ON THE ISSUE OF PREDICTING THE STRENGTH OF ADHESIVE JOINTS IN DISPERSED SYSTEMS

P. Kudryavtsev

KUD Industries PN Ltd - Israel Technology Research Center, Haifa, Israel
pgkudr89@gmail.com

ABSTRACT

This work is devoted to predicting composite materials' properties through the structure and interaction of phases included in its structure. A model is proposed for the substrate's interaction and the adhesive, which is solely due to the forces of intermolecular interactions, such as the van der Waals forces. An equation is derived that reflects the relationship between the strength of intermolecular interaction between two macroscopic molecular systems and the cohesive strength of these systems. A constant is introduced - the coefficient of the effectiveness of the adhesive interaction between the adhesive and the substrate, which indirectly informs about the nature of the interaction of molecular systems and the geometry of this contact, which is the basis of the mechanical theory of adhesion. Dependences have been obtained that make it possible to estimate the strength of the adhesive contact based on a priori information on the values of the adhesive and substrate's cohesive strength and the known nature of their intermolecular interaction. A generalized dependence of adhesive joints' strength on the strength of the adhesive and substrate's initial components and the content of these components is proposed. The cause-and-effect relationships that determine the strength of adhesive bonds are considered. Based on the structural approach, a scheme is proposed that allows one to systematize various physical situations not only for one-component systems but also for multicomponent, multiphase systems.

ALUMINUM OXIDE NANOPOWDERS : PREPARATION, PROPERTIES, APPLICATION

REVIEW

P. Kudryavtsev, D. Beilin

KUD Industries PN Ltd - Israel Technology Research Center, Haifa, Israel
pgkudr89@gmail.com, sitapoltymate@gmail.com

ABSTRACT

Aluminum oxide nanoparticles are essential in the production of composite materials. The article provides an overview of the latest advances in the production, properties of aluminum oxide nanoparticles, as well as the physical and mechanical characteristics of polymer and cement-based materials modified with nano-Al_2O_3.

CELLULOSE NANOFIBERS AND THEIR NANOCOMPOSITES

REWIEV

M. Ioelovich

Designer Energy, Rehovot, Israel
ioelovichm@gmail.com

ABSTRACT

Cellulose has a multilevel nano fibrillar architecture. This natural polymer is built from elementary fibrils of their bundles called microfibrils having nano-scale diameters. Such nano fibrillar architecture promotes the isolation of free nanofibers. In this review, the various methods for isolation of cellulose nanofibers (CNFs) and their main structural features and properties are described. An application of the CNFs as reinforcing nanofiller in various nanocomposites is discussed. Special attention was paid to the use of CNFs in paper compositions, water-soluble and water-miscible polymers, as well as incurable liquid polymer resins. Green nanocomposites made from CNFs and biodegradable polymers are also discussed.

THE USE OF SPECIFIC COHESIVE ENERGY TO PREDICT THE GLASS TRANSITION TEMPERATURE AND SOME OTHER CHARACTERISTICS OF POLYMER MATERIALS

M. Ioelovich

Designer Energy, Rehovot, Israel
ioelovichm@gmail.com

ABSTRACT

In this research, some thermo-physical (glass transition temperature, T_g; melting point, T_m) and mechanical properties (tensile strength, TS; Young's modulus, Y) of hydrophobic polymers were studied. The linear dependences between these properties and the specific cohesive energy were obtained. It was found that the studied properties of polymer materials correlate much better with the volume cohesive energy (E_v) than with the molar cohesive energy. The linear regression equations, $Z = k E_v + C$, with high correlation coefficients, were calculated, where Z is property, k and C are coefficients. The dependences of various properties of polymers on T_g were also studied. It was shown that the obtained relationships allow predicting some properties of polymer materials with sufficiently good reliability.

SCIENTIFIC FOUNDATIONS FOR THE CREATION OF NANOBENTONITE AS A STRUCTURAL MATERIAL

E.G.Shahbazov, E.A.Kazimov

The State Oil Company of the Azerbaijan Republic (SOCAR)
elchinarifkazimov@mail.ru

ABSTRACT

The scientific basis of nanobentonite development was interpreted in the article, the results of the research using mutarotation research methods were presented. Studies on the enrichment of bentonite extracted from the Alpout field of the Gazakh region of the Republic of Azerbaijan

have been carried out and its properties have been studied. It was found that by cleaning the composition of khammal from extraneous mixtures it is possible to increase the mass share of bentonite from 70 to 97%, at the same time the size of the particles of khammal bentonite is 85-130 nm, after enrichment 8-10 nm. Also, in the initial sample, the size of the crystals of montmorillonite and bentonite was 13.3-19.5 nm, but after the enrichment process, these dimensions were 8.3-10.0 nm. The swelling process of bentonite has been studied. It was found that swelling of both enema and enriched bentonite occurs in two stages. At both stages, more intensive swelling of the enriched bentonite was observed. It was determined that metal ions (cations) located at an inter-layer distance are broken by oxygen atoms in montmorillonite molecule as a result of the hydration process.

