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CONTENTS

ABSTRACTS OF PUBLISHED ARTICLES

UDC 669.14.018.295

Development of high-strength structural steels – since the first experiments up to now. Malyshevsky V. A., Kalinin G. Yu., Kharkov A. A. – Voprosy Materialovedeniya, 2011, N 1 (65), p. 17–27.

The paper describes the way I. V. Gorynin's scientific school of developing the high-strength structural steels was formed since the early 1950s up to the present time. Achieved results and fields of structural steels application in shipbuilding and other industries are demonstrated.

Keywords: high-strength structural steels, creation of scientific school, achieved results, fields of application.

UDC 669.15–194:621.039.531

High irradiation resistant steels for vessels of water-water reactors of new generation. Karzov G. P., Oryschenko A. S., Teplukhina I. V. – Voprosy Materialovedeniya, 2011, N 1 (65), p. 28–40.

At CRISM "Prometey" was created the complex of irradiation resistant steels based on composition Cr–Mo–V with limited contents of nickel with the help of advanced achievements of radiating materials science and modern precision technologies in metallurgy. This complex covers manufacturing of nearly all types of light-water NPP of WWER type for perspective projects, including ship, icebreaking, small and average capacity, block and integrated types.

Keywords: irradiation resistant steels, water-water reactors, prospects of application.

UDC 669.15–194:621.039.53:539.4

Degradation of properties of structural materials at long time influence of operational temperatures. Gorynin I. V., Timofeev B. T. – Voprosy Materialovedeniya, 2011, N 1 (65), p. 41–59.

The paper reports generalized data on long-duration (up to 30 years) effects of operational temperatures in light-water reactors (250–350°C) on mechanical properties of the materials applied for manufacturing of in-line equipment and pipelines of the Russian atomic power stations with WWER and RBMK reactors. They estimated degradation of properties of structural materials and their welded joints during planned service life, and made the forecast of these materials application in case of its resource prolongation without decrease in safety and reliability.

Keywords: structural materials, operational temperatures, mechanical properties, degradation of properties, forecast of opportunity for resource prolongation.

UDC 669.295:629.5:621.039

Titanium alloys for sea equipment and atomic power engineering. Oryschenko A. S., Kudryavtsev A. S., Mikhailov V. I., Leonov V. P. – Voprosy Materialovedeniya, 2011, N 1 (65), p. 60–74.

They researched influence of alloying, hot deformation and heat treatment upon structure, mechanical properties and characteristics of working capacity of titanium alloys and their welded joints. The basic fields of titanium alloys for sea equipment and atomic power engineering are determined.

Keywords: titanium alloys, alloying, hot deformation, heat treatment, working capacity, application fields.

UDC 678.067:621.891

Antifrictional nonmetallic materials for units of a sliding friction. Bakhareva V. E., Nikolaev G. I., Anisimov A. V. – Voprosy Materialovedeniya, 2011, N 1 (65), p. 75–88.

New high strength antifrictional polymeric carbon-fibre plastics (УГЭТ and ФУТ), their modifications (УГЭТ-ТН and ФУТ-Б), and also new heat resistant antifrictional carbon-fibre plastics (УПФС) were developed for ship and power engineering to guarantee the functioning of friction units with water greasing, including overheated water. These materials surpass traditional polymeric antifrictional materials as concerns durability and wear resistances.

Keywords: antifrictional polymeric carbon-fibre plastics, units of friction, water greasing, durability, wear resistance.

UDC 669.14.018.295:621.78

Change of structure of high-strength tube steel of К70–К80 class of strength at variation of regimes of high-temperature tempering after thermomechanical treatment. Sych O. V., Khlusova E. I., Kruglova A. A., Orlov V. V. – Voprosy Materialovedeniya, 2011, N 1 (65), p. 89–99.

They researched how structure of high-strength strips for the main pipelines – class of strength Х90 (К70)–Х100 (К80) – is forming after various technological regimes of thermomechanical treatment. Research results of temperature and time of storage at tempering influencing on dispersiveness and morphology of structural components are presented. Effects of high-temperature tempering upon structure and mechanical characteristics of an industrial set of strips Х90 (К70)–Х100 (К80) class of strength is shown.

It was discovered that creation of ferrite-bainite structures with bainite predominately granular morphology and fraction of polygonal ferrite of 15–20% in steel with C_{equiv} = 0,45% could provide scheduled complex of mechanical characteristics of steel of К70 (Х90) class of strength. Thermomechanical treatment with accelerated cooling up to temperature below 50°C and the subsequent long high-temperature tempering at temperature (620–640°C) which allows to provide a complex of properties of steel of Х100 class of strength suitable for manufacturing of high-strength strips from steel with carbon equivalent C_{equiv} = 0,58%.

