TECHNOLOGY OF ORGANIC AND INORGANIC SUBSTANSE

INCREASE IN ELECTROLYTHIC CELL INDICES

page 4-5

The results of applied research of electrolytic cells with various constructions process parameters and electrochemical systems check by means of electrolysis current control are represented. The results of back EMF and electrolytic cell resistance control techniques implementation are considered. At the Private Joint Stock Company "Zavod Poluprovodnikov" ("Semiconductor Plant") (Zaporozhye) the hydrogen electrolytic cell electrochemical parameters control through conductometric method application with use of aluminum electrolytic production experimental results, obtained at the PJSC "ZAlK, is introduced. On the ground of aluminum electrolytic production results the hydrogen electrolytic cell control techniques have been designed and introduced. After all technical arrangements have been carried out, their implementation made it possible to reduce the hydrogen production power consumption from 5,6 to 5,3 kW/h, an save 800 000 UAH for each electrolytic cell annually.

The new electrolysis current control techniques, aiming at electrolytic cell technological parameters control and improvement in the supervision process quality are currently discussed.

Keywords: EMF, resistance, electrolytic cell, control, current, voltage.

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RESEARCH OF CONDITIONS OF HEAT-RESISTANT LINING-UP OF CONVERTER

page 6-8

The problems of technology for gas-oxygen refining of stainless steel with the use of converters with the bottom blowing of gas are considered. The argon-oxygen refining is conducted in the special reactor (type converter). Blowing is tricked into from one side at the converter bottom through 2...3 nozzles, located horizontally on the back of the reactor. The amount of nozzles depends on the retort capacity. An important step on the way of increasing the firmness of lining-up of converter of gas-oxygen refining was a change of refractory: transition from periclase-chrome to the dolomitized refractories. Distinctive advantages of the dolomitized refractories are high mechanical wearproofness and neutral attitude toward cut-in silicon, unlike yellow periclase-chrome refractories, collapsing in the reaction. It is noted that argon-oxygen refining technology has many disadvantages, including high expenditure of argon for melting, low firmness of lining-up of reactor and low productivity as for converter redistribution. New material of lining-up of converters is proposed. The use of the dolomitized refractories for the lining-up of converter of gas-oxygen refining allowed to increase the process duration from 30 to 90 minutes.

Keywords: refining, lining-up, decarburization, converter, refractory, lime, argon, natural gas.

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PARTICULARITIES OF STRUCTURE FORMATION OF DISPERSED SYSTEMS IN THE PORTLAND CEMENT TECHNOLOGY

page 8-10

In this publication, readers will find the results of the analytical and experimental research of the physical and chemical processes in the consecutive formation of coagulation, condensation, and crystallization structures at the major technological stages of the present-day production of Portland cements. We have determined the groups of the dispersed systems at the stages of preparation of the source materials and making of the raw stuff mixture for wet, combined, and dry methods of production as well as for the grinding of clinker with additives and for making of cements based on the availability and quantitative ratio of the dispersed phase, wet and gaseous dispersed environment. We have shown the structural, mechanical, and rheological properties of the coagulation structure of cement slurries with typical composition based on limestone and polymineral clay. Readers will also find the particularities of the phase changes in the major rock-forming minerals of the raw stuff mixture in the process of the crystallization structure formation depending on the degree of the thermal treatment while baking at the maximum temperatures of 1110...1450 °C.

Keywords: cement, raw materials, technology, structure, water system, baking, phase composition

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ANODE QUALITY IMPROVEMENT AT FIRE REFINING OF COPPER

page 11-13

The quality of anodes, produced at the copper fire refining division of the Zaporozhye factory of nonferrous metals is studied in the paper. It is shown that the use of phosphorous copper at the stage of copper fire refining not only reduces the quantity of copper anodes with defects, but also improves the operation parameters of electrolytic refining division. The fire refining of copper is an oxidizing process, in which blowing is carried out by air of fusion of copper with its postreduction wood (an operation "poling"). Slag, the greater part of admixtures, is concentrated, in which it appears as a result of poling. The process of fire refining of secondary draft copper has a number of substantial features as compared to a draft copper, obtained from ore raw material, which are conditioned by the high content of the following admixtures: lead, zinc, tin, iron, nickel. The application of additional deoxidant (to the phosphorous copper) at the stage of fire refining of copper allowed to improve the copper anode quality - to decrease the amount of anodes with superficial defects.

Keywords: secondary copper, fire refining, anode

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EFFECT OF PLACEMENT AND REFLECTOR GEOMETRY ON THE PROCESS OF DRYING OF ORGANIC RAW MATERIAL

page 13-15

At present, the actual task of the food industry is the creation of products with a high content of biologically active substances (BAS). One of the ways to improve the quality of food products and nutrition structure of the population is the introduction of organic types of fruit-berry raw material in the diet.

The nutritional value of fruit-berry raw materials is conditioned by their energy, biological, physiological, therapeutic and preventive, organoleptic value and safety, which is determined by the content of biologically active substances in them. One of the promising methods of fruit-berry raw materials conservation with the possibility of the maximum preservation of BAS in the food industry is the use of infrared radiation (IR).

