by fullerene C<sub>60</sub> germanium were studied. The effects of modulation of the charge carriers concentration were found as a function of the crystallite

size of germanium in the nanocomposite and the influence of fullerene on the of charge transport properties. The presence of fullerenes at the grain boundaries of germanium provides additional scattering of phonons that leads to the decrease in a thermal conductivity. Both nanoscaling and modification of the germanium nanocomposites by fullerene result in an essential increase in a thermoelectric efficiency.

**Key words:** nanoscaling, thermoelectricity, fullerene, transport properties

*T.A. IVANOVA, B.N. MAVRIN*

#### **MECHANICAL AND VIBRATIONAL PROPERTIES OF DIAMOND DOPED BY NITROGEN**

In this research we investigated structural, elastic and vibrational properties of diamond doped with nitrogen using the density functional theory. Results were compared with diamond properties. The nitrogen introducing results in a strong lattice deformation near impurities and it decreases in elastic constants, hardness and anisotropy. The experimental data that the diamond surface of (111) is harder than (100) was confirmed. The resonant local modes of nitrogen were studied. Intensities of Raman scattering spectra and IR absorption spectra intensities were calculated.

**Key words:** diamond, impurity, elastic constants, hardness, phonon states density, vibrational spectra

*F.I. VYSIKAIYLO*

#### **ELECTRON CAPTURE BY POLARIZED HOLLOW CARBON MOLECULES IN NANOCOMPOSITES. ANALYTICAL DESCRIPTION OF EMISSION SPECTRA OF STANDING EXCITONS IN CRYSTALS OF IV GROUP OF ELEMENTS DOPED As, B, P**

The author formulated the principles of the cumulative quantum mechanics (CQM). CQM describes: 1) unlimited cumulation of symmetric  $\psi_{n-1/2}$ -electron function of the de Broglie waves (with a spectrum  $E_{n-1/2} \sim \pm(n-1/2)^{\pm 2}$ ) captured potentials in spherical and cylindrical hollow cavities; 2) the polarization quantum-dimensional effects; 3) the split of the quantum level with principal quantum number  $n$  into two sublevels (with  $\psi_n$  and with  $\psi_{n-1/2}$ ) with the splitting energy  $\Delta E_{n-1/2, n} \sim n^{-1/4}$  in the case of the barrier, and with  $\Delta E_{n-1/2, n} = 13,56 \cdot (n-1/4) / \varepsilon^2 (n-1/2)^2 n^2$  [eV] for the potential well with  $U(r) \sim 1/\varepsilon r$  and 4) spectra of the transitions between states with different symmetry of  $\psi$ -functions ( $\psi_n \rightarrow \psi_{n-1/2}$ ) in the superlattices of standing excitons in IV group crystals doped As, B and P.

**Key words:** cumulative quantum mechanics, quantum resonator, hollow fullerene molecule, polarization quantum size effects, symmetric and asymmetric  $\psi$ -function, level splitting in two

#### *M.A. KHASKOV, A.R. KARAEVA, V.N. DENISOV, B.A. KULNISTKIY, V.Z. MORDKOVICH* **PHYSICAL AND CHEMICAL PROPERTIES OF CARBON NANOTUBE-BASED FIBROUS DEPOSIT**

The possibility of fabrication of a carbon nanotube-based fibrous deposit by catalytic chemical vapour deposition of ethanol was investigated. It was shown that under optimized synthesis conditions it is possible to obtain the fibrous deposit with carbon nanotube containing residue of iron as well as multi-walled and few-walled carbon nanotubes. Variation in initial ratio of  $C_2H_5OH/H_2$  and partial replacement of hydrogen by inert gas of different nature allows changing the fraction of carbon nanotubes, their structure and properties of the fibrous deposit.

