

**No. 3 MATERIALS ENGINEERING**

**SOLIDIFICATION PROCESS OF DOUBLE NITRATE  
OF LANTHANUM BISMUTH**

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**ABSTRACT**

The work contains the results of study on solidification of double bismuth-lanthanum nitrate. The study defined crystal growth rate in lengthwise and crosswise directions, type and mechanism of salt crystal formation depending on solution concentration. Results obtained allowed making an assumption on a possibility to control the crystallization process within the investigated system, which is a necessary condition for creating combined materials with preset properties of structural and functional type.

**ELECTRET COMPOSITES POLYMER-PIEZOELECTRIC WITH DEEP  
TRAPPING CENTERS ON THE INTERPHASE BOUNDARY**

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**ABSTRACT**

There is an electret composite comprising a polymer matrix material that contains particles of a piezoelectric material with deep trapping centers on the interphase boundaries between the matrix and particles of a piezoelectric material in the paper. The piezoelectric material may have a tetragonal or a rhombohedral structure, and the polymer matrix material may be selected from high-density polyethylene, polyvinylidene fluoride, and a copolymer of vinylidenechloride and tetrafluoroethylene. The composite has a potential difference  $> 500V$ , lifespan  $>10$  years, dielectric permeability  $\geq 20$  specific electric resistance  $\geq 10^{14}$  Ohm·m; provision of deep trapping centers on the interphase boundaries with activation energy in the range of 1 to 1.25 eV, and stable electret charge.

## WATER RESISTANCE OF THE POLYMER CONCRETES

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### ABSTRACT

Water resistance of the few types of polymer concretes based on furfurool-acetone, epoxy, polyester and liquid butadiene binders was investigated. Test results point to aggression of the water environment in relation to polymer concretes especially to the hydrolyzed polyesters. Some important problems of water environment attack in particularly: water absorption, strength and deformability are discussed. Mechanism of interaction between water and polymer binder is analyzed.

## CONCEPTION OF CORROSION INHIBITING FACTORS CREATION WITH THE USAGE OF NANOTECHNOLOGICAL APPROACH

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### ABSTRACT

Character of inhibitory action of corrosion process an electrochemical research has been conducted by received inhibiting factor. Corrosion inhibiting factor possesses protective features and it is an inhibiting factor of anodal action.

## STRUCTURE AND MECHANICAL PROPERTIES OF CELLULOSE NANOCRYSTALLITES

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### ABSTRACT

Parameters of crystalline unit cell for nanocrystallites of various cellulose samples were determined by precise X-ray technique. A linear dependence of parameters ( $Y$ ) of the unit cell on the dispersity degree ( $D=1/L$ ) of nanocrystallites was observed, where  $L$  is lateral size of nanocrystallites. Based on microstrain distortions mechanism of crystalline lattice, axial ( $M_A$ ), transverse ( $M_T$ ) and volume ( $M_V$ ) moduli of cellulose nanocrystallites were

calculated by the equation:  $M_x = 2\sigma Y_o/k$ , where  $\sigma$  - surface energy of crystallites;  $Y_o$  - parameter of the unit cell for macrocrystals;  $k = \Delta Y/\Delta D$  is coefficient experimentally determined from the dependence  $Y=f(D)$ . The obtained moduli:  $M_A=150-155$  GPa,  $M_T=12-15$  GPa,  $M_V = 4-6$  GPa, were in the range obtained by other methods that confirms the proposed microstrain distortion mechanism causing variability of unit cell parameters of nanocrystallites. Besides, the axial moduli of amorphous domains (about 70 GPa), nanofibrils (about 110 GPa), its) and single cellulose fibers also were calculated.

