

EFFECT OF LATTICE DISTORTIONS ON CRYSTALLINE STRUCTURE OF CI

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ABSTRACT

Impact of lattice distortions on parameters and packing density of crystalline unit cell of various cellulose samples has been studied. It was disclosed that decrease of the degree of paracrystallinity leads to reduction of parameters "a", "b" and specific volume of C1 β unit cell. Parameter "c" tends to increase with decrease in the degree of paracrystallinity. Using the specific volume of undistorted equilibrium lattice of CI and specific volume of paracrystalline lattice, the degree of distortion of crystalline lattice of various cellulose samples was evaluated. The results showed that large crystallites of tunicate cellulose have a little distorted monoclinic crystalline structure, while monoclinic lattice of smaller crystallites of cotton linter, bast fibers and wood cellulose is more distorted. Triclinic lattice of CI α celluloses was highly distorted. However, paracrystalline distortions in large crystallites of algal or bacterial celluloses are negligible, therefore a high imperfection of CI α lattice is caused by other defects such as vacancies, dislocations, etc. As a result of annealing of CI α celluloses, most of these defects disappear that leads to decrease in distortion degree and conversion of unstable triclinic into stable monoclinic lattice with a higher packing density.

STUDY OF CELLULOSE INTERACTION WITH VARIOUS LIQUIDS

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ABSTRACT

Interaction of dry cellulose samples with hydrocarbons, alcohols, ketones, organic acids, water, amines and some other organic liquids has been studied at 298 K using the methods of calorimetry and sorption. Heat of interaction and maximum equilibrium sorption value were determined. The study showed that interaction of various cellulose samples with non-polar (hydrocarbons) and low-polar liquids (higher alcohols, ketones, organic acids, etc.) was accompanied by a small exothermic heat effect, which was below 20 J/g. Unlike non- and low-polar liquids, interaction of cellulose with highly polar liquids (water dimethylformamide, dimethylsulfoxide, etc.) caused a high exothermic heat effect exceeding 30 J/g DM. It has been found that maximum equilibrium sorption value (S_0) is a linear function of heat of interaction (ΔH); thus, the specific heat of interaction, $h_0 = \Delta H/S_0$, was almost constant regardless of nature of the liquid and structural features of cellulose. Using the constant h_0 value, the sorption of diverse liquids by cellulose can be predicted.

MAGNETOSUSCEPTIBLE ADSORBENTS OBTAINED BY THERMOCHEMICAL ACTIVATION

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ABSTRACT

Magneto-susceptible adsorbents (MSA) were obtained by method of thermochemical activation of lignin and precipitated on its surface iron (III) hydroxide. Dependence of parameters of magnetic susceptibility and porous structure parameters were investigated. Optimal conditions of synthesis for output parameters in determined interval of factors variation were found. Structural characteristics of MSA were compared with industrial activated carbon BAU-A and OU-B. It was demonstrated, that pores volume of MSA doesn't inferior to values for the activated carbons.

THE EFFECT OF IRON NANOPARTICLES ON PHYSICO - CHEMICAL PROPERTIES AND FUNCTIONAL ACTIVITY OF ACTIVE CARBON FROM PLANT MATERIALS

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ABSTRACT

Rape, camelina, wheat and Jerusalem artichoke vegetable wastes (straw) as annually renewable raw materials were processed into activated carbons, which were modified with iron nanoparticles for carbonaceous sorbents to acquire specific properties, since carbonaceous sorbents are usually widely used in the food industry, agriculture, medicine and other fields of human activity.

HEAT-RESISTANT INORGANIC BINDERS

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ABSTRACT

This paper discusses methods for producing of heat-resistant inorganic composite materials, using new classes of inorganic binders, which are the basic salts of various metals. There is demonstrated the possibility of using hydroxo-chlorides and hydroxo-nitrates of aluminum,

zirconium, chromium and other metals as binder. The main products of the thermal decomposition of all types of binders discussed in this paper are nanodispersed high-refractory oxides.

NEW METHOD FOR MANUFACTURING MEMBRANES BY PROCESSING THIN-FILM MATERIALS WITH A FLOW OF ELECTRICALLY CHARGED SOLID PARTICLES

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ABSTRACT

The present work is devoted to the description of the new technology, which relates to a method for producing track membranes by penetration of the working medium within the matrix, and its passage through the matrix of polymer material. The working substance interacts with the matrix in the form of high-speed flow of solid particles. Method for treating thin-film materials with a flow of electrically chargeable solid particles in an electric field generated between two oppositely charged electrodes is proposed. One of the electrodes is made in the form of a net that is penetrable to the solid particles, used as a charging electrode for acceleration of the particles passing toward the thin-film material located above this electrode, while the electrode has a continuous surface, and is used as a charging electrode. The electric field is adjusted to the value needed to satisfy the treatment conditions so that the particles can either be retained in the treated material or can pass through the material, thus forming filters for gases or liquids, track membranes, or the like.

THE NEED FOR CHANGES IN ELECTRIC DISTRIBUTION NETWORK FOR THE USE OF THE MINI AND MICRO *ON GRID* GENERATORS

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ABSTRACT

It is expected that with the diversification of utilization rates, the increased demand for electricity and the difficulties encountered in hydroelectric generation, promote the acquisition of more renewable energy generators connected to the network. There's no way to keep a nationwide system of interconnected components and mini-generation connected to the network, effectively without the deployment of the smart grid. Through studies carried out in some inverters used in solar generators, it was verified the existence of harmonics that are injected in the distribution network, creating fluctuations of voltage and current. Rectification of the sine wave inverter, and the connection of multiple network generators cause oscillations in both voltage and frequency, making necessary a network that not only identify these fluctuations, but to interpret, going further, as should take measures to mitigate the effects of these oscillations. This requires an intelligent, interconnected network to the central data processing, intuitive and with a certain degree of autonomy, reducing response time to

* Employees of HIT - Holon Institute of Technology (Israel) Dr. Makrinich G. and Prof, Fructman A., took part in this work.

problems, directing and compensating voltage spikes and rectifying the quality of electricity injected by miscellaneous generators connected to the same.