Keywords: strips, thermomechanical treatment with accelerated cooling, quenching from rolling heating, high-temperature tempering, bainite, ferrite, carbides, mechanical properties.

UDC 669.15–194.591:539.2:621.77.016.2

Influence of parameters of plastic deformation upon creation of ultrafine disperse structures in low alloyed bainite steels. Korotovskaya S. V., Nesterova E. V., Orlov V. V., Khlusova E. I. – Voprosy Materialovedeniya, 2011, N 1 (65), p. 100–109.

An ultradisperse structure was formed in low-alloyed steels due to propagation of processes of fragmentation in austenite under the deformation going below recrystallization temperature. The creation of structure size 500–1000 nanometers in industrial conditions leads to substantial increase both of strength and plastic properties, but also of resistance to brittle fractures at low temperatures.

Keywords: ferrite-bainite steel, ultrafine grained structure, hot plastic deformation, fragmentation.

UDC 620.182.25:621.791

Development of electron-microscopy specimen preparation for investigations of nanostructured bond zones in dissimilar joints by ion milling. Ushanova E. A., Nesterova E. V., Petrov S. N., Rybin V. V., Kuzmin S. V., Grinberg B. A. – Voprosy Materialovedeniya, 2010, N 1 (65), p. 110–117.

Ion-milling and FIB-milling methods were developed to ensure the investigations of nanostructured bond zones in explosively welded dissimilar joints such as intermetallic alloy Ti–Al–Nb – Ti, Cu – Cu foil – ferritic steel. Foils met the requirements for TEM- and EBSD-specimens from bond zone of explosively welded joints. The advantage of FIB-milling method was shown. The results of nanostructured zones testing of phase composition, fragments size and misorientations were presented.

Keywords: ion milling, FIB milling, explosive welding, bond zone.

UDC 678.067:539.538

Estimation of the matrix loading of Ф4К15М5 polymeric composite viewing the comparative analysis of wear particles size. Kozyrev Yu. P., Sedakova E. B. – Voprosy Materialovedeniya, 2010, N 1 (65), p. 118–122.

On the basis of the analytical dependences and tribotechnical tests of Ф4К15М5 polymer composite recommendations for definition of the correct value module of disperse filler elasticity and the correct value of the loading, due to the composite matrix are given. The obtained results could be used during estimation of wear resistance of non-uniform materials.

Keywords: antifrictional materials, composite, polymer, filler, the module of elasticity, wear particles, wear resistance, tribotechnical tests.

UDC 666.792.32:621.762.5

Influence of activating additives yttrium aluminum garnet and magnesium spinel on compactibility and mechanical properties of SiC ceramics. Perevislov S. N., Chupov V. D., Tomkovich M. V. – Voprosy Materialovedeniya, 2011, N 1 (65), p. 123–129

In this paper, silicon carbide materials were obtained by the method of activated sintering with the addition of 5–20% wt. yttrium aluminum garnet and magnesium spinel at a temperature of 1850–2100°C. The maximum physical and mechanical properties were achieved on SiC material with the addition of 10% wt. $3Y_2O_3 \cdot 5Al_2O_3$: the density of up to 98% of the theoretical bending strength 480±10 MPa, Vickers hardness 21,3±0,2 GPa, fracture toughness K_{1c} = 6,5±0,2 MPa·m$^{1/2}$, which can be explained correct choice of sintering temperature, use of superfine powders and the initial uniform distribution of oxide sintering additives activation between the grains of SiC, as well as getting under optimal conditions, the material with fine-grained structure.

Keywords: silicon carbide, activated sintering, yttrium aluminum garnet, magnesian spinel.

UDC 669.255:537.612

Influence of climatic factors upon coefficient of shielding of composite magnetic screens. Mazeeva A. K., Kuznetsov P. A., Obydennykh N. F. – Voprosy Materialovedeniya, 2011, N 1 (65), p. 130–135.

The paper reports studies' results of protective magnetic screens' (made of cobalt alloy АМАГ-172) working capacity analyzing the influence of various climatic factors. There was researched the influence of temperature upon adhesion of polyethylene terephtalate film and metallic strip, and the regime of screens manufacturing was determined by the test on resistance to stratifying. During the tests it was observed that the shielding factor depends on duration of influence of climatic factors, the obtained data was used to calculate changes of shielding properties of magnetic screens for the operating life up to 20 years. So, after this period the efficiency of shielding could go down to 40% and the shielding factor would be no less than 30 for the single-layered magnetic cylindrical screen in diameter of 50 mm in a range of fields up to 400 mcT.

