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ABSTRACTS OF PUBLISHED ARTICLES

UDC 669.15'786–194.56:539.3:621.78.08

The influence of cooling rate in the interval 1100–800°C on mechanical properties and structure of nitrogen austenite steel. Sagaradze V. V., Pecherkina N. L., Zavalishin V. A., Filippov Yu. I., Mushnikova S. Yu., Kalinin G. Yu. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 5–12.

The influence of cooling rate (from 10³°C/min at water quenching to 2.6°C/min at controlled cooling) in the temperature interval 1100–800°C on the structure and mechanical properties of nitrogen austenite steel 0.04C–20Cr–6Ni–11Mn–0.4N–2Mo–Mb–V–ESR (with electro-slag remelting) was investigated to determine the optimal treatment conditions for the conservation of high values of the impact toughness. Strength σ_B and yield point $\sigma_{0.2}$ of the samples cooled with the rates 20, 10, and 5°C/min small rise in comparison with $\sigma_{0.2}$ and σ_B of the samples quenched in water from 1100°C. Contraction ψ and elongation δ remain practically unchanged. KCV falls almost by 3 times with the reduction of cooling rate from 20 to 2.5°C/min (from 274 to 96 J/cm²). Transmission electron microscope investigation showed that the slowing-down cooling of steel 0.04C–20Cr–6Ni–11Mn–0.4N–2Mo–Mb–V–ESR in the range of high temperatures leads to the more intensive high-temperature decay of γ -solid solution in the interval 1100–800°C and to the growth of the near-boundary nitrides in the structure.

Keywords: nitrogen steel, mechanical properties, structure, electron-microscope investigations, decay of supersaturated solid solutions, nitrides.

UDC 669.15'786–194.56:539.377:537.621

The change of magnetic properties of nitrogen austenite steel 0.04C–20Cr–6Ni–11Mn–0.4N–2Mo–Nb–V after the low-temperature deformation. Zavalishin V. A., Sagaradze V. V., Kataeva N. V., Kalinin G. Yu., Mushnikova S. Yu. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 13–18.

The cold deformation of the previously quenched nitrogen steel 0.04C–20Cr–6Ni–11Mn–0.4N–2Mo–Nb–V–ESR (with electro-slag remelting) for 58% at –75°C and 97% at 20°C doesn't result in the formation of ferromagnetic martensite and doesn't change its paramagnetic properties. Deformation for 8–25.8% at cryogen temperatures (–196°C) leads to the formation of thin ϵ -martensite plates, within which a small amount (~0.20%) of ferromagnetic α -martensite is formed. The observed appearance of deformation α -martensite doesn't lead to the decrease of steel magnetic susceptibility below the acceptable level.

Keywords: nitrogen steel, mechanical properties, structure, electron microscope investigation, low-temperature deformation.

UDC 621.039:669.15–194.56

Optimization for regulation methods of structure large-sized forgings from austenite steels for equipment of nuclear power plants. Dobrynina M. V., Filimonov G. N., Pavlov V. N. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 19–37.

The influence of the basic technology factors is researched at manufacture of large forgings for details of NPP, in particular degrees of deformation and temperatures of heating before deformation upon structural condition of 08Cr18Ni10Ti steel type. On the basis of received results the complex of technological actions directed on reception of homogeneous fine-grained structure (not larger than 3 points on a scale of GOST 5639) is developed.

Keywords: equipment of nuclear power plants, austenite steel, large-sized forgings, fine-grained structure.

UDC 669–413: 669–418: 669.001.5

Modeling of pipe steel composition influence and effects of thermomechanical treatment upon austenite decay and ferrite structure. Zolotarevsky N. Yu., Nesterova E. V., Vasiliev A. A., Titovets Yu. F., Khlusova E. I. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 38–52.

They elaborated mathematical model which describes kinetics of ferrite formation in pipe steel structures and allows forecasting of ferrite structural parameters depending on composition and structural features of initial austenite and cooling mode after hot rolling.

Keywords: pipe steel, austenitic decay, ferrite, thermomechanical treatment, mathematical model.

UDC 669.13:621.762

Theoretical and technological bases of carbide PIG-iron production. Gurevich Yu. G. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 53–59.

