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ABSTRACTS OF PUBLISHED ARTICLES

UDC 669.15□74–194:621.791.052:621.785

Research of structure and properties of metal of zone of thermal influence of welded joints from 09Г2ФБ (E36) steel grade, made with using of thermomechanical processing and quenching with tempering. Kruglova A. A., Hlusova E. I. – Problems of Materials Science, 2008, N 3(55), pp. 5–11.

Features of structure and properties of metal of a zone of thermal influence of welded joint from manganous steel made with using of thermomechanical processing and quenching with tempering are investigated. Influence of heat input of welding and thickness of sheet on structural changes and change of values of work impact connected with them near to border of fusion is shown.

Key words: manganous steel, welded joint, structure, properties, heat input of welding, thermomechanical treatment.

UDC 669.15–194:621.9.048

A composition and structure of alloy steel surface layer after electrodiffusion heat treatment. Pauls V. Yu., Kuskov V. N., Smolin N. I. – Problems of Materials Science, 2008, N 3(55), pp. 12–18.

A composition, structure, mechanical properties and corrosion resistance of alloy steels samples after electrodiffusion heat treatment are investigated. The microhardness of a steel surfaces layer increased in 1.3–2.7 times, wear resistance – in 1.6–1.8 times, heat resistance – in 1.4–1.7 times as a result of processing. The concentration of chromium, nickel, molybdenum, aluminum and silicon in a steel surface layer increased in 1.4–6.7 times in comparison with volume.

Key words: steel, surface layer, electrical current, diffusion, structure, hardening, microhardness, wear, corrosion.

UDC 669.715:620.179

A research of Correlation Structural Parameters and Mechanical Properties with Acoustic Characteristics of Ultrafine-grained aluminium Alloy 1421. Kikin P. Yu., Mishakin V. V., Perevezentsev V. N., Zemlyakova N. V., Kassina N. V. – Problems of Materials Science, 2008, N 3(55), pp. 19–24.

The article presents results of metallographic, X-ray, mechanic and acoustic investigations of ultra small-grained aluminum alloy 1421 after intense plastic deformation and next following gradual thermal treating. Correlation between elastic wave's propagation parameters and micro-hardness, grain size, integral X-ray lines width was found.

Key words: heat treatment, aluminum alloys, mechanical properties, acoustic characteristics

UDC 678.5:621.9:620.178

The research of surface layer hardness of thermosoftening polymeric materials after machining. Erenkov O. Ju. – Problems of Materials Science, 2008, N 3(55), pp. 25–30.

The results of experimental researches to determine the treated surface hardness of blanks from karpolon and teflon are presented. The researches are made for different modes and parameters of machining. The elasticity carry-over effect of treated materials on the treated surface hardness is studied. The reasons of changes in treated surface hardness are discussed for various methods of material machining.

Key words: thermosoftening polymeric materials, hardness, treated surface, degree of reinforcement, turning, compression.

UDC 621.791.75.04

Study of interaction between welding consumables and liquid glass. Kalinnikov V. T., Nikolaev A. I., Rybin V. V., Brusnitsin Yu. D., Malyshevsky V. A., Petrov V. B. – Problems of Materials Science, 2008, N 3(55), pp. 31–40.

Using methods of differential thermal and radiographic analyses determined were characteristics and phase composition of products obtained as a result of interaction between liquid glass and components of welding electrodes coating prepared on the basis of mineral resources of Kolsky peninsula.

Key words: mineral resources, welding consumables, coating components, liquid glass, phase composition, analysis methods.

UDC 539.422.23

Application of sub-size specimens with deep side-grooves for prediction of the temperature dependence of fracture toughness. Part 1. Experimental and calculative investigations. Nikolaev V. A., Margolin B. Z., Rjadkov L. N., Fomenko V. N. – Problems of Materials Science, 2008, N 3(55), pp. 41–59.

Application of pre-cracked Charpy specimens with various depth of side-grooves is considered for fracture toughness prediction. Test results of more than 500 specimens, cut out from materials with various degrees of embrittlement are presented. On the basis of 3D calculations by finite element method the procedure used in standard ASTM E 1921 for calculation of K_e and J , is developed for bending specimens with deep side grooves. Recommendations for prediction of temperature dependence of fracture toughness are given when using sub-sized specimens with deep side grooves.

Key words: fracture toughness, sub-size specimens with deep side-grooves, experimental and calculative investigations.

UDC 539.422.23

Application of sub-size specimens with deep side-grooves for prediction of the temperature dependence of fracture toughness. Part 2. Analysis of stress and strain fields and applicability of fracture criteria. Margolin B. Z., Fomenko V. N. – Problems of Materials Science, 2008, N 3(55), pp. 60–71.

