## THE REGULARITIES OF THE FORMATION OF METAL-GLASS MATERIALS AND COATINGS WITH ENHANCED X-RAY PROPERTIES

page 4–8

This article discusses the use of new metal-glass materials and electric coatings for protection against X-ray radiation. The purpose of research is to establish regularities of formation of metal-glass materials and coatings, offering enhanced X-protective properties. Experimentally investigated the structure and X-ray protective properties: the mass attenuation coefficient of X-ray radiation and the specific lead equivalent to glass-aluminum composite materials and electric-arc coating of Sv-08G2S and Sv-AMg5 filled with hollow glass microspheres , powders of sodium silicate and the leaded glass . Established the attenuation effect of X-ray radiation by hollow glass microspheres, solid particles of liquid silicate the leaded glass, substructural elements formed as a result of heat treatment. Established regularities allow to manage the processes of formation of x-ray protective properties. The research results can be applied to the design of protection against the effects of X-ray emission for hardware, energy facilities, transportation, and medicine.

**Keywords:** composite materials, electric arc coatings, radiation attenuation coefficient, lead equivalent.

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## FORMULATION AND SOLUTION OF THE OPTIMIZATION PROBLEM OF ANIMAL FEED RATION

page 8–11

The optimization problem of feed ration in the creation of the automated production of compound feed and premixes was substantiated. The mathematical formulation of the problem of linear programming was made, the objective function was built, the method for the problem solution was chosen, and software for the method implementation was developed. MS EXCEL spreadsheets and programming language Visual Basic for Application were used that gives to zoo-technicians wide opportunities in the implementation of functional and inexpensive solutions in the field of computational processes as reflected in the practical part of this paper. However, the drawback of this solution is the experts' need for knowledge of software development. The choice of one or another solution must be made in accordance with the financial and staffing opportunities of agricultural enterprises as these items are limiting.

**Keywords:** compound feed, premix, feeding, optimization, method, algorithm, software.

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## ECO-FRIENDLY TECHNOLOGIES OF LEATHER MANUFACTURING USING NATURAL MINERALS MONTMORILONITE AND ZEOLITE

page 11–15

Considerable amount of information is known on the use of natural minerals as ion exchangers, sorbents, catalysts for solving environmental problems, wastewater treatment. However, papers on the use of minerals in the manufacture of leather as a material that can adjust and regulate the efficiency of the dermis structure formation and the relevant properties of finished leather in the literature are very rare.

This paper focuses on particular aspects of the use of naturally occurring minerals in the tanning industry and the ability to create a high-performance structure of dermis with the predicted performance and hygienic indicators through a comprehensive selection of technologically efficient materials on mineral basis.

The effectiveness of application of montmorillonite and zeolite minerals and organic-mineral composition based on them for filling-retanning of leather semi-finished product has been analyzed. The use of finely-dispersed minerals promotes alignment of topographic areas in thickness, increases the yield of the leather in the area by avoiding bonding structural elements of the dermis. Changes in the microstructure of the dermis as a result of mineral filling contribute to the improvement of performance and hygienic properties of finished leather, increase the efficiency

of use of raw materials, reduce costs for chemicals, expand the range of materials, increase the production of environmentally friendly leather, increase the competitiveness of the production of domestic and global markets.

**Keywords:** leather, technologies, mineral, montmorillonite, zeolite, modification, properties.

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## PRODUCTS COMPOSITION CATALYTIC CRACKING VIA AEROSOL NANOCATALYSIS FOR MODIFIED Si/Zr-CATALYST

