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A B S T R A C T S

*S.A. KOLESNIKOV***OXIDATION RESISTANCE OF CARBON-CARBON COMPOSITE MATERIALS
IN TEMPERATURE RANGE OF DIFFUSION DAMPING**

In the area of control of oxidation rate with diffusive processes in a temperature range from 1200 K and to temperatures of sublimation the significant role of properties of carbon matter, its structure and composition are kept. The influence of carbon on oxidation rate in diffusion mode did not study enough. Now new types of carbon structural materials based on new types of precursors of carbon fillers and matrices are developed. Inadequate accounting of peculiarities of structure and material composition creates a high degree of risk at applying these materials in responsible areas of technology. The purpose of this article is generalization of experimental studies on determination of the oxidative resistance of carbon materials and their approximations.

Key words: structural graphite; carbon-carbon composite materials; specific oxidation rate; crystal structure; catalytically active impurity; molecular structure of carbon materials; empirical approximation; oxidation diffusion mode

*A.D. RUD, I.M. KIRIAN, A.M. LAKHNIK, L.Z. BOGUSLAVSKII***LOCAL ATOMIC STRUCTURE OF DISORDERED CARBON MATERIALS**

Using X-ray diffraction, reverse Monte-Carlo methods and Voronoi-Delaunay analysis, the quantitative characteristics were established for a local structure in disordered carbon materials produced by the ball-milling of pristine graphite and high-frequency electric discharge treatment of hydrocarbon gases. Voronoi polyhedra of the synthesized carbon nano-materials are characterized by a wide distribution of topological and metric characteristics with a predominance of pentagonal faces typical for amorphous structures.

Key words: amorphous carbon, medium-range order, local atomic structure, sphericity coefficient, reverse Monte-Carlo method, Voronoi polyhedral

*A.V. IVANOV, N.V. MAKSIMOVA, K.V. POKHOLOK, A.P. MALAKHO, V.V. AVDEEV***PREPARATION OF FOAM GRAPHITE WITH FERRIMAGNETIC MAGNETITE PARTICLES**

The sorbent of liquid hydrocarbons was synthesized on the basis of iron-containing foam graphite, the thermal expanded graphite material with magnetite particles coated on its surface. The composition of the iron-containing phases depending on the time of preparation of foam graphite was studied. The magnetic and sorption properties of iron-containing foam graphite were studied. The dependence of the sorption capacity on the density of the foam graphite was determined.

Key words: iron-containing foam graphite, modification with iron, magnetite, macro-porous structure, hydrocarbons sorption

*A.V. YAKOVLEV, S.L. ZABUD'KOV, E.V. YAKOVLEVA, E.V. FINAENOVA***SORBENTS FROM THERMALLY EXPANDED GRAPHITE FOR WATER PURIFICATION FROM
CATIONS OF METALS AND PETROLEUM PRODUCTS**

The results of study of the sorption properties of thermally expanded graphite on Ni^{2+} and Fe^{2+} cations and petroleum products are presented. The method of manufacturing the self-pressed filters from thermally expanded graphite without the introduction of the binder components was proposed. The relationship was established between conditions of the electrochemical synthesis of interstitial compounds of graphite and physical-chemical properties of thermally expanded graphite obtained on their basis under thermolysis at 900°C and 250°C.

Key words: graphite interstitial compounds, thermal expanded graphite, sorption, cation, oil product

M.B. SHAVELKINA, R.Kh. AMIROV, E.Kh. ISAKAEV, T.B. SHATALOVA, Yu.L. SLOVOOKHOTOV
SYNTHESIS OF CARBON NANOTUBES USING DC PLASMA TORCH

Highly effective method of synthesis of carbon nanomaterials including nano-tubes was developed. The method allows to change independently the concentration of catalyst, the flow rate of carbon, the flow rate of plasma forming gas and the power of the plasma torch during pyrolysis of hydrocarbons or soot in plasma jet using plasma torch. It is shown that changing in the flow rate, pressure and type of plasma gas, as well as the selection of catalysts and change in their composition can affect the yield of carbon nanotubes and their morphology.

Key words: soot, pyrolysis, plasma torch, catalysts, synthesis, of carbon nanostructures, nanotubes

N.P. NONISHNEVA

EFFECT OF VARIOUS ADDITIVES ON FORMATION OF POROSITY OF CARBON-GRAPHITE MATERIALS

Formation of direct porosity of carbon-graphite materials is actual problem. The paper presents the results of research on the influence of modifying additives to the coal pitch on the structure and properties of carbon-graphite composites. The use of modifying additives CARBOREZ P and pulverbakerite (SFTU) to pitch allows increasing the yield of coke residue, increase density, mechanical strength and thermal conductivity of the products. Total porosity of the material and the average diameter of the pores are reduced. The most effective additive is CARBOREZ P.

