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ABSTRACTS OF THE ARTICLES PUBLISHED

UDC 669.15`786–194:621.785:620.187

Analyses of the evolution of the structure of nitrous corrosion-resistant austenitic steel 06X21AГ10H7MФБ under the thermal deformation and thermal influence. Bannykh O. A., Blinov V. M., Kostina M. V. – Problems of Materials Science, 2006, N 1(45), pp. 9–20.

The results are given of the electron-microscopic examinations of changes in the structure of high-strength corrosion-resistant high-nitride nonmagnetic steel of the type 06X21AГ10H7MФБ developed in IMET RAN jointly with CRISM “Prometey” after hot rolling with the subsequent hardening or the tempering under the conditions ensuring the best combination of strength and the plasticity.

Key words: high-strength corrosion-resistant high-nitride nonmagnetic steel, hot rolling, heat working, strength, the plasticity.

UDC 669.14.018.293:669.017.3

Some special features of structural and phase transformations in high-alloy ship steels. Schastlivtsev V. M. – Problems of Materials Science, 2006, N 1(45), pp. 20–24.

The results of the joint operation of the Laboratory of the physical metallurgical science of the Institute of Physics of Metals of Ural, department of RAN, with CRISM “Prometey” are presented in the historical aspect on the study of possibility of manifestation of structural heredity in deformed, and cast low-carbon alloy steels and to the searches for the methods of its elimination.

Key words: high-alloyed ship-building steels, phase transformations, structural heredity, historical aspect.

UDC 669.14.018.41

Structure and the properties of cold-resistant steels for the constructions of Northern design. Rybin V. V., Malyshevskiy V. A., Khlusova E. I. – Problems of Materials Science, 2006, N 1(45), pp. 24–44.

Work is dedicated to the system study of the processes of the formation of structure and properties of economically alloyed steels at the basic stages of the production — of smelting, heat and thermomechanical treatment for creating cold-resistant weldable steels of different categories of strength, optimum composition and prognostication of their fitness for work in the composition of the constructions of the Arctic design.

Key words: cold-resistant weldable steel, the category of strength, the formation of structure, construction of the Arctic design.

UDC 669.15`786–194

Studies of structure and properties of high-strength corrosion-resistant nitrogen-bearing steel. Kalinin G. Yu., Mushnikova S. Yu., Nesterova E. V., Fomina O. V., Kharkov A. A. – Problems of Materials Science, 2006, N 1(45), pp. 45–54.

The results of studies on the influence of the structure of new corrosion-resistant nitrogen-bearing steel with the yield point over 690 MPa are represented, prepared under industrial conditions, for formation of mechanical and corrosive properties. It is shown that during the selected technological regimes of production of sheet rolling, the steel has austenitic structure with high dislocation density and presence of nitrides, evenly distributed in the volume of grains, which ensures simultaneously high strength and impact toughness. The steel does not manifest tendency toward intercrystalline corrosion and toward corrosion cracking in sea water, and it also possesses high resistance to the pitting corrosion. On the basis of physicomechanical properties the new high-strength corrosion-resistant steel, alloyed by nitrogen, is recommended for wide use in different branches of industry for work in aggressive media and in composition of heavily loaded constructions.

Key words: corrosion-resistant nitrogen-bearing steel, mechanical and corrosive properties, the influence of the structure.

UDK 669.15`26`24`28–194:621.791.052

Influence of alloying on structure and properties of the heat-affected zone of welded joint made of high-strength chrome-nickel-molybdenum steel. Motovilina G. D., Pazilova U. A., Khlusova E. I. – Problems of Materials Science, 2006, N 1(45), pp. 54–63.

The influence of chemical composition of base metal and welding method on the structure and the properties of the heat-affected zone of welded joint made of chrome-nickel-molybdenum high-strength improved steels of the type A5 with the predominantly bainite initial structure is investigated.

Key words: high-strength chrome-nickel-molybdenum steel, the chemical composition of base metal, the welding method, heat-affected zone.

UDC 669.295:539.538

Structural and functional materials are basis for the economical, scientific and technical development of Russia.

Kablov Ye. N. – Problems of Materials Science, 2006, N 1(45), pp. 64–67.

Results of the creative collaboration between the All-Russian Institute of Aviation Materials and CRISM «Prometey» in promotion of titanium alloys into industry are described in the historical aspect.