Calculations of stress and strain field for pre-cracked Charpy specimens with various depth of side-grooves are carried out by finite element method in 3D statement. On the basis of calculated results, applicability of various criteria of brittle fracture for prediction of fracture toughness are analyzed.

Key words: fracture toughness, sub-size specimens with deep side-grooves, analysis of stress and strain fields, applicability of fracture criteria.

UDC 669.15–194.56:539.431:621.039.531

Prediction of fatigue fracture resistance of austenite steels under elasto-plastic deformation, creep and neutron irradiation. Margolin B. Z., Buchatsky A. A., Gulenko A. G., Fedorova V. A., Filatov V. M. – Problems of Materials Science, 2008, N 3(55), pp. 72–88.

The most known methods of prediction of fatigue fracture resistance that takes into account creep of material in a cycle of deformation and neutron irradiation are analyzed. Advantages and shortcomings of existing methods are revealed. A new method of prediction of fatigue fracture resistance is proposed. This method does not have shortcomings of existing methods. The verification of developed method is carried out for austenite steels tested at high temperatures.

Key words: fatigue fracture resistance, creep, intensity of neutron current.

UDC 669.15'782'74–194:539.422.22

Anisotropy of resistibility to brittle failure of low-carbon steels with duck streak pattern. Gorynin V. I. – Problems of Materials Science, 2008, N 3 (55), pp. 89–95.

Influence of duck streak pattern (it is caused by the ordered arrangement of ferrite) on resistibility to brittle failure according to impact bending tests of samples by thickness from 27 up to 75 mm, cut out in various directions concerning direction of rolling is investigated.

Key words: low-carbon steel, resistibility to brittle failure, impact bending tests, duck streak pattern.

UDC 669.15–194.56:621.039.531:539.422.24

Fatigue crack growth rate of austenite stainless steels into account the influence of neutron irradiation and high temperature water environment. Fedorova V. A., Margolin B. Z. – Problems of Materials Science, 2008, N 3(55), pp. 96–110.

Influence of water environment simulated coolant of the primary circuit of light water reactors on rate fatigue crack growth rate of austenitic stainless steels is considered. The data on influence of a neutron radiation on fatigue crack growth in air for these materials are analyzed and generalized. Dependences for prediction of fatigue crack growth rate of irradiated austenitic stainless steels in water environment of VVER plants are suggested.

Key words: growth rate of a fatigue crack, neutron irradiation, aqueous medium, heat carrying agent of 1-st contour.

UDC 621.039.536.2:539.422.23

Prediction of the temperature dependence of fracture toughness for RPV materials from test results of surveillance specimens. Margolin B. Z., Fomenko V. N., Gulenko A. G., Shvetsova V. A., Nikolaev V. A., Morozov A. M., Vakulenko A. A., Piminov V. A., Shulgan N. A. – Problems of Materials Science, 2008, N 3(55), pp. 111–124.

Basic principles are considered for construction of the design temperature dependence of fracture toughness $K_{Jc}(T)$ on the basis of test results of surveillance specimens. Construction of $K_{Jc}(T)$ is based on the Unified Curve concept. When constructing $K_{Jc}(T)$, two types of uncertainties are taken into account. The first type may be considered as methodical uncertainties. They are connected with the number and type of tested specimens. The second type may be considered as technological uncertainties. They are connected with spatial heterogeneity of properties of metal of reactor vessel. On the basis of the above uncertainties the main margins for $K_{Jc}(T)$ dependence are introduced. These margins are not taken a priori, and they are calculated on the basis of the performed experimental and theoretical researches.

Key words: reactor vessel, fracture toughness, temperature relation, concept Unified Curve, surveillance specimens

UDC 621.771.23–419.4

The basic production technology for bimetallic plate by method of hot rolling single asymmetrical welded vacuum-processed package. Grachyov G. V., Bocharov S. A., Titova T. I. – Problems of Materials Science, 2008, N 3(55), pp. 125–132.

The basic production technologies of bimetallic plate are considered. Technological features of production of clad plate by modern method of hot rolling single asymmetrical welded vacuum-processed package are shown.

Key words: bimetallic plate, production technology, hot rolling, vacuum-processed package.

UDC669.14.018.293

The modern technologies and ways of increase in production of high-strength structural steels for needs of the ship-building industry. Vladimirov N. F., Grachyov G. V., Malakhov N. V. – Problems of Materials Science, 2008, N 3(55), pp. 133–139.

New technological schemes of production of structural steels are considered. Perspective ways of increase in volumes of production for structural steels are shown.

Key words: structural steels, production technology, perspective directions.

