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ABSTRACTS OF ARTICLES TO BE PUBLISHED

UDC 669.039.53:621.791–112.81

Materials science concept of engineering of highly reliable welded structures in power engineering industry. Gorynin I. V. – Problems of Materials Science, 2007, N 3(51), pp. 33–42.

Materials science concept of engineering of welded structures in Russia's power engineering industry is presented. The major problem faced CRISM "Prometey" was to create materials affording high resistance of base metal and weld metal to thermal and radiation embrittlement. Materials that imparted high reliability to welded structures of power engineering industry during long service life were developed by the Institute, in particular, by the welding laboratory headed by V. A. Ignatov.

Key words: materials science concept, welded structures.

UDC 669.15`782`74–194.2:621.771.016.3

Cold resistance of metallurgical semi-finished items (plates and forgings) of low-carbon economically-alloyed silicon-manganese steels. Berezhko B. I., Bykovsky N. G., Olenin M. I., Kalinicheva N. V., Evdokimova N. V., Romanov O. N., Stol'nyj V. I., Bushuev S. V., Sergeev Ju. K. – Problems of Materials Science, 2007, N 3(51), pp. 43–49.

Properties of metallurgical semi-finished items (plates and forgings) of low-carbon economically-alloyed silicon-manganese steels used for manufacturing circular forgings with the help of precision technologies are studied.

Key words: low-carbon economically-alloyed silicon-manganese steel, metallurgical semi-finished items, cold resistance, quenching from rolling heat.

UDC 669.295:621.039.531:621.791–112.81

Prospects for using of low-activated titanium alloys in welded structures of nuclear power plants. Kozhevnikov O. A., Mikhailov V. I., Mezhonov V. A. Ushkov S. S. – Problems of Materials Science, 2007, N 3(51), pp. 50–60.

Prospects for using radiation-resistant low-activated titanium α -alloys as structural materials for engineering of welded structures of nuclear water-cooled and water-moderated power plants with enhanced service life and high ecological safety are shown.

Key words: low-activated titanium alloys, welded structures, nuclear power plants.

UDC 669.295:621.165–226.2

Using of titanium alloys as a material for steam turbine blades. Skotnikova M. A., Chizhik T. A., Tsybulina I. N., Lanina A. A., Krylov N. A., Kazachkova Zh. S. – Problems of Materials Science, 2007, N 3(51), pp. 61–70.

Studied by methods of optical metallography, scanning electron microscopy and X-ray crystal analysis are structural and phase transformations taking place in the material of steam turbine blades made of two-phase ($\alpha + \beta$) titanium alloy TC5 before and after drop-impact loading at a rate of 300–600 m/sec which corresponds to deformation velocity range of $4 \cdot 10^4$ – $1 \cdot 10^5$ sec⁻¹.

Key words: titanium alloys, steam turbine blades, drop-impact loading, structural and phase transformations.

UDC 669.15–194:621.039.531:621.791

Low-activated welding materials to weld the vessels made of 15X2B2ΦA-A radiation-resistant low-activated steel for ecologically safe nuclear reactors. Rybin V. V., Karzov G. P., Galjatkin S. N., Shcherbinina N. B., Burochkina I. M., Zubova G. E. – Problems of Materials Science, 2007, N3(51), pp. 71–80.

The data on mechanical properties and structure in the state after heat treatment of weld metal in joints of 15X2B2ΦA-A radiation-resistant low-activated steel up to 100 mm in thickness made by the automatic submerged-arc process with the use of Св-08X3ГВ2ΦТА-A welding wire featuring fast fall in induced radioactivity are given.

Key words: radiation-resistant low-activated steel, submerged-arc welding, welding wire, mechanical properties, structure, fast fall in induced radioactivity.

UDC 621.791.92: 621.039.536.2

Problems of creation of welding materials for depositing corrosion-resistant coatings on the vessels of water-cooled reactors of nuclear power plants. Karzov G. P., Galjatkin S. N., Mikhaleva E. I., Morozovskaja I. A. – Problems of Materials Science, 2007, N 3(51), pp. 81–88.

Created and brought into production are the welding materials of new generation for depositing corrosion-resistant coatings on the vessels of nuclear power plants with increased reliability and service life, which are intended to provide resistance of surfaced metal to brittle failure before expiring of service life of the reactor plant.