The purpose of the researches is to determine the uniformity of the heat flow distribution from the quartz radiator on a flat receiving surface (a tray with a product) and the effect of the reflector shape and geometrical placement on the temperature field uniformity.

In this regard, the experimental design of the IR-dryer was developed. To determine the uniformity of the heat flow distribution in the experimental IR-dryer, its heat engineering system was considered. As a result of mathematical processing of experimental data, it was proved that the proposed reflector placement at the corresponding level should provide the uniform heat flow distribution from radiators on the flat receiving surface, and, hence, uniform heating of plant material both on the top surface of the receiver, and on the bottom.

Keywords: organic fruit-berry raw material, IR-dryer, reflector geometry, flat receiving surface.

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CAGULATION STRUCTURE OF CEMENT SLURRY WHITH A VARIETY OF CLAY COMPONENT

page 15-17

The features of the coagulation structure formation in water dispersed systems – chalk-based cement slurry in the use of clay components with different chemical and mineralogical composition and dispersion are shown. The comparisons of properties of polymineral clay for Portland cement production with the varieties of kaolins, used for white cement production are given. It is noted that varying of the types of clay components in raw mixtures for Portland cement clinker production with the prescribed properties (saturation factor, modules, phase composition) is an important factor of influencing the coagulation structure formation and properties of the slurry at wet and combined production methods. At applying the specified methods in the white cement technology, the use of enriched kaolin as the clay component promotes the increase of both final product whiteness and slurry stability.

Keywords: cement, dispersed system, composition, dispersion, mineralogy, coagulation structure, rheology, viscosity.

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TO THE CHOICE OF TEMPERATURE CONDITION OF PRODUCTION LINE OF ELECTROLYTIC PRODUCTION OF MAGNESIUM

page 17-19

The mathematical model of the temperature condition of the production line of electrolytic production of magnesium, working in the system of titanium-magnesium production is given. The ranges of possible fusion temperature fluctuation of the production line units at periodic supply of raw materials are shown. The variants of the practical use of the worked out mathematical model at the design and operation of

production lines for the electrolytic production of magnesium are proposed. After the increase of electrolyte temperature in a technological cell to 31°C, because of intensive mass exchange in the electrolyte volume, a surplus heat is taken through the elements of electrolyzer construction, and the temperature of electrolyte during 45 mines is stabilized to a value, near to initial. At consideration of temperature condition of the production line as factors, which cause deviation from a temperature equilibrium, the arrival of heat with the chloride of magnesium, inundated in a head unit and warmth of magnesium chloride mixing with an exhaust electrolyte, acting from a dividing unit was taken into account. The proposed equations for the calculation of temperature condition can be used for the design of the production lines of magnesium electrolysis, and also for the current performance analysis of the production line, operated in the system of titanium-magnesium plants. They can be taken as the basis at the APCS software development for workshops of electrolytic production of magnesium, in which the production technology is used.

Keywords: electrolysis of magnesium, production line, lower titanium chlorides, factorial experiment, humidity.

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FUNDAMENTAL RESEARCH

ANALYSIS OF SPONTANEOUS MAGNETIZING PROCESSES IN CLEAN IRON CRYSTALS

page 20-22

This article shows the results of analysis of theoretical and experimental data, fixed in basis of metals magnetic memory method. A research object is an elementary cell of crystalline grate of clean iron. Its central atoms seem to be stopped up by the eight electrons “neighbours”, occupying the corners of cube and formatting a simple cube grate. The uncompensated magnetic moments which are oriented in space strictly definitely are created in such way. So there is the spontaneous magnetizing of crystals of clean iron. Also it is shown in the article the role of effect magnetostriction in magnetic domains formation, i.e. the change of the orientation of magnetic moments and formation of new domains while ferromagnetic is crystallizing. The tasks of further deep analysis of microstructure of clean iron and application of this knowledge on the real ferromagnetic crystals are given.

Keywords: spontaneous magnetize, crystals of clean iron, magnetic moments of atoms, crystalline grate defects.

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DEVELOPMENT OF POLARIZATION NONDISTRUCTIVE CONTROL METODS OF OPTICALLY TRANSPARENT MATERIALS

page 22-24

The polarization optical control methods are described in the paper. The main purpose of the study is the possibility of improving the polarization optical control methods in two directions: possibility of the optical control method simplification with the purpose of its more efficient use in the production of optical instruments, and

sensitivity increase. The possibility of using the polarization optical control methods for the detection of internal mechanical stresses in optically transparent materials, and also the possibility of increasing the sensitivity of these methods is discussed in the paper. The increase of control sensitivity is proved by the method of comparison with the control, conducted on the standard equipment with the traditional scheme. The developed methods are simpler to operate, compared with conventional control devices and allow to improve the diagnostics accuracy of mechanical stresses in optically transparent materials. The results can be used in the optical production for quality control of materials and finished optical parts.