The paper studies bases of working out the production technology of carbide pig-iron details and shows results of the thermodynamic analysis of interaction of chrome, titan and elements of pig-iron. Results of experimental research of carbide pig-iron properties subject to different technological modes are described and the technology for carbide pig-iron details manufacturing is developed.

Keywords: carbide pig-iron, powder metallurgy, sintering, pressing.

UDC 621.039.536.2

Prevention of adverse structural changes in metal at thermal straightening of a thin-walled vessel.

Svetlikov V. A., Kuklin O. S. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 60–69.

The paper formulates rules for changing transportable normal-circular source of heat to forecast structural changes in metal at thermal straightening of a thin-walled vessel. They have calculated maximal temperature of back surface of covering.

Keywords: thin-walled vessel, thermal straightening, structural changes.

UDC 678.5:537.63:536.421.4

Polymerized materials structural memory of the influence of weak magnetic field pulses on its original components. Datsko O. I., Abramov V. S., Datsko I. O. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 70–75.

Polymerizing materials with original components produced in different forms (two pastes, one paste, powder and liquid) and different methods of curing (chemical, light emission, heat) have been investigated. Effects from the influence of weak magnetic field pulses (WMFP) in different modes on the original components of polymerizing materials on the level of microhardness H_{μ} of polymerizing material and level of damped oscillations decrement Q^{-1} of the original component (powder) have been investigated.

It has been determined that after the influence of WMFP there are changes in the levels of properties H_{μ} and Q^{-1} which reveal the dependence on the mode of WMFP application, an extreme behavior, the correlation, the time dependence of Q^{-1} which is of the oscillation-damping character. The obtained results show that the polymerized material and materials of the original component possess the effect of structural memory of WMFP effect on original components. The effect originates in material of the original component; it is inherited by the cured polymerized materials.

The method of WMFP influence of original components of polymerizing material can be applied in practice for an additional purposeful change of physical and mechanical properties of polymerized material.

Keywords: impurity-defect complex, damping oscillations decrement, microhardness, weak magnetic field, structural memory.

UDC 669.293:295:621.77

Influence of deformation-heat processing applying equal-channel multiangular pressing on pinning force in a multifibrous superconductor on the basis of niobium-titanium alloy. Beloshenko V. A., Dmitrenko V. Yu., Chishko V. V., Mikhailov V. I., Gajda D., Pięntosa J., Piechota S., Diakonov V. P. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 76–80.

They have studied influence of the combined deformation (equal-channel multiangular pressing, hydroextrusion, drawing), as well as the heat treatment on volumetric pinning in a multifibrous superconductor on the basis of alloy Nb + 50 mas. %Ti. The paper also presents the qualitative analysis of whirlwinds pinning on alloy structural heterogeneities.

Keywords: multifibrous superconductor, NbTi alloy, equal-channel multiangular pressing, pinning force.

UDC 678.743–41:621.891

Management of operational properties of metal-fluoroplastic materials. Kornopoltsev V. N. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 81–88.

The paper considers a possibility of tribotechnical characteristics management for sheet metal-fluoroplastic material (SMFM) due to creation of porous ceramic metal structure-defined coating on steel substrate and using of teflon compositions impregnating the porous layer.

The author presents the relation of area, occupied by bronze framework, and deterioration of thickness of working layer and the SMFM, and besides states that the contact of the bronze framework with counterbody changes within 10–15% from the general area of interfacing as the wear of the working layer (0.2–0.25 mm depth) advances. Comparative SMFM (grade DU) and presented material tests at $p = 2$ MPa and $V > 2$ m/s have been proved that DU material working layer abrades to 0.2–0.25 mm in less than 30 hours, and new SMFM abrades to 0.01–0.015 mm in 100 hours.

The paper shows that it is possible to increase lead concentrations in polymeric composition (on the base of polytetrafluoroethylene) filling the porous bronze layer at air sintering and under surplus pressure due to the introduction of the additive of a lead dioxide or a carbon-graphitic material (coke, graphite) into polymeric composition. The lead dioxide additive would enable decreasing of the friction factor of SMFM on steels under high velocities, but introduction of a carbon-graphitic material allows raising wear resistance of polymeric composition when working with low velocity of the sliding motion.

Keywords: sheet metal-fluoroplastic material, structure, porous layer, teflon, lead, wear intensity, slide velocity, lead dioxide, carbon-graphitic material.