UDC 669.12'26'24:539.377

Influence of structure and temperature on redistribution of alloying elements during cold and warm deformation of Fe–Cr–Ni alloys. Derjagin A. I., Zavalishin V. A., Sagaradze V. V., Kuznetsov A. P., Ivchenko V. A., Vildanova N. F., Efros B. M. - Problems of material science, 2008, № 3 (55), pp. 140–147.

It was shown that the deformation-induced redistribution of elements in the X11H30 steel decreased down to zero as the deformation temperature increased from 0 to 300°C. The maximum Curie temperature of ferromagnetic clusters of the deformation origin was the same and equal to about 160°C in the X11H30, X12H30 and X15H38 steels. The field-ion microscopy examination revealed particles of an ordered phase of the L1₀- or L1₂-type 3 to 5 nm in size whose concentration accounted for 5–10% of the volume.

Key words: nanostructure coatings, boundary coating-substrate, plastic deformation, tensile and compression stresses.

UDC 669.782'71'786:539.374:539.422.23

Features of plastic deformation and destruction of nano-structure coatings SiAlN. Panin A. V., Shugurov A. R., Kazachenok M. S., Sergeev V. P. – Problems of Materials Science, 2008, N 3(55), pp. 148–154.

The surface morphology of as-deposited SiAlN coating on Cu substrate and square-like pattern of coating delamination under thermal cycling, uniaxial tension and alternating bending revealed the multilevel “chess-board” distribution of stresses and strains at the coating-substrate interface. The

distribution results from the necessity of deformation compatibility of the coating and substrate characterized by different Young moduli and coefficients of thermal expansion.

Key words: nanostructure coatings, coating – substrate interface, plastic deformation, tensile and compression stresses.

UDC 669.27:539.385:620.187

Structure of tungsten after intensive plastic deformation by torsion under high pressure and its thermal stability. Popov. V. V., Valiev R. Z., Sergeev A. V., Popova E. N., Kazyhanov V. U., Stolbovsky A. V. – Problems of Materials Science, 2008, N 3(55), pp. 155–162.

Submicrocrystalline structure of W obtained by high pressure torsion (HPT) (5 turns, 400°C) and its thermal stability have been studied by TEM. Grain boundaries of submicrocrystalline W in the initial state and after 400–500°C annealing have been investigated by the method of the Mossbauer emission spectroscopy.

Key words: plastic deformation by torsion, tungsten, submicroscopic structure, thermal stability, method of the Mossbauer emission spectroscopy.

UDC 539.213:669.017.3

The structure-phase transformations in amorphous and nanocrystalline alloys of system TiNi–TiCu initiated by hydrogen. Skryabina N. E., Frushart D., Sheyin A. B., Zabolotskij D. S., Sheljakov A. V. – Problems of Materials Science, 2008, N 3(55), pp. 163–168.

The peculiarities transition of structure due to interaction with hydrogen of pseudo binaries TiNi–TiCu based alloys (with different initial structure state) had been investigated. It was established the transformation of nanocrystal structural into amorphous under hydrogenation process. The phenomena of “hydrogen embitterment” found out for the amorphous alloys.

Key words: pseudo-binary alloys, nanocrystalline condition, structure - phase transformations, saturation by hydrogen, structure amorphousation.

UDC 669.017.3:539.374

Nonequilibrium diffusion phase transformations and nanostructuring during severe cold deformation. Shabashov V. A. – Problems of Materials Science, 2008, N 3(55), pp. 169–179.

Nanostructuring of iron alloys, which was realized by the deformation-induced dissolution of interstitial phases and iron oxides and by the formation of superfine secondary strengthening phases in the metal matrix, is described. The deformation dissolution is activated due to the dispersion of the phases in the initial mixtures, a high diffusion mobility of carbon, nitrogen and oxygen in the metal matrices.

Key words: alloys of iron, nano-structuring, intensive cold deformation, phase transformations.

UDC 669.715'884:548.3

Influence of dispersibility degree of crystal structure on disintegration of oversaturated solid solution of multicomponent Al–Li alloy. Kajgorodova L.I., Piljugin V.P. – Problems of Materials Science, 2008, N 3(55), pp. 180–185.

Electron-microscopic research of deformation influence by shift under pressure upon a structural condition of alloy on the basis of system Al–Li is carried out in deformed, annealed and aged conditions. It is shown, that for receiving in alloy of ultradisperse crystal structure it is expedient to use intensive deformation with the subsequent low temperature anneal. At the subsequent ageing the increase in degree of dispersiveness of crystal structure promotes change of character of initiative and proportion of metastable and stable phases.

Key words: resistance to fatigue failure, creep, intensity of a stream of neutrons.