Key words: functional materials, titanium alloys, piping production, aeroplane building, historical aspect

UDC 669.295:621.74.002.6

Formation and development of production of titanium semifinished products for shipbuilding. Ushkov S. S., Kudryavtsev A. S., Karasev E. A. – Problems of Materials Science, 2006, N 1(45), pp. 68–78.

The scientific, design, research and technological aspects of the development of melting titanium and the basic stages of creation of the domestic industrial technology for production of ingots and semifinished products from structural titanium alloys are presented.

Key words: titanium alloys, technology of production, basic development stages.

UDC 669.15`71–194:621.791–112.81

Creation of welded steel-aluminum hull constructions. Ushkov S. S., Baranov A. V., Pavlova V. I., Osokin E. P. – Problems of Materials Science, 2006, N 1(45), pp. 79–92.

Ship-building bimetal on the basis of low-alloy 10XCHД (D40) steel and the aluminum 1561 alloy are created, intended for joining the aluminum superstructure with the steel ship's hull.

On the basis of the new technical solutions by the construction-engineering formulation of steel-aluminum connections the welding technique is developed of butt, T-beamed and overlapped joints of bimetal, which makes it possible to maximally realize the mechanical properties of the developed bimetal in the composition of hull constructions, to 15–20% to increase the fatigue strength of steel-aluminum units, to exclude the use of scarce austenitic welding materials, to 40–60% to decrease the labor expense for the fulfillment of assembly-line-welding works, to use the mechanized welding methods in CO₂ medium (instead of argon), to ensure impenetrability of butt joints of bimetal and corrosion resistance of steel-aluminum connections at requirement level, presented to the hull materials.

Key words: steel-aluminum constructions, bimetallic adapters, welded joints, construction-engineering formulation, mechanical properties.

UDC 669.715`793

Some aspects of the creation of modern sea high-strength aluminum alloys with scandium. Rybin V. V., Andreev G. N., Barakhtina N. N., Osokin E. P. – Problems of Materials Science, 2006, N 1(45), pp. 92–102.

In the creation of new ship-building materials the determining role of metal science approach among other aspects of scientific search is shown based on the example of the development of aluminum alloys.

Key words: aluminum-magnesium alloys, alloying with scandium, strengthening, recrystallization, the materials science approach.

UDC 669.15–194:621.039.536.2:669.046.516

Basic principles of the alloying of steels for the vessels of atomic reactors of the type VVER.

Morozov

A.

M.,

Filimonov G. N., Tsukanov V. V. – Problems of Materials Science, 2006, N 1(45), pp. 103–111.

The data about the influence of elements of admixtures are presented, and also data for nickel and other basic alloying elements for the resistance to the irradiation embrittlement of steel of composition Cr–Mo–V. The influence of heat working is investigated on for the shift of ΔT_F . The basic criteria of selection of the hull steels for the varied conditions of operation are formulated, preliminary estimation of the radiation service life of reactor vessels is given.

Key words: atomic reactors, steels of hull, the principles of alloying, thermal working, resistance to irradiation embrittlement, the forecasted service life.

UDC 669.15–194:621.039.524.4

Development and the improvement of radiation resistant steels for the vessels of water-cooled water-modulated atomic reactors. Karzov G. P., Nikolayev V. A., Filimonov G. N. – Problems of Materials Science, 2006, N 1(45), pp. 111–123.

The materials science aspects of the creation of structural materials for the base model of future series NPP units with higher resistance to radiation and thermal embrittlement are examined.

Key words: water-cooled water-modulated atomic reactors, radiation resistant steels, resistance to radiation and thermal embrittlement.

UDC 669.15–194:621.039.526

Structural materials for the fast-neutron reactors with the sodium and lead heat-transfer agents.

Markov

V.

G.,

Trapeznikov Yu. M. – Problems of Materials Science, 2006, N 1(45), pp. 124–132.

The complex of studies is carried out and the structural materials are developed, recommended for the hull constructions (steel of brands 10X18H9, 08X16H11M3) and the steam generators (steel of the brand 10X2M) of reactors with the sodium and lead heat-transfer agents.

Key words: structural materials, fast-neutron reactors, hull constructions, sodium heat-transfer agent, lead heat-transfer agent, the steam generators.

