

INFLUENCE OF THE POLYMER NATURE ON MODIFIED BITUMEN PROPERTIES (p. 4-8)

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The causes of poor quality of road pavement were considered in the paper, and it was shown that one of the ways of its improvement is using known and new polymers as bitumen modifiers. The influence of different modifiers on the performance characteristics of modified bitumens (softening temperature, penetration, ductility, and adhesion of binders) has been studied. The optimal conditions for obtaining the polymer modified bitumens (PMB) have been determined and the optimal ratio of modifier - bitumen that allows to obtain samples, which meet the requirements of regulatory documents (DSTU B V.2.7 -135: 2007 Polymer modified bitumen. Specifications.) has been shown. A relatively simple technique that allows to obtain reproductive outcomes, characterizing the dependence of the PMB adhesion properties on the environmental temperature, has been developed. It is recommended to use a polymeric petroleum resin with carboxyl groups (PPRC) and indene-coumarone resin (ICR) as additives that significantly improve the adhesive properties of bitumen.

Keywords: bitumen, bitumen emulsion, polymer modified bitumen, polymeric petroleum resins, adhesion.

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PHYSICAL AND CHEMICAL ASPECTS OF MECHANICAL ACTIVATION OF POLYTETRAFLUOROETHYLENE COMPOSITE IN OBTAINING AND RECYCLING (p. 9-15)

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For successful recycling of polymericfluorine wastes by selecting equipment and its operating modes, their grinding to certain sizes of fractions, effective activation of the composite ingredients and their homogeneous combination is ensured.

It is found that introducing fine aggregate, made of recycled materials, to polytetrafluoroethylene leads to the crystallization processes intensification that is associated with a decrease in the nucleation energy barrier. An increase in the content of the aggregate is accompanied by a decrease in the thermodynamic parameters of polymer composite materials and high strength and durability levels.

Critical concentration of aggregate, made of recycled materials, which ensure the composite structure homogeneity and the required performance characteristics, is defined.

Critical concentration of aggregate, made of recycled materials is 25 %, thus, tensile strength of the composite $\sigma_t = 20$ MPa, compressive strength $\sigma_c = 25$ MPa, specific elongation $\delta = 140$ %, wear rate $I = 11,0 \cdot 10^{-6}$ mm³/N·m are obtained.

The methods of instrumental study have confirmed the efficiency of technology for obtaining polytetrafluoroethylene composite with aggregate, made of polymericfluorine materials.

Performance characteristics of the composite ensure increasing the service life of the seal assembly of compressor 4HM16-10/200 by 1.5 times.

Keywords: polymericfluorine materials, recycling, fractional composition, activation technology, structure study, properties, critical concentration, durability.

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THERMODYNAMIC LIMIT OF SURFACE LAYERS OF POLYMER LININGS IN FRICTION INTERACTION (p. 20-26)

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GRANULAR COMPOSITE FOR REMOVING COBALT AND METHYLENE BLUE IONS (p. 16-20)

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The influence of the composite content of montmorillonite – polyvinyl alcohol on physico-chemical and adsorption properties of resultant granular sorbents for removing cobalt (II) ions and cationic dye of methylene blue from aqueous solutions is first given in the paper. For studying the basic properties of the resultant materials, the X-ray phase analysis and sorption methods were used.

It was shown that the optimum content of montmorillonite in granular composite is 38 %. Increasing the montmorillonite content does not significantly affect adsorption properties and water absorption. The results of the X-ray phase analysis indicate the penetration of polyvinyl alcohol molecules in the interlayer space of the mineral, leading to a change in the respective basal reflections in the diffractograms. It was found that the granular composite of montmorillonite and polyvinyl alcohol have relatively high adsorption characteristics relative to the removal of cobalt ions and methylene blue in a wide range of pH solution.

The research results can be useful to obtain and study the basic properties of granular sorbents for extracting cations and cationic dyes from aqueous solutions.

Keywords: montmorillonite, adsorption, polyvinyl alcohol, granulating, cobalt, methylene blue, swelling, modification.