Keywords: composite magnetic screens, shielding factor, adhesion, climatic factors.

UDC 621.762.222

An estimation of superficial energy of powders of WC, TiC at mechanical crushing. Boyko V. F., Vlasova N. M., Zaytsev A. V. – Voprosy Materialovedeniya, 2010, N 1 (65), p. 136–142.

The paper offers the method (alternative to the existing) of definition of a superficial tension in solid bodies, elaborated on the basis of generalization of Rittinger's law, Gibbs' equation of thermodynamics, and diffraction analysis of the crushed powders' granulometric characteristics – its prototype (WC) and original (TiC). Values of superficial tension of titan carbide factor is defined.

Keywords: destruction by crushing; surface tension coefficient, granulometric of characteristics, tungsten carbide, titan carbide.

UDC 621.892:669.27

Tribological characteristics of liquid lubricating compositions with ultra fine particles of tungsten dichalcogenides additives. Tolochko O. V., Breki A. D., Vasilyeva E. S., Maximov M. Yu. – Voprosy Materialovedeniya, 2010, N 1 (65), p. 143–149.

Recently, nanotechnology attracts attention of scientific world very often; there is already a whole range of methods of nanoparticles production, they managed to synthesize nanoparticles of solid lubricants (friction modifiers). But at the same time there is an opportunity to realize estimation of size and morphology factor of the particles based on tribological properties of liquid lubricant compositions (LC) containing nanomodifier.

Determination of basic tribological characteristics of liquid LC with serpentinite was carried out in accordance with state standards – ГОСТ 9490–75 – on a four-ball friction machine (ЧШМ-3,2). Aviation oil MC-20 was applied as a base lubricant. Comparative analysis of the data reveals additives of micro- and nanoparticles of tungsten disulfide to show an opposite effect on EP quality, though LC with nanosized particles is distinguished by EP quality. Relatively low concentrations of WS2 in aviation oil increase its antiwear properties.

Preliminary data shows nanosized WSe2 to be great additive increasing greatly the limit of LC loading capacity, but neutral referring the wear in sliding friction.

Keywords: wear factor, EP properties, scuffing index, stress of welding, friction modifiers, liquid lubricant compositions, dichalcogenides of tungsten, nanoparticles of solid lubricants.

UDC 621.791.053:669.85/.86

Influence of rare-earth metals upon creation of structure and properties of low alloyed seam metal. Melnikov P. V., Mikhailov-Smolnyakov M. S., Motovilina G. D., Khlusova E. I. – Voprosy Materialovedeniya, 2010, N 1 (65), p. 150–161.

The paper describes influence of rare-earth metals upon creation of metal structure of seams at welding by powder wires. During research it was worked out, that rare-earth metals render essential influence on the sizes of dendrites, morphology of carbides and properties of welded seams metal.

Keywords: rare-earth metals, low alloyed powder wire, metal of welded seam, creation of structure and properties.

UDC 669.295:620.197:669.236

Use of ruthenium for increase of corrosion resistance in hostile environments of industrial titanium alloys. Malinkina Yu. Yu. – Voprosy Materialovedeniya, 2010, N 1 (65), p. 162–166.

The paper shows the possibilities to increase corrosion resistance of 5В and ПТ-3В industrial titanium alloys by cathodic alloying or protective platings on the basis of ruthenium. Such alloying is very efficient for resistance to crevice and crater corrosion in chloride media at the increased temperatures.

Keywords: industrial titanium alloys, cathodic alloying, protective platings on the basis of ruthenium, resistance to crevice and crater corrosion.

UDC 669.15–194.56:621.039.531:539.421.5

Research of neutron irradiation effect on fracture toughness of 08Х18Н10Т steel and metal of its welded joints. Smirnov V. I., Margolin B. Z., Lapin A. N., Kokhonov V. I., Sorokin A. A. – Voprosy Materialovedeniya, 2010, N 1 (65), p. 167–183.

The paper reports about the research in the field of neutron irradiation effect on fracture toughness of chrom-nickel austenite steel 08Х18Н10Т and weld metal irradiated in reactor БОР-60. There were determined the characteristics of fracture toughness of these materials on application of various damaging doses and temperature. It was discovered that the orientation of destruction surface referring the direction of rolling would be of great importance for fracture toughness. Temperature effects and preliminary repeated static loading on crack unstable development was also examined. Experimental results were compared with expected dose impacts of 08Х18Н10Т steel and weld metal fracture toughness.

Keywords: chrom-nickel austenite steel, weld metal, neutron irradiation, fracture toughness.