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ANALYSIS OF THE STRESS-STRAIN STATE IN CARBURIZED GEARWHEELS

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Abstract—This article studies the static strength, static fracture and stiffness of the teeth of a wheel made of structural alloy steel of 12KhN3A grade before and after the carburizing of the working surface. The results of the analysis show that the static strength and static destruction of the part before and after chemical heat treatment are approximately equal, however, the gear wheel, strengthened by this method, has a higher hardness. The study and simulation of the applied loads were carried out using a 3D-model in the SolidWorks 2018 Simulation software**.**

Keywords: gear wheel, cementation, tooth, surface hardening, stress-strain state

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STRUCTURE AND PROPERTIES OF COPPER M0b AFTER COMBINED PLASTIC DEFORMATION

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Abstract—The paper presents the results of studies of the structure and physical and mechanical properties of copper M0b after combined plastic deformation under different schemes of equal channel angular pressing (ECAP) and upsetting or ECAP and multi upsetting. Comparative characteristics of the structure, hardness and deformational decompaction of copper are given. Interesting to note that after ECAP and multi upsetting treatment, a deeper development of the structure has been observed.

Keywords: equal channel angular pressing, upsetting, plastic deformation, hardness, relative decompaction, fine structure

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CHANGE IN INTER-ATOMIC COMMUNICATION CHARACTER IN THE FORMATION OF SOLID AND LIQUID SOLUTIONS. RELATIONSHIP OF VIBRATIONAL AND CONFIGURATION ENTROPY AND THEIR PHYSICAL INTERPRETATION

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Abstract—The purpose of this work is to show that during mixing, two hidden (latent) processes proceed simultaneously and compensate each other: the first initiates an increase in the average heat capacity, equal in magnitude to the entropy of mixing, which requires energy absorption to ensure a constant temperature, the second – simultaneous latent heat release by strengthening interatomic bonds. The passage of these two processes during mixing shows the identity of the vibrational and configurational (statistical) entropy.

Keywords: vibrational and configurational entropy, entropy of mixing, second law of thermodynamics, traditional and classical approaches

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FORMATION OF MAO-COATINGS OF HIGH THICKNESS ON TITANIUM ALLOYS AND EVALUATION OF TRIBOLOGICAL PROPERTIES IN FRICTION PAIR WITH BRONZE

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Abstract—The article presents experimental data on the effect of microarc oxidation parameters on the thickness and structure of the MAO-coating and its tribological characteristics in friction against bronze. The application of thick antifriction coatings by the MAO-method on titanium alloys has been developed. The possibility of using MAO-coatings of high thickness in sliding friction units was investigated.

Keywords: microarc oxidation (MAO), titanium alloys, coating, thickness, friction, wear, friction coefficient

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NANOSTRUCTURED COMPOSITE POWDERS FOR PRODUCING PROTECTIVE COATINGS OF MACHINE-BUILDING PARTS AND UNITS

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Abstract—The paper studies a method for producing nanostructured composite powders of the metal – nonmetal system. Powders preparation by universal disintegrator-activator technology, processing in planetary ball mills and bowl grinders is shown on the Al–Zn–Sn composition and titanium nitride nanoparticles. Judging by engineering-and-economical performance, the most promising method for obtaining nanostructured composite powders is the method of processing in a bowl grinder.

Keywords: nanostructured powders, titanium nitride, protective coatings, composite powders

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ON THE MICROPLASMA SPRAYING OF VOLUME-POROUS FUNCTIONAL COATINGS BASED ON γ-Al_2O_3

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Abstract—This paper presents the results of comprehensive studies of the process of obtaining volume-porous catalytically active coatings based on γ-Al_2O_3 using a controlled microplasma spraying process.

Keywords: catalysis, volume-porous coating, microplasma spraying, adhesive strength, specific surface area, pore size

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INFLUENCE OF SLIDING BEARING DESIGN ON EFFICIENCY OF THE FLUOROPLAST MACROMODIFIER FOR ANTIFRICTION CARBON PLASTICS

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Abstract—The paper presents the results of laboratory and bench tests of UGET and FUT antifriction carbon plastics macro modified with PTFE. The efficiency (friction coefficient reduction) of this modification of carbon fiber reinforced plastics has been confirmed. The dependence of the method's efficiency on the design of sliding friction units has been established. The plastic deformation of the fluoroplastic, when designing sliding bearings, the key factor that determines the effectiveness of the modifier is taking into account. The design of the friction unit should exclude the pressure gradient in the fluoroplastic protectors and prevent the possibility of an uncontrolled exit of the fluoroplastic from the friction zone.

Keywords: antifriction carbon plastics, friction and wear, sliding, fluoroplastic, modifier

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RESEARCH OF PROPERTIES OF FIBERGLASS BASED ON POLYETHERETHERKETONE

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Abstract—This article presents the results of studies of the properties of fiberglass based on polyetheretherketone (PEEK). A comparative analysis of the physical, thermophysical, elastic-strength and dielectric properties of fiberglass based on PEEK and fiberglass based on epoxy binder is carried out. The results of a study of the fire-insulating properties of fiberglass based on PEEK are presented.

Keywords: thermoplastic binder, thermosetting binder, PCM, fiberglass, aviation materials

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THERMOPHYSICAL AND PHYSICAL-MECHANICAL PROPERTIES OF THE MODERNIZED INDUSTRIAL PVC-PLASTIC COMPOUND

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Abstract—A directed modernization of the formulation of industrial PVC-plasticate of I40-13A grade using zinc borate, antimony oxide and chalk was carried out. It has been found that the introduction of these additives into the compound makes it possible to obtain a plastic compound with improved values of thermal stability and thermophysical properties. At the same time, the modernization of the formulation of industrial PVC-plasticate grade I40-13A leads to a noticeable improvement in the main physical and mechanical indi-

cators of the original compound. It is shown that a slight modernization of the original formulation of industrial PVC-plastic compound can be used to obtain materials that meet fire safety requirements.