UDC 669.15–194.2:539.431:621.039.5

Low-cycle fatigue of low-alloy heat-resisting 15X2MΦA steel. Karzov G. P., Timofeev B. T., Chernayenko T. A. – Problems of Materials Science, 2006, N 1(45), pp. 133–146.

The experimental data for resistance of low-cycle fatigue of 15X2MΦA steel (and metal of its welds) developed in CRISM «Prometey» almost 50 years ago are generalized for the first time. This steel is widely utilized during production of VVER-440 reactors. The data, obtained on the sufficiently representative number of meltings of base metal (21 meltings) and welded tests (16 specimens) and characterizing by high stability, are compared with the results, obtained on the normative dependence ПНАЭ Г-7-002-86.

Key words: low-alloy heat-resisting steel, the resistance of low-cycle fatigue, the reactors BBЭP-440.

UDC 669.245.018.44

Development of high-temperature alloys for elements of construction of the radiant part of the coils of the high-temperature installations for oil synthesis. Oryshchenko A. S. – Problems of Materials Science, 2006, N 1(45), pp. 147–159.

Structural materials for preparing the radiant coils, which work in the high-temperature installations of petrochemical complex under the extremely rigorous conditions are developed.

Key words: high-temperature alloys, radiant coils, high-temperature installations, the petrochemical complex.

UDC 669.295:621.039

Alloys on the basis of titanium — promising material for atomic power engineering. Rybin V. V., Ushkov S. S., Kozhevnikov O. A. – Problems of Materials Science, 2006, N 1(45), pp. 159–168.

The questions of activation ability, radiation durability, pore formation, possible hydrogen absorption, influence of hydrogen, radiation defects and their combined influence on the tendency toward the embrittlement of titanium alloys are examined in connection with operating conditions of water-to-water NPP. The prospects of application of the weakly activated titanium α -alloys are shown as the structural materials of the reactor vessels, intra-hull devices, steam generators, heat exchangers and other articles for creating water-to-water type nuclear power plants with 1,5–2 times increased service life and the high ecological safety both in the process of operation, repair and modernization and with the radioactive waste disposal as well. Dismantling of NPP units made of titanium alloys can be performed 3–5 years after reactor shutdown.

Key words: water-to-water NPP, alloys on the basis of titanium, activation ability, radiation durability, pore formation, hydrogen absorption, radiation defects, tendency toward the embrittlement.

UDC 539.21

Nano-materials of structural and functional class. Rybin V. V., Kuznetsov P. A., Ulin I. V., Farmakovskiy B. V., Bakhareva V. E. – Problems of Materials Science, 2006, N 1(45), pp. 169–178.

The new direction of studies is formed, connected with the use of nano-technology for obtaining the structural and functional materials with the special properties. Studies of the most promising nano-materials of the catalytic, magnetic and tribological classes are conducted.

Key words: nano-materials, catalytic, magnetic and tribological classes, the reactors of steam conversion, antifriction carbon-fiber reinforced plastics, fulleroid type polyhedral multilayer carbonic nano-structures.

UDC 678.067:539.538

Antifriction carbon-fiber reinforced plastics in machine building. Rybin V. V., Bakhareva V. Ye., Nikolayev G. I., Anisimov A. V. – Problems of Materials Science, 2006, N 1(45), pp. 178–191.

The results of long-term investigations are generalized on creation and application of antifriction base carbon-fiber reinforced plastics of brands УГЭТ and ФУТ and their modifications in machine building. The problem of creation of polymeric antifriction materials is solved, which possess the combination of high tribotechnical characteristics, physicomechanical and technological properties. The materials have strength, wear and impact resistance, stability of sizes at the level of metals, but in contrast to them they are capable of working in water and aggressive liquids (water, acids, alkali, oil, hydraulic fluids) or in the extreme conditions without lubrication along counterbodies made of different materials (steel, bronze, titanium alloys, ceramics).

Key words: antifriction carbon-fiber reinforced plastics, tribotechnical characteristics, physicomechanical and technological properties, aggressive medium, wear resistance.

UDC 621.793.7

Control of the structural-phase state of coatings on basis of Al₂O₃ during the spraying by the method HVOF. Oryshchenko A. S., Slepnev V. N., Galeyev I. M., Blank E. D. – Problems of Materials Science, 2006, N 1(45), pp. 191–194.