page 16–18

The analysis of experimental studies of the process of catalytic cracking of vacuum gasoil in conditions of the aerosol nanocatalysis technology for a new sample of the Si/Zr-catalyst is given. The influence of the process temperature and the frequency of mechanochemical activation (MCA) of the catalyst on the yield of cracking products — gasoline and diesel fractions is determined. The process of catalytic cracking of vacuum gasoil in the investigated conditions proceeds with high light-products selectivity and primary formation of the diesel fraction (DF). The maximum yield of the DF was 60 %. The frequency of MCA of 6 Hz leads to the maximum of the formation of the gasoline fraction (GF) at temperatures of 350, 400, 450, 500 °C and the frequency of 6,5 Hz is optimal for the maximum obtaining of the product with a maximum of 300 and 550 °C. The temperature of the beginning of the catalytic reaction is determined. The temperature of ignition of the studied sample of the Si/Zr-catalyst in conditions of AnC was 350 °C and at the increase of the frequency of MCA decreased to 300 °C.

**Keywords:** catalytic cracking, aerosol nanocatalysis, mechanochemical activation of catalyst.

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## TANK PRESSURIZATION SYSTEM MODERNIZATION USING HOT KEROSENE INJECTION

page 19–22

The research is related to the sphere of rocket and space technology, in particular to the systems of gas-cylinder pressurization of fuel tanks with a high-boiling fuel component (kerosene). Mathematical modeling of parameters of the new pressurization system was carried out. The design of this system is as follows. Hot kerosene is injected into the ullage space of the tank. It enters, for example, from the injector of the engine. The gas pressure in the tank is maintained by the gas-cylinder system. The behavior of the main parameters of the system, gas pressure in the tank and its bulk temperature was defined. All parameters were obtained within the required limits. Influencing factors were revealed. Noticeable effect of hot kerosene consumption and its temperature on the value of gas pressure in the tank was noted. The need of helium for the tank pressurization can be reduced by a third. The system efficiency was estimated on the example of the I stage of the medium capacity launcher (~ 10 kg of payload).

**Keywords:** tank with kerosene, pressurization by helium, hot kerosene injection.

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## JUSTIFICATION OF PRODUCTION TECHNOLOGY OF CHOPPED PRODUCTS USING STRUCTURED EMULSIONS

page 22–26

One of the most important problems of modern science is obtaining of materials with the specified mechanical properties and structure. The use of alginate emulsions with the residues of calcium is a promising raw material for the production of structured products. Under certain conditions, the use of AlgNa and slightly soluble salts CaSO4 in a new technology is expedient that will allow to control and manage the process of gelation in the technological flow of the manufacture of new products. The wide range of new technologies, including emulsification of various raw materials, namely polysaccharides, is used at this stage of development of food technology for the production of fundamentally new goods. The studied emulsifying ability of sodium alginate is reduced to the given dependence of the point of phase inversion on the concentration of sodium alginate and viscosity of the suspension. Generalization of analytical and experimental studies on justification of technological parameters of production of the thermo-stable structured emulsion allowed determining rational parameters of production of the latter in a part of prescription composition and modes of separate technological operations. As a result, we developed a principal technological scheme of production of minced meat products with the structured emulsion.

**Keywords:** emulsion, structurization, sodium alginate, emulsifying ability.

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## THE NEW ADDITIVE TO PETROL

page 26–28

The multifunctional oxygen-containing additive (Dispersant PME-T) to motor petrol and diesel fuel was developed. The additive is resistant to thermal influence, keeping its high surfactant properties, and also allows to homogenize the system of hydrocarbon — water — alcohol. The formed thin fuel dispersion is well combusted in the engine, thus greatly reduces negative emissions into the atmosphere, according to the environmental European standards. The intermolecular interaction of alcohols with ethanolamines in the presence of nonionic surfactant with the formation of the stable system was proved. Oxyethylated long-chain alcohols, nonylphenol ethoxylates, alkenyl succinimides can be used as nonionic surfactants. Stability of the system is reduced at temperatures above 50 °C and broken with the formation of initial substances. Such system increases the hazard class (moderately hazardous substances); it is human friendly and biodegradable.