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As the analyses of scientific studies showed, thermodynamic processes occur in the surface layers of metal-polymer friction pairs of drawworks band-shoe brake in their friction interaction. During electrothermomechanical friction of friction linings and brake pulley, the latter stores energy, its surfaces undergo forced cooling, and linings, which are placed on the band, are exposed to the physicochemical transformation. Therefore, there is a need to study the behavior of surface and subsurface layers of polymer linings in different thermodynamic states since lining is an element of friction pairs and affects the drawworks band-shoe brake friction unit efficiency. Statistical mechanics, applied to the surface layer of polymer lining and patterns of changing the studied parameters in evaluating the thermodynamic limit are first considered in the paper. Adding more and more particles (ions and electrons) causes, respectively, changes in the volume and, thus, the average environment of any particle gradually becomes virtually unchanged. The results of experimental studies of the first-order phase transition, conducted in stand conditions have shown that, at the temperature increase on the friction surfaces of friction pairs from the set, there are current fluctuations, which will continue to exist at the temperature increase, which adversely affects the friction units performance. The research results are important since they answer the questions: what processes occur in friction pairs, what leads to their rapid deterioration, and consequently failure of the drawworks band-shoe brake friction unit.

Keywords: surface layer, electrons and ions (particles), thermodynamic limit, statistical mechanics.

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PROPERTIES OF WHISKERS. PLASTIC DEFORMATION (p. 26-30)

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Despite a sufficiently large number of conducted studies, the analysis of literature sources has shown that the development of plastic deformation in whiskers has a number of problem-specific features. A literature review of the research problem has been proposed in the paper and such an important property of whiskers, as plastic deformation, has been studied more thoroughly. Herewith, on the basis of studying the results of previously conducted experiments the influence of this property on the fracture degree of crystals, and also on several other characteristics, has been shown.

The research results from the point of view of the future use of whiskers have been analyzed in the paper, the principles of influence of deformation tests on the lattice structure and properties of whiskers have been considered in-depth.

Keywords: whiskers, mechanical properties, structure, plastic deformation, dislocations, researches

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FORMATION OF SPHERULITES AND PENTAGONAL QUASICRYSTALS IN METALS BEING ELECTRODEPOSITED (p. 30-34)

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The aim of the work was experimental verification of validity of the phenomenon of phase formation through a stage of liquid state in metals being electrodeposited. The idea of the work was based on the known fact, that at minor undercooling of melt solidification of metal usually occurs in dendritic form, and at significant undercooling of melt dendritic form transfers to spherulite one. At that spherulites, as a rule, are being formed on the interface between metal and a melting-pot. Besides, superfast solidification of greatly undercooled melt causes formation of quasicrystals with pentagonal symmetry. Therefore, if metals being electrodeposited really pass through a stage of undercooled liquid state and rapidly solidify at the deposition temperature, than spherulite forms of crystallization and pentagonal quasicrystals should be detected in their layers adjacent to the cathode. As the result of experimental investigations accomplished by the method of scanning electron microscopy formation of spherulites and pentagonal quasicrystals in the adjacent to the cathode layers of metals (copper, lead and cobalt) being electrodeposited was discovered. It is shown, that presence of spherulites and pentagonal quasicrystals in electrodeposited metals is the result of superfast solidification of undercooled liquid metallic phase being formed during electrochemical deposition of metals. Formation of spherulites and pentagonal quasicrystals in the adjacent to the cathode layers of metals being electrodeposited proves the validity of the phenomenon of phase formation through a stage of liquid state in metals being electrodeposited.

Keywords: Spherulite; Pentagonal Quasicrystal; Liquid State; Electrodeposited Metal; Undercooling; Superfast Solidification.

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THE INFLUENCE OF CELLULAR CONCRETE SURFACE MODIFICATION ON ITS PHYSICAL AND MECHANICAL PROPERTIES (p. 34-39)

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Interaction of polyorganosiloxanes of different spatial structures with polymethylmethacrylate and epoxide resin in different ratios was investigated, namely double and triple systems were considered in the paper. The obtained systems were used in modifying the cellular concrete surface and identifying the main physical and mechanical properties such as surface adsorption, impregnation depth, water absorption, ultimate bending strength.