The analysis of the conditions of forming of different phases of Al₂O₃ is carried out during the high-speed spraying of hot-gas coatings. The influence of phase state of the coatings on the micromechanical properties, the microhardness and the resistance to cracks of the coatings is shown. The influence of technological factors on the phase composition and the micromechanical properties of the coatings, applied by the HVOF method is investigated.

Key words: the oxide of aluminum, phase composition, α -Al₂O₃, γ -Al₂O₃, microhardness, the coefficient of intensity of stresses, HVOF coating, the detonation coatings.

UDC 621.791.755

Theoretical analysis and the experimental check of laws governing the wear of the two-layered electrodes of low-temperature plasmatrons. Vinogradov S. Ye., Kuznetsov V. Ye., Oryshchenko A. S., Rutberg F. G., Rybin V. V., Safronov A. A., Shekalov V. I., Shiryaev V. N. – Problems of Materials Science, 2006, N 1(45), pp. 195–200.

As a result of theoretical analysis the calculated dependence of wear degree on the relationship of areas of the refractory and electro-conductive layers of bimetallic electrodes of plasmatrons is obtained. Dependence has a minimum, depending on electrical resistance and the thermal conductivity of the materials, which compose the electrode. The experimental studies of electrodes in the composition of plasmatrons confirm the obtained dependences. Due to the creation of two-layered electrodes it is possible to increase the wear resistance in 1,5–2 times.

Key words: low-temperature plasmatrons, bimetallic electrodes, refractory layer, electro-conductive layer, degree of wear, the calculated dependence.

UDC 621.791.04

Prospects of using the mineral-ore base of Karelian-Kola region for the production of welding materials and fluxes.

Kalinnikov V. T., Nikolayev A. I., Brusnitsyn Yu. D. – Problems of Materials Science, 2006, N 1(45), pp. 201–211.

Mineral products are examined from the raw material of Karelian-Kola region for their use as the promising welding materials. The noticeable part of the materials can be obtained from the concentrates produced and the half-finished products, including from the present withdrawals of the existing ore-dressing and metallurgical enterprises. The possibility is established of the chemical conditioning of the products regarding the content of limitable admixtures of phosphorus and sulfur. The prospects of using the new raw-material base for organizing the production of the welding materials of the traditional and new compositions are shown.

Key words: welding materials, fluxes, mineral products, the raw materials of Karelian-Kola region, prospects for the use.

UDC 621.791.04:621.039.536.2

Modern base materials for welding and cladding of the VVER type reactor vessels. Karzov G. P., Galyatkin S. N., Mikhaleva E. I., Morozovskaya I. A., Yakovleva G. P. – Problems of Materials Science, 2006, N 1(45), pp. 212–219.

The welding materials of the new generation are developed and industrially mastered, which made it possible to increase plasticity and impact toughness of anticorrosive cladding after maximum technological temperings with the retention of required strength and corrosion resistance.

Key words: the VVER type reactor vessels, the welding materials of new generation, anticorrosive cladding, an increase in the plasticity and impact toughness.

UDC 621.791:669.35+669.14

Investigation of special features and the development of advanced welding techniques of copper alloys with steels and cladding of copper alloys on steel. Rybin V. V., Vaynerman A. E., Baranov A. V., Andronov Ye. V., Pichuzhkin S. A. – Problems of Materials Science, 2006, N 1(45), pp. 220–229.

The special features of interaction of liquid copper alloys with steels in the process of welding or cladding are studied. The new technological processes of the cladding of copper alloys on steel and welding of copper alloys with steels without melting are developed or with minimum melting of steel, that ensure a considerable increase in the mechanical properties of the joints.

Key words: copper alloys, steel, welding, cladding, technological processes, the special features of interaction.

UDC 620.197.6

Developments in the field of the anticorrosive protection of metal structures and objects of technology. Kuz'min Yu. L., Mikhaylova M. A., Nikolayev G. I., Pirogov V. D. – Problems of Materials Science, 2006, N 1(45), pp. 230–238.

The results of studies in the region of electrochemical cathodic and protector protection and paint and varnish coats are given.

Key words: metal structure, electrochemical cathodic anticorrosive protection, protector protection, the paint and varnish coats.