

## GREEN NONISOCYANATE POLYURETHANES: SYNTHESIS & APPLICATION

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### ABSTRACT

The substitution of isocyanate and phosgene precursors for the industrial production of polyurethane materials is discussed in this article. Polyurethanes are currently one of the polymer compounds most used worldwide for numerous applications such as rigid and flexible foams, coatings, elastomers, adhesives and sealants and, nowadays, these applications are regained in devices in everyday life such as wall and roofing insulation, in furnishing, in cars, in clothes or in shoes. Nevertheless, their preparation needs using of harmful and dangerousness compounds such as phosgene and isocyanate precursors. Their dangerousness operate at 3 steps of the life of polyurethane: synthesise of monomers, formulation of materials and end of life of materials. After a first part dedicated to the historical, market and manufacture of polyurethane and its dangerousness, this articles focuses on the description and discussion on the routes to substitute the dangerousness precursors to synthesise non-isocyanate polyurethane, reporting their advantages and limits and finally examines the outlooks to follow for the wider use of non-isocyanate polyurethane to recover all applications of classic polyurethane in chemical industry.

## RF ABSORPTION BY SUPERPARAMAGNETIC NANOPARTICLES Fe<sub>3</sub>O<sub>4</sub>

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### ABSTRACT

In this work, the process of electromagnetic (EM) waves' absorption in a colloidal system of Fe<sub>3</sub>O<sub>4</sub> nanoparticles with an average size of 9.50 nm in 2% aqueous solution in sodium dodecyl sulfate (SDS) was investigated. For this purpose a new method for measuring the temperature of nanoparticles and their environment by means of thermistors is proposed. The Q-factor of investigated system as a function of the EM waves' frequency was measured and the spectrum of ESR was obtained. The ESR spectrum of the Fe<sub>3</sub>O<sub>4</sub> nanoparticles presented a slightly asymmetric singlet with g=2 and a line-width of  $\Delta H=0.1$  mT. It is shown that the observed absorption spectrum corresponds to paramagnetic behavior of the investigated nanoparticles. The nanoparticles – SDS liquid system exhibited a resonance-like behavior of the absorption, where the resonance frequency was determined about 170 MHz, the absorption rise up to the resonance frequency was rather slow. The observed absorption of EM field energy was accompanied by a small temperature rise of the system.

*In the matter of discussion*

## **CORRECTION OF MATERIAL EQUILIBRIUM CONDITIONS IN HETEROGENEOUS SYSTEMS**

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### **ABSTRACT**

Modern understanding of heat and work in open systems requires the exclusion of their analytical expressions change in entropy and volume associated with the transfer of substances across borders open systems. This makes it necessary to revise the material conditions of equilibrium, previously found without this circumstance. Since in this case the expression of warmth and expansion works are different for the processes of diffusion, osmosis and filtration, the conditions of the material balance in these processes are different. In the article on the basis of the principle of distinctiveness of these processes shows that, in this case, the chemical potential of the components give way to their diffusion, osmotic and filtration potentials, expressed in terms of the known parameters of the substances in their pure form and in a state of mixture. This correction of material equilibrium conditions can simplify the kinetic transport equation in multicomponent systems and is at the basis of the parameters mentioned thermal and volumetric effects of mixing real substances. This opens the way to the construction of mixing theory.

## **APPLICATION OF POLYMER COMPOSITE COVERING FOR CORROSION PROTECTION OF REINFORCED CONCRETE STRUCTURES OF OIL REFINERY**

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### **ABSTRACT**

The protective polymer composite coverings are developed in order to increase of corrosion resistance of concrete structures. The optimal application technology of the coverings was studied and determined for the purpose of work with the materials of construction. For ensuring of compatibility with the material, the analysis has been carried out and the technological optimum of drawing polymer composite coverings is defined. There was life-long service expectations counted of these coverings that are applied to the ready surface and the coverings formed in the course of joint formation. The research is confirmed the practical implementation of technology and updated operational impacts.

**SUBSTITUTION EFFECT OF HYDROXYL GROUPS IN C-2 POSITION  
OF ANHYDROGLUCOSE UNITS OF CELLULOSE  
BY NITROGEN-CONTAINING GROUPS**

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**ABSTRACT**

In this paper structural characteristics and properties of cellulose, chitin and chitosan have been studied. The obtained results showed that substitution of hydroxyl group in the C2 position of anhydroglucose unit of cellulose by nitrogen-containing groups leads to transformation of crystalline unit cell, increasing of interplanar distances and cell volume, and reduction of packing density of crystallites. Since cellulose contains lesser amounts of atoms C and H, the combustion of this polysaccharide requires lower oxygen amount than of nitrogenated polysaccharides; as a result, the exothermic value of combustion enthalpy increases when going from cellulose to chitosan and chitin. Study of hydrophilic properties revealed that wetting enthalpy and sorption of water vapor depend on the degree of amorphicity (Y) of the biopolymers. At the same Y-value the hydrophilic properties of cellulose and chitosan containing hydroxyl or amino groups were higher than of chitin containing hydrophobic acetyl groups. In the sequence: cellulose-chitin-chitosan, an increase in hydrolyzability of the biopolymer samples was observed. Furthermore, three methods for determination of degree of crystallinity and amorphicity such as X-ray, calorimetry and sorption, were discussed.