UDC 666.3:621.762

The structure and properties of ceramics produced from bifractional powder systems. Kozlova A. V., Buyakova S. P., Kulkov S. N. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 89–95.

The phase composition, structure and mechanical properties of ceramic materials made from fine-grained and coarsely dispersed ZrO_2 powders were studied. The paper shows, that the dependence of the porosity volume and an average pore size from the increasing of fine-grained powder content is nonlinear. The ratios of fine-grained and coarsely dispersed powders corresponding to the maximum and minimum value of porosity volume were calculated. The strength of these materials increases with the increasing of fine-grained powder content.

Key words: strength, porosity, fine-grained and coarsely dispersed powders.

UDC 678.743.41:621.793

PTFE thin film adhesion on metal surfaces. Ayurova O. G., Kornopoltsev V. N., Mogonov D. M., Maksanova L. A. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 96–100.

The paper shows the research results for definition of efforts at shear displacement of metal plates stuck together by politetrafluoroethylene film coatings (modified and not modified) densely pressed by heat treatment. The greatest shear force (till 16–18 MPa) has been required for plates of Al and steel “СТ3” of all the chosen metals and alloys. When chemical modifying of PTFE-coatings was previously applied it was registered the increasing of the shear force, indirectly testifying the presence of cohesive and adhesive interaction of PTFE – metal.

Keywords: film coating, metal surface, politetrafluoroethylene, thermal processing, shear force, cohesive and adhesive interaction.

UDC 687.175:677.074:620.179.13

Studying of gas segregation from a structural material of an air tight protective suit applied for work in high purity argon medium. Andronov E. V., Oryshchenko A. S. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 101–106.

During a high temperature treatment of chemically active materials air tight protective suits are used in manned ground chambers in argon medium. They protect personnel from harmful argon influence and besides they don't contaminate high purity argon with active impurities. The objective of this study is to research gas segregation from the cloth 1108, used for manufacturing of air tight protective suits. Gas

segregation was examined in vacuum during an isothermal soaking of cloth at a temperature of 20, 40 and 60°C. A big potential of segregation has been revealed for water steam, carbon dioxide, carbon/nitric oxide, air and hydrogen. The segregation velocities, which achieve their maximum at a temperature of 40°C, are as follows: $4.235 \cdot 10^{-7}$; $7.171 \cdot 10^{-7}$; $16.504 \cdot 10^{-7}$; $50.245 \cdot 10^{-7}$; $98.855 \cdot 10^{-7}$ l·torr/s·cm². Their content as well as qualitative ratio of velocities during their segregation are preserved at temperatures from 20 to 60°C. The results could be used for correction of preventive measures schedule for air tight protective suits; functioning purification and temperature regulation systems for argon; and locking operators into chambers.

Key words: high temperature treatment of chemically active metals, argon, air tight protective suits, kinetics and gas segregation velocity; mass-spectrometry; partial pressure measurer.

UDC 621.762:661.665.3:532.612

Method of estimation of surface tension analyzing dispersed carbide boron. Boiko V. F., Vlasova N. M., Zaitsev A. V. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 107–111.

The estimation of energy of surface tension of dispersed boron carbide is given based on a Rittinger model of process of crushing of granulated materials. Factor of a superficial tension is determined by results of analysis of grain-metrical characteristics of grinded powders.

Keywords: dispersed boron carbide, surface tension, method of estimation.

UDC 621.793

Method of magnetron spraying for obtaining different forms of carbon nanotubes. Antonenko S. V., Malinovskaya O. S. – Voprosy Materialovedeniya, 2011, N 3 (67), p. 112–116.

Method of magnetron spraying was used to obtain X-, Y-shaped carbon nanotubes, nanobuds and “sea urchin” nanotubes. Various forms have been achieved by varying a type of substrate and catalyst used. The proposed method has been patented (patent 2355625 from 16.07.2007) and entered in the list of 100 best inventions of Russia in 2008. It allows obtaining different forms of nanotubes in the required quantities at low cost without the use of explosive substances (hydrocarbons, etc.) and complex systems. The resulting nanotubes could be applied in nanoelectronics as transistors, diodes and other electronic devices.

Keywords: method of magnetron spraying, carbon nanotubes, methods of electronic microscopy.