Keywords: technical diagnostics, optical control method, polarization.

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GRADED-GAP SEMICONDUCTORS AND THEIR APPLICATION

page 24-26

In graded-gap semiconductors spatial dependence of energy gap leads to quasi-electrical embedded layers of different size for holes and electrons, respectively alter their mobility. This results in diffusion-drift mechanism of transfer of alignment-grown carriers, change of coordinate distribution of concentrations, changing of conditions in the surface recombination compared to homogeneous semiconductors. The view of graded-gap semiconductor band structure is determined by the spatial distribution of built-in micro, and the presence of internal and external microfields. The heterogeneity of such fields in space leads to a corresponding different efficiency of band structure that is the result of two mechanisms.

Solar cells based graded-gap semiconductors have a much better power characteristics compared to homogeneous causes considerable interest in their use.

Keywords: graded-gap, semiconductor crystal solar cell.

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WEAR DYNAMICS OF HOES

page 27-28

The paper presents the data, reflecting the given theoretical studies of the wear process of hoes, depending on their geometrical parameters and forces, acting on the surface of the tillage working element. The scheme of the forces action and particles motion direction on the hoe blade during the cultivator motion is given. Standard sizes of hoes and their geometrical parameters are given. The functional dependence for abrasive wear of hoes on such parameters, as normal specific dynamic soil pressure, friction path, hoe material hardness, friction area, is given. It is shown that for ensuring the hoes durability and wear rate reduction it is necessary to reduce the wear ability of abrasive, and also ensure optimal parameters of hoes, which reduce the wear dynamics and ensure the tillage quality.

Keywords: hoe, deformation, technological process, crumbling angle, opening angle, abrasive wear.

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EENERGY AND ENERGY-SAVING

INFLUENCE OF CAPILLARY STRUCTURE CARACTERISTICS ON BOILING INTENSITY IN HEAT PIPE

page 29-31

The research results of the influence of capillary structure characteristics on the heat transfer intensity in the heating zone of miniature heat pipes are presented in the paper. Also, the research results of the influence of heat removal conditions in the condensation area on the internal characteristics of phase transition processes are given.

Copper heat pipes, filled with methanol were selected as experimental samples. The capillary structure was made of copper fibers with diameters of 50 microns and 70 microns, and the length of 3 mm and 7 mm.

The analysis of experimental data showed that the increase in fiber diameter by 1,4 times leads to the decrease in the heat transfer intensity more than by 15 %. At the same time, the essential influence of the length change on the vaporization process in the heating zone of heat pipe was not observed.

The obtained results can be used in designing passive cooling systems of radio-electronic equipment, based on the miniature heat pipes.

Keywords: miniature heat pipe, heating zone, heat transfer coefficient, capillary structure

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EXPERIMENTAL INVESTIGATION OF HYDRODYNAMICS AND HEAT TRANSFER IN CONDITIONS OF FREE CONVECTION

page 31-33

The paper gives a generalization of the results of experimental investigation on heat transfer and hydrodynamics on the surface of horizontal cylinder in conditions of free convection, in the range of Rayleigh numbers $9{,}1\cdot10^3<Ra<1{,}7\cdot10^5$. The results of the research are well generalized by the method described in [6], thus additional work carried out by the author on the analysis of the influence of a choice of the defining temperature also showed the appropriateness of using the recommendations [6]. Visualization of the dynamic boundary layer, which is formed around the heated cylinder, allows visual confirmation of the approaches used in the analysis of results (laminar flow, boundary layer theory, symmetry of the cylinder washing pattern with respect to the vertical plane of symmetry, laminar thermal trace development over the tube surface etc.). By changing the radial coordinate of the smoke stream supply, experimental determination of the approximate frontier of existence of the dynamic boundary layer is possible. The research results are in good agreement with the available data on heat transfer and hydrodynamics of the single cylinder in a large volume, in conditions of free convection.

Keywords: heat transfer, free convection, horizontal tube, hydrodynamics, boundary layer, visualization.

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DEFINITION OF INFORMATION UNCERTAINTY IN POWER ENGINEERING

page 33-35

The approach to solving the problem of initial information uncertainty using the fuzzy-set theory is given in the paper. The features of using the fuzzy approach to solving the problems in

the design and operation of electrical distribution networks are considered. It is shown that, in the design, the main forms of initial information uncertainty are ambiguity, intervality, randomness. The method of defining these uncertainty forms using the fuzzy-set theory is given. The method of converting standard design tasks into the fuzzy form is given.

In the operation of electrical distribution networks, one of the tasks is ensuring the required electricity quality. In solving this task, there is the problem of defining linguistic uncertainty and randomness. The method of uncertainty definition in the fuzzy-set theory is given. The given approach uses achievements of deterministic and stochastic approaches, summarizes them within the single mathematical apparatus. In addition, it allows formalizing the linguistically uncertain concepts and on this basis forming new generalizing forms of analysis.

Keywords: electrical distribution network, design, operation, uncertainty, fuzzy sets

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