HOLOGRAPHIC INTERPRETATION OF CLUSTERS OF RELATED WATER IN GELS OF IRON OXYHYDRATE (III), YTTRIUM AND ALUMINUM

Yu.I. Sukharev , I.Yu. Apalikova

Chelyabinsk State University. Chelyabinsk, Russia.
Yury_Sucharev@mail.ru.

ABSTRACT

The appearance of the electroacoustic echo is associated with nonlinear interactions in oxyhydrate crystallites containing giant clusters of water, so this phenomenon is a new method for studying nonlinearity in colloidal chemical systems as well. Detection of the electro-acoustic effect in systems of the type of oxyhydrates of d-elements indicates the regular formation of giant polyhedral structures involving water in gel systems. These designs live in time, change.
Some electromagnetic impulse excites a package of infrasonic oscillations that propagate along the gel flooded cluster environment. Over time, the electromagnetic oscillations become out of phase, that is, they become incoherent. As a result, the nonlinear interaction of this packet with the previously formed sound waves with a frequency with the electric field of the second pulse with frequency or is realized. At the same time, a new reversed sound packet is born with a frequency equal to the frequency of the original packet and propagates in the opposite direction. This sound package creates a pulsating giant aquatic oxyhydrate cluster. That is, so-called reversed waves are born. In the reversed packet, the electromagnetic coherence of the oscillations and the growth of the amplitude of the electromagnetic package are revived at a time. The amplitude of the reversed packet becomes the maximum. All this is united by the concept of "electromagnetic acoustic or phonon echo" in oxyhydrate colloidal medium. The oxyhydrates of most d- and f-elements show pronounced ferroelectric properties, which are manifested in the appearance of a spontaneous nano-electric current in a colloidal-chemical cell. Fluctuations in the amplitude of the measured current can vary from 5-10 nA to 0.5 μA, and the amplitude of the current does not depend on the duration of the experiment. In this case, one-time strong current bursts can occur, reaching values of 0.2 μA at a background level of 5 nA. It is visually difficult to distinguish the current dependencies for oxyhydrates of various elements of iron, tin, zirconium, yttrium, etc. The time interval between pulses is 51.2 seconds.

HIGH-ENERGY FUEL PELLETS

M. Ioelovich

Designer Energy Ltd, Rehovot, Israel

ioelovichm@gmail.com

ABSTRACT

The purpose of this study was to obtain high-energy pellets from natural biomass sources with improved fuel properties and durability. Two biomass types, namely residues of mixed coniferous wood and olive pomace, were selected as feedstock for this purpose. It was found that olive pomace is a promising natural source for the production of fuel pellets. The chosen biomasses were used for pelletization along with auxiliary materials, such as starch, synthetic rubber (SBR), polyethylene waste (PEW), etc. The milled biomass samples and their mixtures with binders were compacted under increased pressure and temperature and then cooled. Besides, part of the pellets was coated with a melt of high-energy agents, such as PEW, etc. The pellets were studied by methods of calorimetry, water vapor sorption, and durability testing. The results have shown that fuel characteristics of the pellets containing hydrophilic starch binder were lesser than those of coals; moreover, both fuel properties and durability of these pellets were reduced after sorption of water vapor. The use of hydrophobic binder (e.g. SBR) improves the durability of the pellets, whereas the additional coating with a layer of high-energy combustible agent (e.g. PEW) allows obtaining the especial high-quality pellets with high fuel properties and high durability both in a dry and wet state. As a result, the energetic features of these special solid biofuels become comparable with those of fossil coals.

TECHNICAL PROPOSALS FOR THE USE OF COMPOSITE MATRIX-ISOLATED FLOCCULANTS-COAGULANTS

P. Kudryavtsev , N. Kudryavtsev

KUD Industries PN Ltd - Israel Technology Research Center, Haifa, Israel
pgkudr89@gmail.com

ABSTRACT

Coagulation and flocculation methods are the most widely used processes for purifying natural and wastewater from the bulk of various contaminants. This work presents the characteristics of the new composite matrix-isolated flocculants-coagulants ASFC and ISFC developed by the authors compared to the traditionally used salts of aluminum and iron. The characteristics of natural waters are given, according to which the efficiency of using the obtained flocculants-coagulants is studied. To characterize the action of the developed materials and compare them with known products, their coagulating ability was used to purify water with a high color value from the Orsha River and an average color value from the Volga and Tvertsa rivers flowing in Russia. An attempt has been made to assess the effectiveness of magnetic treatment of the developed composite flocculants-coagulants on their performance. Based on the conducted research and production and technological tests, recommendations have been developed to use composite matrix-isolated flocculants-coagulants for the purification of natural waters and industrial wastewater.