Key words: coal pitch, modifying additives, porosity, pore diameter, average physical-mechanical indicators, graphite materials

N.S. SMIRNOVA, D.A. SHLYAPIN, M.V. TRENKIN, D.I. KOCHUBEY, P.G. TSYRUL'NIKOV
PD/SIBUNITE CATALYSTS FOR LIQUID-PHASE ACETYLENE HYDROGENATION MODIFIED BY GALLIUM AND INDIUM

The structure and catalytic properties of catalysts modified by gallium and indium Pd/Sibunite for liquid-phase hydrogenation of acetylene were studied. The nature of introduced modifier (M: gallium, indium) and molar ratio of Pd:M was shown to affect strongly on the catalytic activity and selectivity of the samples. The highest activity in series under study is observed for 0.5%Pd-0.16%Ga/Sibunite, which is connected with formation of some amount of joint Pd-Ga phase.

Key words: liquid-phase hydrogenation of acetylene, EXAFS spectroscopy, palladium, gallium, indium, Sibunite

Yu.M. NIKOLENKO, A.M. ZIATDINOV

NANO-GRAPHITES AND THEIR FILM STRUCTURES ON VARIOUS SUBSTRATES

Results of growing of various film structures of nano-sized graphite particles (nano-graphites) on silicon and copper substrates are presented. The activated carbon fibers were used as a source of nano-graphite. Data of various physical methods on obtained films and conclusions on their qualitative analysis are presented as well.

Key words: nano-graphite, morphology, film structure, structure, electronic structure

P.A. VITYAZ, V.T. SENYUT, L.V. MARKOVA, T.V. GAMZELEVA, M.L. HEIYFETS
STRUCTURE PECULIARITIES OF CARBON NANOCOMPOSITES ON BASIS OF SINTERED MODIFIED NANODIAMONDS

In the article the influence of the conditions of modifying annealing and technological modes of sintering under pressure on the structure, morphology and phase composition of carbon composites on the basis of detonation nano-diamonds and diamond blend with the sizes of diamond particles of 4–10 nm was studied. Annealing the diamond blend in the reducing and hydrocarbon atmosphere was shown to provide the increase in the mechanical strength of the sintered material. It was established that the main crystalline phase in the samples on the basis of purified nano-diamonds after their vacuum annealing, thermal treatment in hydrocarbon atmosphere and sintering under pressure is the diamond phase.

Key words: modification, nano-diamonds, detonation diamond-containing blend, carbon nanocomposites, high pressure, sintering

*A.A. SHUL'ZHENKO, E.E. ASHKINAZI, L.F. STASYUK, V.G. GARGIN, A.P. ZAKORA,
V.G. RAL'CHENKO*

INVESTIGATION OF PHYSICAL AND MECHANICAL PROPERTIES OF HYBRID DIAMOND CARBIDE PLATES USING SINTERED DIAMOND MICROPOWDERS OF POPIGAIY DEPOSIT

The possibility of use the micro-powders of IMPACT diamond of Popigai deposit was studied for the manufacture of hybrid diamond carbide plates. The studies found that the heterogeneity of the disperse composition of the polycrystalline layer affects its physical and mechanical properties and performance. Overcoming this negative factor is possible by pre-treatment of initial diamond micro-powder providing the homogeneity of grain composition, physical and mechanical properties (strength). It allows preserving the initial grains under high pressure.

Key words: diamond, CVD diamond, diamond-hard alloy plate, high pressure, sintering, hardness, wear resistance

L.Yu. ANTIPINA, T.P. SOROKINA, P.B. SOROKIN

TRANSFORMATION OF MULTI-LAYER GRAPHENE INTO DIAMOND FILM UNDER ACTION OF CHEMICAL FUNCTIONALIZATION: THEORETICAL STUDY

In given study we proposed a new way to produce the pure diamond films with the method of graphene chemical functionalization. Our ab-initio calculations showed that depending on functionalization graphene may be converted spontaneously to cubic or hexagonal diamond film with a different surface and properties. The functionalization was studied at application of hydrogen, fluorine, and water at different temperatures and pressures.

Key words: DFT, graphene, multilayer graphene, diamond film

B.Sh. DYSKINA, V.S. LESYUK, T.V. KABANOVA

COMPOSITION OPTIMIZATION OF PROTECTIVE COATING FROM HIGH-TEMPERATURE OXIDATION OF GRAPHITIZED ELECTRODES

The comparative analysis of known compositions of protective coatings of graphitized electrodes was carried out. The results of experimental tests are given for aluminum oxide and silica compounds as a cover of graphite laboratory samples on the basis of cokes of various structures. The effective decrease in an oxidation of graphite based on the needle-shaped coke covered with the non-oxygen silica-containing compounds was revealed.