**Key words:** catalytic chemical vapor deposition, carbon nanotubes, carbon nanotube-based fibers, thermal analysis, Raman spectroscopy, electron microscopy, gas chromatography

*T.F. YUDINA, N.N. SMIRNOV, I.V. BRATKOV, T.V. ERSHOVA, G.M. STROGAYA, N.Yu. BEIYLINA, E.P. MAYANOV, P.G. ELIZAROV*

#### **USE OF THERMAL - EXPANDED GRAPHITE FOR OBTAINING GRAPHENE OXIDE COLLOIDAL SOLUTION**

The possibility of obtaining graphene oxide colloids by mechanochemical dispersion of aqueous suspensions of expanded graphite on ultrasonic devices was shown.

**Key words:** graphene oxide, colloids, mechanochemical dispersion

*V.A. TYUMENTSEV, A.G. FAZLITDINOVA, S.A. PODKOPAEV, V.V. CHURIKOV*  
**FINE STRUCTURE OF POLYACRYLONITRILE AND CARBON FIBERS**

The data on the component composition and texture of polyacrylonitrile fibers depending on the size of coherent scattering regions on the angle of orientation with respect to the filament axis were obtained. The carbon fiber material was shown to be heterogeneous one; its component composition is determined by the conditions of obtaining and also depends on the angle of orientation of coherent scattering regions.

**Key words:** polyacrylonitrile fiber, carbon fiber, texture, coherent scattering region

**I.A. BUBNENKOV, Yu.I. KOSHELEV, T.V. OREKHOV, E.G. CHEBLAKOVA, I.A. KONDRASHOVA,  
Yu.A. MALININA**

**STUDY OF PHENOL FORMALDEHYDE RESIN CARBONIZATION AND CARBON-POLYMER  
COMPOSITES ON ITS BASE**

Influence of carbon filler structure on the process of graphite-polymer composition material carbonization was studied. The structure properties of the carbon filler were established to influence essentially on the carbonization process. It was experimentally determined that for carbonization the temperature of 800°C is high enough. The increase in a carbonization temperature was shown to result in possibility to regulate a macro-structure parameters of obtained material (porosity).

**Key words:** carbon filler, carbonization, graphite-polymer composite material

**Yu.G. KRYAZHEV, V.S. SOLODOVNICHENKO, I.V. ANIKEEVA**

**LOW-TEMPERATURE SYNTHESIS AND  $sp^2$  – CARBON STRUCTURES MODIFICATION USING  
TRANSFORMATIONS OF CARBON-CHAIN CHLORINATED POLYMERS**

Reactive chlorinated polymers with conjugated double bonds – polyvinylene chlorides were obtained by dehydrochlorination of carbon-chain chlorinated polymers under the action of potassium hydroxide in organic media. Subsequent heat treatment of these materials leads to the formation of carbon materials. The possibility of the synthesis of carbon composites with nanoscale modifying additives – carbon globules (carbon black) and metal oxides (Fe, Co, Ni) incorporated in amorphous carbon matrix was shown.

**Key words:** low-temperature carbon synthesis, polychlorovinyls, carbon composites

**V.E. VAGANOV, S.M. LOMAKIN, E.V. NEFEDOVA, V.Yu. ORLOV, V.V. RESHETNYAK**

**STUDY OF INFLUENCE OF CARBON NANOTUBES ON INFLAMMABILITY OF COMPOSITES  
ON BASE OF POLYETHYLENE TEREPHTHALATE**

The effect of carbon nano-additives on the combustion parameters of nanocomposites based on PET was studied. The stabilizing effect of nano-additives on the combustion process of PET was established. On results of studies the possible mechanisms of carbon nano-additives effect on PET flammability were formulated.

