CARBON NANOTUBES (CNT): PREPARATION, PROPERTIES, POLYMER AND CEMENTIOUS COMPOSITES WITH USING CNT

REVIEW

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ABSTRACT

This review is designed to be a comprehensive source in the field of production technology and properties of carbon nanotubes (CNT) and their application in the production of polymer and cementious nanocomposites. Excellent mechanical, thermal, and electrical properties of carbon nanotubes have motivated the development of advanced nanocomposites with outstanding and multifunctional properties. In this context, the present paper offers a discussion on technology, modeling, characterization, processing, manufacturing and, applications of these nanocomposites based on a review of the latest literature data.

SILICON DIOXIDE NANOPARTICLES: PREPARATION, PROPERTIES, APPLICATION

REVIEW, PART I

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ABSTRACT

Silicone dioxide nanoparticles are essential in the production of composite materials. The article provides an overview of the latest advances in the production, properties of silicone dioxide nanoparticles, as well as the physical and mechanical characteristics of polymer and cement-based materials modified with nano-SiO_2.

PREPARATION, CHARACTERIZATION, AND APPLICATION OF AMORPHIZED CELLULOSE

REVIEW

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ABSTRACT

This review describes the methods of cellulose amorphization, such as dry grinding, mercerization, treatment with liquid ammonia, swelling in solvents, regeneration from

solutions, etc. Moreover, the main characteristics and applications of amorphized celluloses are discussed. A simple and cheap method for producing completely amorphous cellulose (CAC) is the treatment of cellulose with a cold NaOH/Urea - solvent at the solvent to cellulose ratio R ≥5. Structural studies showed that amorphous cellulose contains mesomorphous clusters with an average size of 1.85 nm and specific gravity of 1.49 g/cm^3. Furthermore, each such cluster consists of about five glucopyranose layers with an average interlayer spacing of 0.45 nm. Amorphous cellulose is characterized by increased hydrophilicity, reactivity, and enzymatic digestibility. Due to its amorphous structure, the CAC is converted to glucose almost completely under the action relatively small dose of cellulolytic enzymes. Such a sample can be used as an amorphous standard, and as a substrate for the commercial production of glucose, which can be applied in biotechnology as a promising nutrient for various microorganisms. In addition, the application of CAC in agriculture was described. A waste-free method for producing amorphous nanocellulose was considered, and the main applications of nanosized amorphous cellulose were discussed.

RELATIONSHIPS BETWEEN COHESIVE ENERGY, GLASS TRANSITION TEMPERATURE, AND MELTING POINT FOR VARIOUS POLYMERS

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ABSTRACT

In this research, the dependence of glass transition temperature (T_g) and melting point (T_m) on the specific cohesive energy was studied for various non-& low polar and polar polymers. It was found that the studied thermo-physical features of polymers correlate much better with the volume cohesive energy (E_v) than with the molar cohesive energy (E_m). When using polymers belonging to a certain group, only non-& low polar or only polar, a linear dependence $T_g = f(E_v)$ was obtained with relatively small deviation. However, when studying this dependence for all studied polymers of different groups, the linear correlation is highly disturbed. This disturbance can be explained by the fact that the concept of cohesive energy was developed only for non-& low polar polymers. To adapt this theory to polar polymers, it is necessary to introduce a special correction to eliminate the contribution associated with polar interactions and hydrogen bonds to the cohesive energy. After calculating the corrected volume cohesive energy ($E_{v,c}$) the linear regression equations, $T_x = aE_{v,c} + b$, with high correlation coefficients were derived for all polymers of different classes, where T_x is T_g or T_m; and a, b are coefficients. The relationship between T_m and T_g was also obtained.

STUDY ON AN ADVANCED NANOSTRUCTURED WAX INHIBITOR IN CRUDE OIL PRODUCTION

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ABSTRACT

A new composition for controlling the build-up of paraffin has been developed. Preference was given to naphthenic acids, polypropylene glycol, caustic potassium, and copper nanoparticles with a size of 50 nm, bulk weight 5 g/cm^3, specific surface area 12 m^2/g. The optimal concentration of the hydrophobic reagent and its application technology under field conditions are recommended. The developed reagent is applied in crude oil production, namely for asphalt-resin-paraffin deposits control, in individual wells in Azerbaijan.

THE EFFECTIVENESS OF ACTIVATED POWDER ALUMINA- AND IRON-CONTAINING COAGULANTS-FLOCCULANTS OF ASFC AND ISFC BRANDS FOR PURIFICATION OF NATURAL WATERS AND WASTEWATER

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ABSTRACT.