Key words: needle-shaped coke, graphitized electrodes, oxidation, coating, oxidation reducing

N.I. POLUSHIN, M.S. OVCHINNIKOVA, A.L. MASLOV, I.Yu. KUCHINA

STUDY OF STRENGTH CHARACTERISTICS OF COMPOSITE ELECTROCHEMICAL NICKEL COATINGS WITH NANO-DIAMONDS

This article reflects the results of a study of dependence of micro-hardness of electrochemical nickel composite coating with the diamond nano-particles as a dispersion phase on the concentration of diamond nano-powder in an electrolyte. The results of tests of model samples and tools on resistance to abrasion and wear resistance are presented.

Key words: composite electrochemical coating; nano-diamonds; abrasion resistance; micro-hardness; tool life; diamond electroplating tool

M.A. KHASKOV, V.A. BOLSHAKOV, Yu.I. MERKULOVA, T.A. GREBENEVA

INFLUENCE OF CARBON NANOTUBES ON KINETIC ASPECTS OF CURING THERMOSETTING BINDERS ON EXAMPLE OF EPOXY RESINS

Using differential scanning calorimetry it was shown that the presence of carbon nano-tubes (CNTs) accelerates the curing of the epoxy resins in the chemical-control regime at the beginning of the reaction, but slows it down at higher degree of conversion that, as it was proposed, is related with high aspect ratio of CNTs. At the diffusion-control regime, CNTs partly slow down the curing reaction due to the increasing of polymer matrix fragility and enhancing of its physical aging rate.

Key words: carbon nanotubes, epoxy resins, curing kinetics

E.R. VALINUROVA, F.Kh. KUDASHEVA

STRUCTURAL-GROUP COMPOSITION OF FIBER-FORMING OIL PITCHES

The group composition of fiber-forming oil pitches with different formability was determined. Narrow fractions of asphaltenes were separated. The molecular weight, elemental composition, the main structural parameters of narrow fractions of asphaltenes was determined.

Key words: oil pitch, asphaltenes, narrow fractions, structural parameters

A.V. DMITRIEV, S.V. MORDANOV

SIMULATION OF OXIDATION PROCESS OF ANTHRACENE FRACTION BY FINITE ELEMENT METHOD

In given study the process of oxidation of anthracene fraction under air bubbling was investigated. On the basis of digital simulation the analysis of oxidation kinetics was carried out. The ways of the experimental verification of the kinetic model of anthracene oxidation are considered.

Key words: anthracene fraction, oxidation kinetics, babbling

E.P. SHESHIN, A.Yu. KOLODYAZHNYIY, A.S. RAUFOV

SOURCES OF GENERAL LIGHTING WITH FIELD-EMISSION CATHODES FROM CARBON MATERIALS

A real alternative to the existing energy-saving light sources can be environmentally friendly energy-saving cathodoluminescent light sources (CLS) of the new generation, based on the luminescence under the action of electrons obtained by field emission from field-emission cathode. Unfortunately, there is no developments to optimize the design of general purpose lamps with field-emission cathodes neither we, nor abroad yet. However, up to date, several prototypes of cathodoluminescent light sources with long life time were developed in the MIPT laboratories. Therefore, the first step is to develop a working prototype of a highly low cost CLS at mass production.

Key words: field emission, field emission properties of materials, field emission cathodes, carbon, carbon fibers, cathodoluminescent light sources

O.E. MAKAROVA, E.P. SHESHIN

BLADE THERMALLY EXPANDED GRAPHITE FIELD EMISSION CATHODES

Cathodoluminescent lamps which operation is based on the phenomenon of field emission are energy efficient, durable and environmentally friendly light sources. Fabrication of the source main element – a field emission cathode – from carbon materials having chemical resistance, high stability and unique mechanical properties is the most promising. It is possible to obtain high emission current values due to increasing the emitting surface area using blade type of the cathodes.

Key words: cathodoluminescence light sources, autoelectronic emission, carbon materials, blade automated

A.Yu. KOLODYAZHNYIY, E.P. SHESHIN

FIELD EMISSION OF SOME TYPES OF POLYACRYLONITRILE CARBON FIBERS

With the development of field-emission technologies new areas of their application are opening up, where cathodoluminescence light sources may realize all their advantages. Currently field emission properties of polyacrylonitrile carbon fibers (PAN CF) are under heavy research. The aim of this work is to compare PAN CFs field emission properties and to make conclusion on the possibility of their industrial application.

Key words: field emission, field emission properties of materials, field emission cathodes, carbon, polyacrylonitrile carbon fibers