CONSTRUCTION TECHNOLOGY ON THE BASIS OF ARTILLERY GUNS

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ABSTRACT

The problem of developing the new methods of pile installation arises due to the necessity of erection of pile basement in difficult climatic/environmental conditions. The present paper describes the way of driving piles by shooting them into the ground from a specially redesigned single-barrel combat artillery piece. Also the paper presents main technical solutions dedicated to this retrofitting. For shooting piles into the soil we offer the method of pulse indentation and artificial increase of a pile weight, both of them together provide a 2.5-fold increase in penetration compared to a conventional shot. This paper describes the basic configuration and gives a schematic diagram of the piston rammer design as an important part of construction ordnance. The final part of the paper presents the results of practical use of the described patents in building construction and industrial construction at the facilities of Western Siberia, and gives a brief description of the problems currently being solved by the developers of construction artillery in Perm (Russia).

NANOSYSTEM PREVENTING COMPLICATIONS IN OIL AND GAS PRODUCTION

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ABSTRACT

The article was dedicated to the nanosystem application having synergistic effect developed on the basis of "low impact and excitation" effect for asphaltene-resin-paraffin (ARP) deposits prevention causing technological complications during the oil production and transportation. The nanosystem made on the basis of organic solvent, surface active substances (SAA) and metal nanoparticle simplifies the oil production, prevents mechanical mixtures in oil well equipment, solves the mixtures on down-hole zone and pipe, and decreases oil viscosity. Time between overhauls and oil production increased as the result of nanosystem application at the well № 1331 Palchig pilpile field of "Oil Rocks" OGPD, and great economic benefits were achieved.

**EVOLUTION OF THE REPULSIVE FORCE
OF LIKE CHARGED SPHERES INTO THE ATTRACTIVE FORCE
WITH REDUCTION OF DISTANCES BETWEEN THE SPHERES**

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ABSTRACT

Previous numerous laboratory and numerical investigations demonstrate great deviations of the interaction force of charged bodies from the interaction force calculated by Coulomb's law, formulated for point charges. Here we present numerical results. The first calculations were fulfilled for the case of spheres with equal radiuses. It was shown that in the case of charges with the same sign of charges diminishing of distances between charges leads to a diminishing the repulsive force, but in the case of charges with different signs of charges it leads to increasing of a attractive force. The most interesting result of the present paper is the investigation of the special case when the repulsive force of like-charged conducting balls (spheres) with different radiuses at small distances between the spheres $L < L_*$ is transformed to the attractive force. Numerous solutions of the correspondent electrostatic problems allowed us to find the function L_* of the two values – relation of radii of the balls and relation of their charges on them. And at end it was shown that realization of generalization of the known analytical problem about interaction point charge with conduction ball permitted to find results that are valid also for the case of balls with big relation of radiuses.

**REVERSIBLE IMPINGING STREAMS:
A NEW METHOD OF INTERACTION
GAS - PARTICLES**

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ABSTRACT

A new generation of high-intensity impinging streams – reversible impinging streams (RIS) provide for as-long-as-desired presence of disperse material in them. It has been found that in the course of interaction between gas and solid phases the particles spontaneously form a compact cloud which is called pseudopiston. It reverts within the moving impinging gas streams where the concentration of particles (well mixed) in it is close to that in dense movable rarefied beds. Reciprocation motion conditions of the pseudopiston characterized by the high relative speed of phases have been modeled and experimentally determined. The particle concentrations practically used in RIS are at least an order of magnitude higher compared to those applied in other known variants of impinging streams. In the present article the data on some areas of RIS prospective application in heat and mass transfer processes as well as in some other processes are given.

**TECHNICAL PRINCIPLES OF SIMULTANEOUS WHITE LIGHT
AND 5-ALA-INDUCED FLUORESCENT IMAGING
FOR REAL-TIME MICROSURGICAL RESECTION
OF MALIGNANT GLIOMAS**

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ABSTRACT

Administration of 5-aminolaevulinic acid (5-ALA), a natural metabolic precursor of haem results in selective accumulation of protoporphyrin-IX (PpIX) in malignant glioma tissue. Fluorescent imaging of PpIX has been used for rapid intraoperative identification of tumors enabling more complete and accurate tumor removal. In the standard fluorescence detection mode, the surgeon switches the light source coupled with an operating microscope from the normal white light to the violet-blue excitation light (375±440 nm) and observes PpIX fluorescence through a longpass filter, introduced into the optical path of the microscope. Although violet-blue illumination reveals the fluorescent areas, it hides the anatomical details of the tissue, and the continuous flow of the surgical procedure is interrupted. In the present study, we report a new imaging technology which permits visualization of tumor fluorescence in the presence of intensive broad-band microscope illumination which allows the surgeon to discriminate visually brain tissue from tumor, and to perform surgery without interruption or delay for tissue identification. The system does not require any modifications of the microscope optics or light source and can easily be adapted to any type of surgical microscope. The weak fluorescence of tumor tissue is acquired by the imaging system, processed in real time and presented as a high contrast synthetic image to be introduced into the visual pathway of the microscope. Also, the fluorescent image is superimposed with true color background image and saved for documenting and archiving purposes. The current technology has been tested in three cases of human malignant glioma and demonstrated reliable recognition of tumor fluorescence signals in the presence of the typical level of background illumination. The system facilitated the intraoperative discrimination of malignant glioma tissue.