Coagulation is an important process for water and industrial wastewater treatment. Coagulation is the most widespread method of natural and wastewater purification from the bulk of colloidal, finely dispersed, and partially dissolved contaminants. The characteristics of the new composite flocculants-coagulants ASFC and ISFC developed by the authors compared to traditional aluminum and iron salts are given. Comparing the coagulating and flocculating capacities of ASFC and the combined use of aluminum sulfate and silicon salts has been carried out. The effectiveness of activated coagulants ASFC and ISFC for the purification of natural and wastewaters has been evaluated. It is shown that the coagulants ASFC and ISFC activated in a pulsed magnetic field, in comparison with the initial products, have improved coagulating properties and greater efficiency in the purification of natural and wastewater from suspended solids and oil products.

A DYNAMIC MODEL OF THE INTERACTION OF BIOMASS AND PHYTOCENOSES RESOURCES IN A CYCLIC CHANGE IN EXTERNAL INFLUENCES AND THE POSSIBILITIES OF ITS USE

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ABSTRACT

The results of studies are presented in the framework of an extended dynamic model that describes the interaction of the biomass of the ecological system and resources in a situation of cyclically changing levels of negative impact (seasonal changes), which are an integral feature of the existence of phytocenoses. At the heart of this model is the perception that an environmental system is capable of accumulating the resources necessary for its existence in the area of space in which the system is located. It is shown that in the conditions of cyclically repetitive changes in living conditions (seasonal changes), when the increase in biomass density occurs in the spring-summer period and is limited, and the increase in resource density occurs in the autumn-winter period due to the humification of the fall, this model can qualitatively display some typical cases of the evolution of phytocenoses. Solutions of the model equation system are presented, describing the accumulation of resources during biomass activities, the redistribution of power supplies between resources and biomass, and the loss of resources through abiotic processes that take into account how the system's sustainability and the degradation of the system in light of changing weather conditions. It has been shown that the correlation between the parameters of the proposed model and the physically measured characteristics of phytocenoses is possible, at least theoretically.

THEORETICAL RESEARCH AND MODELING OF THE OPERATING MECHANISM OF PROTEIN ELECTRIC GENERATORS OF ETC CELLS

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ABSTRACT

Protein generators of electricity - catalytic enzyme complexes (nano biobarriers) of electron transport chains (ETC) of membranes of plant and animal cells. Based on the convergence of bioenergy and nanotechnology, fundamental theoretical studies have been carried out, as a result of which nanobiological - electrophysical, nano bioheat energy and mathematical models of the mechanisms (technologies) of the operation of protein electric generators - asymmetric, potential, energy nano biobarriers (nano heterostructures) were created. The creation of such models, as well as convergent nanotechnologies and nano heterostructures, may make it possible to build systems for generating, storing, and using a new generation of electricity, comparable in efficiency with natural organisms.

ON ENERGY CONSUMPTION IN THE SYNTHESIS PROCESSES

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ABSTRACT

In this article, based on the easily provable dialectical "principle of dichotomy" of nonequilibrium processes, it is shown that the processes of hot and cold nuclear fusion, transmutation of chemical elements, and the phenomenon of "excess" energy release in various kinds of "fuel-free generators" and "over-unit" devices are due to the consumption of free energy released in the process of continuous condensation of the "hidden" mass of the Universe. The presence of its vibrational part of gravitational energy is substantiated and its value is found. It is shown that it is the transformation of this energy that is the cause of all evolutionary phenomena in nature. The specificity of these phenomena, their accompanying radiation losses, and the consequences of these processes in terms of the circulation of matter and energy in the Universe are discussed.

THE WAY TO NEW PHYSICS

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ABSTRACT

This article is a presentation of the 1st volume of the author's selected articles, united by the topic "Synthesis of thermostatics and thermokinetics" and published in 2020. These articles substantiate the necessity and expediency of a unified presentation of equilibrium and nonequilibrium thermodynamics as a deductive and phenomenological discipline that avoids hypotheses, postulates, model concepts, and considerations of a molecular kinetic and statistical mechanical nature in the foundations of the theory and admitting their application only in applications of the theory as their own. kind of unique conditions. This approach made it possible to give a substantiation different from the generally accepted substantiation of all the provisions of the theory of irreversible processes while maintaining the main advantage of the classical thermodynamic method - the immutable validity of its consequences. The articles show that this approach eliminates several difficulties that gave rise to the demarcation of the once unified classical physics into three incompatible directions.

OVERCOMING THE WARP BARRIER BASED ON GRAVITATIONAL WAVES IN THE FRAMEWORK OF NEW PHYSICS

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ABSTRACT

The article proposes, within the framework of a new cosmological model, which includes dark matter, to revise the "equation of the Einstein vacuum field". Based on a more complete field equation, taking into account the polarization medium of the quantum vacuum (dark matter), it is proposed to use the Wakefield accelerator to accelerate spacecraft to superluminal speeds using longitudinal gravitational waves