## **INVESTIGATION OF ULTRASONIC AND THERMAL EFFECTS' INFLUENCE ON THE SIZE DISTRIBUTION OF CARBON NANOADMIXTURES**

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### **ABSTRACT**

Results of detailed investigation of ultrasound and heat treatment of astralenes in aqueous solutions are presented. It is shown that such treatment does not lead to the required dispersion of carbon nanoadmixture: average particle size varies in the range 0.4...0.6  $\mu\text{m}$ . Volumetric content of particles with a size less than 100 nm does not exceed 15% and 5% for ultrasonic and heat treatment, respectively.

## **DISLOCATION STRUCTURES ON THE GRAPHITE SURFACE**

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### **ABSTRACT**

Dislocation rows and nets were studied on the graphite surface, using Scanning Tunneling Microscopy and Scanning Resistance Microscopy. It was shown that the dislocation structures, lying under one or two atomic layers of graphite, were mainly observed on the surface. The dislocation structures did not influence on the surface topography. It was found that their contrast could vary in the scanning probe microscopy images. This effect was explained by the shift of the upper graphite layer during scanning process and the local changes of the layers stacking in graphite.

**THE PRODUCTION OF POLYMER TRACKING MEMBRANES  
BY SUPER DEEP PENETRATION METHOD**

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**ABSTRACT**

The new super deep penetration (SDP) method of polymer tracking membranes production was developed. Its advantages with respect to (as compared to) nuclear methods was discussed.

**INFLUENCE OF MICRO- AND NANODISPERSED ADDITIONS ON  
QUALITIES OF WOOD-AND CEMENT COMPOSITIONS**

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**ABSTRACT**

Problems of obtaining wood-and cement compositions with improved physical-and technical indices when introducing micro-and nanodispersed additions and microsilica into the structure of composition are studied.

**RESEARCH OF THE NANOSILICA MODIFIED CEMENT STONE  
STRUCTURE FORMATION**

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**ABSTRACT**

In the article results of research of nanosilica additive and features of hydration and structure formation of the cement stone modified by this additive are presented.

**BEHAVIOUR OF CONCRETE STRUCTURES UPON THE IMPACT  
OF UV AND RAIN OF NATURAL ACIDITY pH**

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**ABSTRACT**

A common basic assumption in civil engineering is that rainwater is chemically neutral (pH = 7.0). However, even under pristine conditions, rainwater is often more acidic due to natural emissions of organic acids. Even natural rain acidity may be very aggressive against natural stones and concrete. A harmful impact of UV radiation on the concrete durability was discussed by the authors for the first time in 2006. The objective of the current research was the characterization of weathering processes occurred in the wet cast concrete subjected to the normal acidic rain and UV radiation, and the evaluation of their possible effect on the reinforced concrete durability. It was revealed that organic acids contained in rain of the natural acidity promote an intense concrete carbonation, even when a permeability of concrete looks to be low.

**QUANTITATIVE ACOUSTIC EMISSION NON-DESTRUCTIVE INSPECTION  
METHOD AND IT APPLICATION FOR REVEALING, TYPIFYING  
AND ASSESSING FLAWS IN SPECIMENS PREPARED  
BY LASER SINTERING**

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**ABSTRACT**

Quantitative Acoustic Emission Non-Destructive Inspection (QAE NDI) technology, photo-elastic, optical and electron fractography methods were used for:

- Revealing, typifying, and assessing flaws in specimens prepared by laser sintering
- .Determination of non-uniformity of powder melting, appearance of secondary micro-cracks during macro- crack development, and other disadvantages of technological processes
- .Establishing interdependence between the  $J$ -integral values of the revealed flaw, design criteria acceptable  $J$ -integral values of flaws for specific specimens and criteria for rejecting specimens from operation.
- The optimal intervals (steps) of laser beam displacement.

It was also established that the main crack in a system of micro-cracks under dynamic loading could start to propagate earlier and faster, and for greater lengths than an individual main crack. These accompanied by specific variations of the characteristics of AE signals, increase in the  $J$ -integral value of the main crack and a significant decrease resistance specimens to fracturing.