**Key words:** carbon nanostructures, polymers combustion, PET

**A.D. RUD, N.I. KUSKOVA, L.Z. BOGUSLAVSKIY, I.M. KIRYAN, G.M. ZELINSKAYA, N.M. BELYIY  
STRUCTURE-ENERGY ASPECTS OF CARBON NANOMATERIALS SYNTHESIS BY HIGH-  
VOLTAGE ELECTRIC DISCHARGE METHODS**

The electric discharge methods of treatment of carbon-containing substances were developed. Under these methods application the various carbon nano materials (CNM) were synthesized. The complex studies of structural state of CNM obtained with the electro discharge treatment of gaseous and liquid hydrocarbons of alkanes and cycloalkanes were carried out. In these compounds carbon atoms exist in  $sp^3$  state of hybridization. The CNM were established to be amorphous carbon with the graphite-like type of short-range and onion structure.

**Key words:** amorphous carbon, electro discharge synthesis methods, hydrocarbons, carbon onion structures

**P.A. VITYAZ, M.L. KHEIFETZ, V.T. SENYUT, A.G. KOLMAKOV**

**SYNTHESIS OF POLYCRYSTALLINE DIAMOND MATERIALS ON BASIS OF DETONATION  
NANODIAMONDS**

The analysis of the graphite-diamond phase diagram taking into account the size of the particles was carried out and modes of synthesis of diamond materials from nanostructured and ultradisperse powders were studied. Features of sintering both the purified particles and particles with non-diamond forms of carbon on a surface were revealed. It was established that at sintering diamond nanopowders covered by a thin layer of non-diamond carbon the material synthesis occurs by a way similar to catalytic synthesis instead of direct transformation of graphite lattice into diamond one.

**Key words:** nanodiamonds, nanostructured superhard materials, synthesis, high pressures, carbon, phase transformations, sintering, crystallization

**V.E. PERELMAN, L.A. GUBENKO**

**NEW IN TECHNOLOGY OF OBTAINING SUPERFINE GRAPHITE**

The article presents data on production and properties of blanks produced from superfine coke-pitch compositions. Blanks were obtained on a screw press using technology, when material in a press during molding stage is subjected to both simultaneous and step-by-step drawing deformation with different signs and di-

reactions, precipitation, shear and torsion at pressures from 10 to 40 MPa. In this case, the total deformation of charge being treated reaches several hundred percent. It provides a high quality and uniformity of properties of fine-pitch coke pieces from fine blends containing up to 24 ÷ 28% of the pitch.

**Key words:** dispersibility, coke, pitch, pressing, annealing, density

*Yu.S. BURANOVA, I.A. PEREZHOGIN, B.A. KULNITSKIY, L.A. IVANOV, V.D. BLANK*

#### **ELECTRON MICROSCOPY STUDIES OF AL<sub>2</sub>O<sub>3</sub>-FILLED BORON-NITRIDE-CARBON NANOTUBES**

Nanotubes containing boron, nitrogen and carbon were obtained in high isostatic pressure apparatus at the temperature of 1650°C and pressure of 1.5 MPa in the presence of yttrium aluminium garnet powder in Ar. Some of obtained tube contained alumina in different phase modifications. The studies were performed on the transmission electron microscopes equipped with spectrometric attachments and on scanning electron microscope. Concentration of boron and nitrogen was established to be the same while the carbon content can be changed from tube to tube.

**Key words:** boron nitride, nano tubes, aluminium transition oxides

*S.A. URVANOV, M.A. KHASKOV, Yu.L. ALSHEVSKIY, A.R. KARAEVA,  
V.Z. MORDKOVICH, N.Yu. BEIYLINA*

#### **CARBON FIBERS MODIFIED WITH LONG-LENGTH CARBON NANOTUBES AND FULLERENES**

The data on the modification of carbon fibers by means of growing the carbon nanotubes or fullerenes deposition are presented. Carbon nanotubes were grown on the carbon fiber surface by chemical vapor deposition with the use of following catalysts: Fe, Co, Fe/Cu, Fe/SiC, Fe/Al<sub>2</sub>O<sub>3</sub> and Co/Al<sub>2</sub>O<sub>3</sub>. Carbon nanostructure coating was studied by scanning electron microscopy and Raman spectroscopy. The investigation of the impact of described modifications on the physical and mechanical properties of composite materials based on modified carbon fiber is presented. The increase in adhesion between the matrix and filler in the case of the modified fibers was established.