Modifying the surface of cellular concrete was conducted to improve its performance properties since at the large number of open capillary pores during operation in outdoor conditions, products lose their basic feature – heat insulating. Also, modified products have a 5 times higher ultimate bending strength.

As a result of studies, it was found that impregnations, based on silicone varnish KO-075 were the most effective modifying compositions. They united 2 principles at once: surface hydrophobization with its simultaneous strengthening.

The obtained data are of great interest for both researchers and cellular concrete products manufacturers. Modified cellular concrete products can be used as supporting structures in low-rise construction that in turn will lead to saving energy and labor costs.

Keywords: cellular concrete, modification, penetration, ultimate bending strength, impregnation depth, water absorption.

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IMPROVEMENT OF METHOD OF DETERMINING FIREPROOF PROPERTIES OF COATING AND WOOD TREATMENT QUALITY (p. 40-43)

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The analysis of methods of determining fireproof properties and effective wood protection was conducted. The need for developing reliable rapid methods of determining the wood treatment quality at construction projects was identified. Estimation of the maximum possible temperature penetration

through the wood thickness and the method of determining the fireproof properties of the coating and wood quality by the rapid method was justified, and taking into account the conditions of constant heat and mass transfer during the tests, the device was developed. The results of determining the effectiveness of fireproof wood treatment with geocement-based coating by a standardized method showed the compliance of the 1st group in a two-coat application and the 2nd group in a one-coat application. The study on determining the quality of fireproof wood treatment with geocement coating using the rapid method showed that the temperature on the reverse side for the untreated wood sample was on average 200 °C, for fireproof samples in a one-coat application – 143 °C, and in a two-coat application – 97 °C, which makes it possible to conclude about the appropriateness of applying the proposed rapid method for practical implementation.

Keywords: fire resistance, geocement, wood, rapid method, coating, device, temperature, surface treatment quality.

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USE OF WOOD AS A WRAPPER FOR DRY ISOSTATIC PRESSING (p. 44-47)

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The regularities of the process of hard and soft wood pressing are studied in the paper, with the purpose of determining the possibility of using wood as a wrapper for dry isostatic pressing, as it meets the basic wrapper requirements. The advantage of this material is a sufficiently low cost, lack of iron powder adhesion and easy removal after pressing. It is shown that the use of soft wood as the wrapper material allows to

obtain products from iron powder mixtures with high density and strength. It is found that the use of additional heat treatment improves the wood pressing, as well as the absence of pressing friction on the matrix walls improves the iron powder compaction. The results of the conducted studies can be used in creating powder products of complex shape, which operate under medium and heavy loads.

Keywords: iron powder, wood wrapper, dry isostatic pressing, density, porosity.

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INTERNAL DIFFUSION TRANSFER OF MOISTURE DURING BIRCH VENEER FILTRATION DRYING (p. 48-52)

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The technology of veneer production is a multistage, energy intensive and the drying stage is characterized by the highest energy costs. The authors proposed a filtration drying of packed birch veneer, which allows maximizing the heat agent drying potential, and, respectively, compared with the existing equipment, reducing energy costs for the drying process and ensuring high quality of dried veneer. The moisture transfer phenomena during packed veneer drying are defined as laws of both the external diffusion and internal diffusion processes. The solution of the differential equation of internal diffusion for a thin plate of finite sizes for the boundary conditions of the first type is given, on the basis of which the internal moisture diffusion coefficient from the veneer sheets is defined and its

dependence on temperature is determined. The dependencies, given in the paper make it possible to predict the dependence of the filtration drying process of packed sliced birch veneer and at the design stage of a new drying equipment to establish economic feasibility of the process modernization.

Keywords: birch veneer, diffusion, filtration drying, internal diffusion coefficient.

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