Key words: nuclear water-cooled power plant, reactor vessel, corrosion-resistant coating, welding materials, resistance to brittle failure.

UDC 621.791.92: 621.039.536.2

Studies of quality of one-layer corrosion resistant build-up made in conditions of OSC "Izhora plants". Titova T. I., Shul'gan N.A., Bocharov S. A., Starchenko E. G., Mastenko V. Ju., Voronov A. V., Shibaev D. I. – Problems of Materials Science, 2007, N 3(51), pp. 89–95.

The possibility of using one-layer electro-slag build-up for cladding critical shell-type structures to obtain high quality build-up jointing at reduced production cost was studied.

Key words: critical shell-type structures, one-layer electro-slag build-up, cladding.

UDC 621.791.92: 621.039.536.2

Methods of identification of metal in the I and II layers of two-layer build-up in industrial conditions. Titova T. I., Shul'gan N. A., Semernina I. F., Bocharov S.A. – Problems of Materials Science, 2007, N 3(51), pp. 96–101.

Methods of identification of material in two-layer build-up in industrial conditions are decided and their potentialities as applied to nuclear power plant equipment are studied.

Key words: critical shell-type structures, two-layer electro-slag build-up, methods of identification.

UDC [669.36 + 669.14]:621.791.052

Studies of composition and structure of weld metal and their effect on mechanical properties of welded joints of aluminum bronzes with steels. Vainerman A. E., Pichuzhkin S.A. – Problems of Materials Science, 2007, N 3(51), pp. 102–106.

The composition and properties of structural components originating in welds of welded joints of copper alloys with steel as well as the effect of these newly formed phases and structures on mechanical properties of welded joints, in particular, on their impact strength are studied.

Key words: aluminum bronze, steel, welded joints, mechanical properties.

UDC 669.295:621.039.534.25:621.791.722

The use of electron-beam welding in manufacturing of cassette-type steam generators from titanium alloys. Ushakov B.G., Semenov V.A. – Problems of Materials Science, 2007, N 3(51), pp. 107–112.

The advantages of electron-beam welding over arc processes in manufacturing of marine cassette-type steam generators from titanium alloys are revealed.

Key words: titanium alloys, cassette-type steam generators, electron-beam welding.

UDC 621.791.052: 621.039.531

Design of welded joint with incomplete penetration for recovery of Charpy impact-test specimens exposed to radiation. Frolov S. A., Zinkovsky V. I., Kozlov V. D. – Problems of Materials Science, 2007, N 3(51), pp. 113–117.

Designed to recover Charpy impact-test specimens exposed to radiation is a welded joint with incomplete penetration, different from the standard design of welded joint (with full penetration).

Key words: design of welded joint, incomplete penetration, Charpy impact-test specimens, exposure to radiation, recovery of specimens.

UDC 621.791.052:669.017.3:536.424

Effect of alloying elements with the form memory on structure and service properties of welded joints. Blednova Zh. M., Myshevsky I. S. – Problems of Materials Science, 2007, N 3(51), pp. 118–126.

The possibilities of using materials containing elements with form memory as alloying constituents in welding are considered.

Key words: welded joints, alloying elements, form memory effect, service properties.

UDC 621.791.052: 539.431:621.039.536.4

Some features of assessment of low-cycle fatigue of welded joints in power engineering. Daunis M. A., Timofeev B. T. – Problems of Materials Science, 2007, N 3(51), pp. 127–140.

The behavior of welded joints under the action of cyclic loads in elastoplastic area was studied. A number of characteristic features of weld metal untypical of base metal to be taken into account in assessment of low-cycle fatigue of equipment weldments are found.

Key words: pipelines of NPP, welded joints, cyclic loads in elastoplastic area, low-cycle fatigue.

UDC 621.791.052:539.4

The effect of mechanical non-uniformity of welded joints on their strength. Ostsemin A. A. – Problems of Materials Science, 2007, N 3(51), pp. 141–150.

Presented on the basis of solution to the plane problem from plasticity theory is calculated evaluation of static strength of joints of plates with double-V asymmetrical edge preparation with asymmetrical mechanical non-uniformity. This evaluation serves to define an interlayer local strengthening factor, optimal bevel angles and a gap.

Key words: welded joints, double-V asymmetrical edge preparation, static strength, mechanical non-uniformity.