**Key words:** carbon fibers, carbon nanotubes, fullerenes, composites

*I.A. SHARONOV, E.R. RAZYAPOV, V.M. SAMOIYLOV, Yu.I. FOLOMEIYKIN, L.M. BUCHNEV*

#### **CONDUCTIVE CORUNDUM - CARBON CERAMICS CONTAINING CARBON FILLERS OF DIFFERENT TYPES**

Prototypes of resistive corundum - carbon ceramics were obtained, and measurements of their specific electroresistance were carried out. As electroconductive additives it were used such carbon fillers as natural graphite, soot, artificial graphite, carbon fibers, multilayer carbon nanotubes and a water suspension of graphene. The content of conductive fillers was varied from 0.4 up to 20 % on volume. Depending on type and the content of fillers in samples their density was varied from 2.6 up to 2.3 g/cm<sup>3</sup>, and specific electroresistance was varied from 10<sup>8</sup> up to 10<sup>-3</sup> Ohm • cm. Dependence of specific resistance on the content of a filler has a percolation character.

**Key words:** percolation, ceramic resistors, corundum ceramic, conductivity, carbon

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#### **CATALYTIC SYNTHESIS OF CARBON NANOTUBES AND METHOD OF THEIR INTRODUCTION INTO ALUMINOSILICATE MATRIX**

A new efficient catalyst for production of carbon nanotubes (CNT) with a narrow diameter distribution was synthesized. A new method for synthesis of CNT-SiO<sub>2</sub> composite which can be efficiently introduced into an inorganic matrix was developed. The use of the CNT-SiO<sub>2</sub> composite under the synthesis of ceramic membranes made allowed obtaining the pores commensurable with the diameters of tubes after burning out CNT. Thus, changing the nano tube properties on the diameter and length it is possible to regulate the porous structure of ceramic membranes.

**Key words:** carbon nano tubes, catalyst, gibbsite, aluminum hydroxide, membranes, porous structure

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#### **OBTAINING AND SOME TECHNOLOGICAL PROPERTIES OF CARBON POWDERS BASED ON CARBON NANOTUBES AND BINDERS OF DIFFERENT NATURE**

The paper describes a method for obtaining carbonized composites based on multiwalled carbon nanotubes and a number of conventional binders for carbon materials (coal tar pitch, petroleum pitch, phenol formaldehyde resins). The most important technological parameters of the process of obtaining the composites are



revealed as well as the influence of their values on the properties of the materials (bulk density, heat and electrical conductivity).

**Key words:** carbon nanotubes, carbon nanomaterials, coal tar pitch, carbonized composites, moulding, carbonization, graphitization

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#### **RHEOLOGICAL PROPERTIES OF COAL PITCHES MODIFIED WITH CARBON NANOTUBES**

The effect of carbon nano tubes additives on the viscosity of low, medium and high temperature coal tar pitches was studied. Coal tar pitch modification with carbon nanotubes reduces the conditional activation energy of viscous flow of pitch, does not change the viscosity and does not reduce the temperature range of visco-fluid state of the binder, which makes them suitable for improving the characteristics of coal-binder pitches in carbon-carbon composites.

**Key words:** carbon nanotubes, coal tar pitch, viscosity, viscous flow activation energy

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#### **PILOT PLANT FOR PRODUCTION OF NON CALCINED ISOTROPIC PITCH COKE**

A new technology for production of high quality isotropic coke from coal coking byproducts was developed. For testing the technology the pilot plant was constructed which consisted of two assemblies: thermal oxidation and coking. For the increase in productivity it was proposed to accomplish the thermo oxidation into coking reactor. Quality check of obtained coke proved the possibility of using it as raw material for production of high quality construction graphites.

**Key words:** non-calcined pitch coke, pitch, thermal oxidation, coking, thermal polycondensation, pilot plant