Keywords: polyvinylchloride, plasticate, composition, modernization, thermal stability, thermophysical and physical-mechanical properties

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RESEARCH OF CORROSION-RESISTANT WELDING OF NPP EQUIPMENT PERFORMED WITH A STRIP ELECTRODE BY ARC AND ELECTROSLAG METHODS

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Abstract—This article presents the results of studies of corrosion-resistant surfacing with a strip electrode under a layer of flux on carbon steel, performed by arc and electroslag methods. The similarity of the chemical composition, structure, mechanical and corrosion characteristics of the deposited metal in both cases is established. It has been shown that electroslag surfacing provides greater purity for non-metallic inclusions.

Keywords: corrosion-resistant coating, electroslag strip surfacing, fusion zone, intergranular corrosion, pitting corrosion, microstructure

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COMPOSITION AND MORPHOLOGY OF HOT-SALT CORROSION IN HEAT RESISTANT NICKEL ALLOYS

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Abstract—This article investigates the change in the structure of heat-resistant nickel alloys doped with cobalt, chromium, molybdenum, aluminum, niobium, tungsten and titanium and aluminum, cobalt, rhenium, tantalum, ruthenium, molybdenum, tungsten and chromium under the influence of a solution of 75% Na_2SO_4 + 25% NaCl in temperature range 600–750°C. As the results of the study show, a corrosive film

of a layer structure based on oxides of chromium, aluminum, nickel and nickel sulfides is formed on the metal surface. It has been established that the nature of corrosion destruction of metal depends on the composition and content of alloying elements in it.

Keywords: nickel heat-resistant alloys, hot-salt corrosion, Na_2SO_4 + NaCl salt

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INVESTIGATION OF IRRADIATED METAL OF INTERNALS OF WWER-TYPE REACTOR AFTER 45 YEARS OF OPERATION. Part 4. Mechanical properties and fracture mechanisms

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Abstract—Experimental data are obtained for austenitic chromium-nickel steel of 18Cr–10Ni–Ti grade(analog of AISI 321 steel) irradiated with mixed neutron spectrum to various damage doses at temperature near 300°C. Metal for investigations has been taken from decommissioned components of internals of WWER type reactor. On the basis of the tests of standard cylindrical specimens the strengthand the plasticity characteristics are determined over wide temperature range. The fracture mechanisms are studied by SEM examination.

It is revealed that the fracture strain decreases with decrease of temperature and the transition occurs from transgranular ductile to intergranular brittle fracture. The performed review of other published works has shown that this phenomenonmay be observed for various austenitic steels irradiated with mixed neutron spectrum and for austenitic and ferritic steels with implanted helium. This phenomenon is termed as low temperature helium embrittlement (LTHE).

Keywords: irradiated austenitic steel, mechanical properties, fracture mechanism, low temperature helium embrittlement

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STRUCTURAL INTEGRITY ASSESSMENT AND LIFETIME PREDICTION FOR THE CONTROL RODS COUPLINGS OF THE WWER-440 REACTOR. Part 1: Investigation of steel 14Kh17N2 grade embrittlement under neutron irradiation

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Abstract—The effect of neutron irradiation on the mechanical properties, fracture toughness and hardness of martensitic-ferritic stainless steel 14Kh17N2 grade (analogue of AISI 431 steel) is investigated. The investigation is carried on the metal of control rods couplings of WWER-440 reactor of Unit 3 of Novovoronezh NPP. The metal had neutron fluence up to $8 \cdot 10^{20}$ neutr./cm^2. The dependence of yield stress of the steel 14Kh17N2 grade on temperature and neutron dose is defined and correlations between its yield stress, fracture toughness and hardness are evaluated.

Keywords: martensitic-ferritic steel, properties, neutron irradiation, control rods coupling

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STRUCTURAL INTEGRITY ASSESSMENT AND LIFETIME PREDICTION FOR THE CONTROL RODS COUPLINGS OF THE WWER-440 REACTOR. Part 2. Assessment of the coupling structural integrity and justification of its material degradation monitoring interval

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The structural integrity of the control rods couplings of the WWER-440 reactor is analyzed. On the basis of material investigation of the control rod couplings (martensitic-ferritic stainless steel grade 14Kh17N2, analogue of AISI 431 steel) that were under operation in the Unit 3 of Novovoronezh NPP it is shown that the structural integrity of the coupling is satisfied until the radiation-induced hardening of its material not exceed 423 units of Vickers hardness.

Keywords: structural integrity, control rods couplings, 14Kh17N2 steel, irradiation

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STRUCTURAL INTEGRITY ASSESSMENT AND LIFETIME PREDICTION FOR THE CONTROL RODS COUPLINGS OF THE WWER-440 REACTOR. Part 3. Optimization of post-irradiation recovery annealing of the control rods couplings

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Abstract—The optimization of post-irradiation recovery annealing of metal of control rods couplings (martensitic-ferritic stainless steel 14Kh17N2 grade, analogue of AISI 431 steel) is carried out. It is shown that the optimized recovery annealing leads to complete recovery of the mechanical properties of coupling metal embrittled under neuron irradiation. The recovery annealing does not reduce corrosion resistance of control rod tube made of austenitic stainless steel 08Kh18N10T grade (analogue of AISI 321 steel).

Keywords: martensitic-ferritic steel, austenitic stainless steel, irradiation, recovery annealing

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