**STUDY ACIDIC CORROSION OF CELLULOSE**

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**ABSTRACT**

Structural changes of cellulose fibers after corrosion with mineral (sulfuric and hydrochloric) acids of various concentrations have been studied. It was found that 2-7 M acids cause a selective corrosion of non-crystalline domains (NCD), which leads to transverse splitting of relatively long fibers and obtaining of shorter low-molecular fragments of the fibers, namely micron-size particles of so called microcrystalline cellulose. On the other hand, more concentrated acids (8-10 M) corrode not only NCD, but also tightly packed lateral surfaces between nanocrystallites connected via strong inter-crystalline contacts, thus facilitate the releasing free nanocrystalline particles.

## **EMBODIMENT OF THE CONTROLLED THERMONUCLEAR FUSION IN NONSTATIONARY CONDITIONS**

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### **ABSTRACT**

In this paper a burning cycle and a basic design of the reactor for the implementation of fusion using a deuterium stream and gaseous target of deuterated diborane (B<sub>2</sub>D<sub>6</sub>) were proposed. Two modes of the reactor operation were considered. The presented modeling shows a positive estimation for the burning cycle in which different volatile boranes can be used also. This type of reactor, and use the burning cycle, allows to the energetically positive balance - 9.26 MeV per the beam deuteron. In addition, in this process the helium isotope (<sup>3</sup>He) is generated, which is a valuable product and may be used in other types of fusion reactors. For absorption of excess neutrons a solution of boric acid which contains the natural mixture of boron isotopes was considered to use. In this case, the formation of lithium borate would occur.

## **NEW VARIANTS OF WIND ENERGY PLANTS**

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### **ABSTRACT**

Energy of an air stream takes the important place among renewables. It can be utilized and to be available in any region of Earth. Here described features of a design of wind power installations of two main types. Depending on orientation of an axis of rotation in relation to the VP direction they can be classified as follows: - with the horizontal axis of rotation parallel to the VP direction, and vertical axis perpendicular to AF. Are given the original options of a design of such installations developed with participation of authors.

## **INNOVATIVE ENHANCEMENT OF AN ENGINEERING BUSINESS: OPERATION CYCLE METHOD**

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### **ABSTRACT**

The main investing resource of innovative improvement of engineering business is the capital received from selling its equity capital. The investment attractiveness of an enterprise on stock market is determined by continuous innovative improvement of its operation cycle ensuring the conversion of technological (physical) systems into economic systems. Any innovating project realized on the basis of income-producing ideas results in recognizing intangible assets on the balance sheet of an enterprise what increases the value of business of an enterprise on stock market. To manage the value of an engineering business a theory of operation cycle and a closed

integrated set of parametric equations and criteria have been created. As a result of fulfilling an innovating project we will get the growth of sales value of products and services and the adequate increase of balance cost of intangible assets in a manufacturing capital. Innovating projects form the required architecture (proportions) of cash flow vectors in an operation cycle. As a rule, productive, technological and allocative innovations ensure the growth of business value of investment attractive enterprises on stock market which are a prototype for designing (creating) income-producing ideas for the innovative enhancement of its own business. Therefore, managers of enterprises study the reports of JSCs being their competitors on stock market. The received information is initial to manage the value of business on the basis of operation cycle method. The algorithm of this method includes a formation of economically and technologically analogical enterprises having higher market value of stock capital and similar criteria of operation cycles. On the basis of this information the ideas of innovating projects which will ensure the achievement of the planned value of business on stock market are formulated.

## **ON THE PROCESS RELIABILITY IN CHEMICAL ENGINEERING**

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### **ABSTRACT**

This article is a brief introduction to process reliability in chemical engineering in contrast with mechanical reliability. The authors particularly concentrate on implementation possibilities and results. Some new approaches to implementation of this scientific-engineering method for the use of economy are suggested, due to the reveal of the new facts about reliability. The importance of reliability is well known in engineering and scientific community, but the reasons of outages often are not fully recognized. That is the reason why till nowadays, implementation of process reliability has only been the matter of certain techniques and best practices. The only possibility to measure it numerically, before process reliability method was presented, was mechanical reliability calculations and elemental methods which are not applicable for a number of reasons.

## **EFFICIENCY OPTIMIZATION IN BOREHOLE SURVEY BY NANOTECHNOLOGY-BASED APPROACHES**

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### **ABSTRACT**

The article discusses the effectiveness of high-conductive nanoparticles in drilling fluid soil-based structures. The study of changes of relative amplitude of high-frequency inductive logging measurements of drill mud resistance is considered