DECELERATION OF SOLID PARTICLES IN SOFT CONDENSED MATTER

P. Kudryavtsev

KUD Industries PN Ltd - Israel Technology Research Center, Haifa, Israel
pgkudr89@gmail.com

ABSTRACT

The development of modern technology stimulates the intensive development of research on studying the interaction of small solids and liquids at high speeds. In these studies, various methods of accelerating solid particles are being developed. Explosive methods, railgun accelerators, and accelerators based on electric fields became widespread here. We discovered a new phenomenon associated with an electric charge's appearance on the surface of microparticles placed in an electric field. In this work, an attempt is made to analyze the possible mechanisms of interaction of a moving solid with a target, which is a viscous liquid or soft matter. The main factors determining the behavior of particles when entering a viscous medium are determined. It is shown that a noticeable effect of viscosity on the motion of a particle in a liquid or soft matter begins approximately at a viscosity of more than $10^9\ Pa \cdot s$. Below this value, the influence of the Stokes force can be practically ignored. Four versions of models of interaction of a solid particle with a target made of liquid or soft matter are proposed. A dimensionless parameter is introduced to describe a particle and a target's interaction that characterizes the ratio between the particle's initial kinetic energy and the value of the energy spent on heating the medium, particles, and their destruction. Each of the proposed models describes only a certain part of the interaction between the particle and the target.

OPTIMAL WASTE-FREE TECHNOLOGIES FOR PRODUCTION OF NANOCRYSTALLINE CELLULOSE AND ITS COMPOSITES

M. Ioelovich

Designer Energy, Rehovot, Israel
ioelovichm@gmail.com

ABSTRACT

In this paper, novel, optimal, and waste-free technologies are proposed for the production of nanocrystalline cellulose (NCC) and its composites with inorganic pigment, as well as for the production of semi-finished products containing aggregates of nanoparticles. The following optimal hydrolysis conditions were found: concentration of sulfuric acid (SA) 40 wt.%, temperature 80°C, duration 1 h, acid/cellulose ratio 7. After the hydrolysis stage, the hydrolyzed cellulose was diluted with water and disintegrated to release individual nanocrystalline particles. Finally, the diluted dispersion of NCC was evaporated to obtain a trade product such as a concentrated paste of NCC. To produce composites, the SA in unwashed hydrolyzed cellulose was neutralized with calcium hydroxide to obtain the white pigment, calcium sulfate. Moreover, the spent acid was collected and treated with hydroxylapatite (HAP) to produce a valuable by-product, superphosphate (SUP), selling of which significantly reduces the cost of NCC. The wastewater collected after washing, neutralization, and evaporation was purified and returned to the technological cycle for dilution and washing. To reduce the production cost, the expensive stages - disintegration and evaporation of diluted dispersion, were eliminated; as a result, cheap semi-finished products containing aggregates of NCC or its composite with inorganic particles were manufactured along with by-products.

METHODS FOR LOCATING UAVs AND RADIO CONTROL SYSTEM DEVICES

S. Abyshev

Federal State Budgetary Educational Institution of Higher Education "MIREA - Russian Technological University", RTU MIREA, Moscow Russia
svabyshev@gmail.com

ABSTRACT

Location is determined by measuring the received signal delay time at different receiving points. To implement such technology should be used synchronized receiving RTS in the control center. In this case, the accuracy of location depends on the distance of the receiving antennas to each other.

STATISTICAL IDENTITY FOR VERTICAL TWO-PHASE FLOWS

M. Barsky

University Ben-Gurion, Beer-Sheba, Israel
barskym@bgu.ac.il

ABSTRACT

Entropy is a key parameter in the analysis of properties of mass systems. This notion was first formulated in thermodynamics and then expanded to many branches of knowledge. A successful attempt to formulate the notion of entropy for two-phase flows was made. As a result of the analysis of entropy correlation with other parameters characterizing a critical two-phase flow, a statistical identity has been determined for this process. The statistical identity establishes the balance of potential and kinetic energy between the parameters characterizing two-phase flows.