**Keywords:** oxygen-containing additives, aliphatic alcohols, surfactants, petrol — water — alcohol system.

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## PROPERTIES OF STRONG BINDING WIRE AFTER PRERECRYSTALLIZATION ANNEALING

page 29–31

The purpose of the paper is the justification of the thesis on the definition of incomplete pre-recrystallization annealing as an independent type of heat treatment of solid binding wire. For that, the rod made of steels 50—70 was subjected to patenting in nitre bath and drawn with the total reduction of 65,8 %. Next, the wire was exposed to the short term forced tempering at 400—420 °C. The parameters of the deformation and heat treatment of strong binding wire were determined, which provide tensile strength of about 1270—1520 N/mm$^2$, tensile strength with knot not less than 9,5 unit kN, relative elongation not less than 5 %. It is expedient to classify the annealing of steel cold-deformed wire, providing a slight strength reduction (up to 5—10 %) with a significant ductility increase (2—3 times), as incomplete pre-recrystallization annealing, with the introduction of this concept, based on the nature of the phase-structural transformations to the theory and technology of heat treatment.

**Keywords:** thermomechanical treatment, cold-deformed steel, incomplete pre-recrystallization annealing.

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## JUSTIFICATION OF PARAMETERS AND NUMERICAL EXPERIMENTAL STUDIES OF ELECTRICALLY HEATED FLOOR

page 32–36

Algorithms and software solutions, which allow to ensure the optimum modes of power supply to the heaters of multilayer structured floor in rooms taking into account design and thermal parameters of electrically heated floor and peculiarly external meteorological factors, are proposed. The application of research results in production practice of specialized complexes will allow significantly improve the efficiency of using the traditional, alternative and renewable energy sources for ensuring the technological needs of livestock production. The proposed method allows at the stage of project development analyze and determine the geometric parameters and power characteristics of heat-generating modules of electrically heated floors of production facilities with various functional purposes. The managed mode of energy consumption by electric-heat-accumulating microclimate systems provides real conditions of energy consumption in the off-peak period of the daily load curve of electrical networks with reduced payment for energy under the zone tariff. Considerable heat-accumulating properties of electrically heated floors allow such systems to operate in the mode «consumer-regulator».

**Keywords:** energy efficiency, energy saving, energy flow, multilayer structure, microclimate, algorithm.

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## COMPUTER MODELING OF CRYSTALLIZATION PROCESSES AS A RESERVE OF IMPROVING THE QUALITY OF PISTONS OF ICE

page 36–40

The use of pattern recognition procedure for the description of the localization of defects in the molded pieces «piston» for ICE (internal combustion engine) is proposed in the paper. The relevance of this research is explained by the need of rapid development of new high quality molded pieces for the automotive industry, or optimization of the existing equipment design to improve the product quality. The results of computer modeling of the process of metal mold casting and alloy crystallization for the advanced casting technology, involving the use of thermal insulating coatings of metal mold are given. The results of computer modeling can be used for formalization of the process of describing the localization of defects in pistons and, based on this, for development of measures on resource saving and improving the quality of molded pieces. It was proposed to use the results of statistical classification on the basis of such formalized description.

**Keywords:** molded piece, metal mold, computer modeling, thermal insulating coating.

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## IDENTIFICATION OF RESERVES OF IMPROVING THE QUALITY OF BODY CASTINGS BASED ON THE COMPUTER-INTEGRATED SIMULATION OF EQUIPMENT

page 41–43

The paper reflects the results of studying the possibilities of identifying the reserves of improving the quality of shaped castings on the basis of the computer simulation of the processes of mold casting. Software products Solid Works and LVMFlow were used for the simulation. The purpose of such simulation is the forecasting and definition of probable formation of defects in the casting body, without conducting practical experiments that significantly reduces the expenditure of materials and time for obtaining the results. The selection of alternative ways of eliminating the porosity, associated either with the addition of feeders on the casting sides, or with the increase of the volume of feeders, based on the presented simulation results, should be made in favor of the second, since the addition of two additional feeders did not improve the result.

**Keywords:** steel, commutator sleeve, feeder, porosity, computer simulation.

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