UDC 621.791.052:539.375

Application of criteria from elastoplastic fracture mechanics to assessment of properties of welded joints. Ostsemin A. A., Utkin P. B. – Problems of Materials Science, 2007, N 3(51), pp. 151–160.

On the basis of theoretical analysis it is found that the major theoretical concepts of elastoplastic fracture mechanics can be applied to the assessment of serviceability of welded joints with technological defects having the apex radius essentially different from the radius of fatigue crack.

Key words: elastoplastic fracture mechanics, technological defects, welded joints, assessment of properties.

UDC 621.039.546:621.791.65–194.55

Peculiarities of fusion welding of shells made of precipitation-hardened steels as applied to the structure of fuel elements of fast-neutron reactors. Tabakin E. M., Ivanovich Ju. V., Baikalov V. I., Ukai Sh., Seki M., Kaito T. – Problems of Materials Science, 2007, N 3(51), pp. 161–168.

The results of studies of possibilities of remotely controlled sealing of fast reactor fuel element shells made of ferritic and martensitic precipitation-hardened steels are presented.

Key words: fast-neutron reactor, fuel elements, ferritic and martensitic precipitation-hardened steels, sealing of shells.

UDC 620.179.1:539.37

Problems of prediction of serviceability of structures from the nondestructive testing data. Varovin A. Ja., Karzov G. P., Margolin B. Z. – Problems of Materials Science, 2007, N 3(51), pp. 169–186.

Reviewed are the problems arising in analyses of strength of structures containing defects on the basis of nondestructive testing data and ways to resolve conflicts between the requirements of those who is involved in the strength calculation and the capabilities of those who is in charge of metal continuity inspection.

Key words: serviceability of structures with defects, detectability functions, nondestructive testing, calculation methods.

UDC 622.242:621.791.052.019

Finding approaches to standardization of technological presence of defects in welded joints of structures of various purposes. Leonov V.P., Vasiliev A.K. – Problems of Materials Science, 2007, N 3(51), pp. 187–203.

A methodology of evaluation of cyclic strength of welded joints with technological defects is worked out, a calculation-experimental analysis of conditions for their evolution is performed, criteria of presence of

defects in welds on fixed ice-proof drilling rigs, differentiated with respect to categories of importance of structural elements and safe from the point of view of fracture mechanics and fatigue strength, are established.

Key words: fixed ice-proof drilling rigs, welded joints with technological defects, cyclic strength, calculation-experimental analysis.

UDC 621.039.536.4:621.791.052:620.194.2

Methods of corrosion crack control in welded joints on pipelines of channel-type nuclear power plants. Blumin A.A., Borkin P.I., Vasiliev H.V., Zueva M. I., Karzov G. P., Pazikov A. A., Stepanov Ju. V., Shalygin A.S. – Problems of Materials Science, 2007, N 3(51), pp. 204–207.

Efficient measures to prevent origination of cracks in the pipelines of operational power-generating units of channel-type NPP are worked out.

Key words: pipelines of channel-type NPP, welded joints, corrosion cracking.

UDC 621.791.019:620.179.1

Nondestructive inspection and estimation of hazard that welding defects may bring about in the course of operation of equipment. Lepikhin A.M. – Problems of Materials Science, 2007, N 3(51), pp. 208–213.

Some aspects of estimation of hazard that welding defects may bring about during operation of welded structures and industrial equipment.

Key words: welded structures, welding defects, nondestructive inspection.

UDC 669.295:621.791.92

Studies of quality of ПТ7М oxidized titanium alloy built-up with the use of high-temperature rolling. Kozlov I. V., Mikhailov V. I., Semenov V.A., Khromushkin K. D., Fatiev I. S. – Problems of Materials Science, 2007, N 3(51), pp. 214–217.

The results of experiment on building-up of ПТ7М oxidized alloy onto titanium alloy with the use of rolling at a temperature close to weldpool crystallization temperature are considered. The promise of reviewed method in manufacturing of fittings as a means of control defects of build-up structure is shown.

Key words: titanium alloy, high-temperature building-up, defects of structure.

UDC 620.194.2:621.791.052

Assessment of corrosion damage liability and corrosion crack resistance of corrosion-resistant build-up- and reactor steel welded combination. Panasjuk V. V., Dmytrakh I. N., Fedorova V. A., Timofeev B. T. – Problems of Materials Science, 2007, N 3(51), pp. 218–226.

Approaches to prediction assessments of corrosion damage liability of corrosion-resistant build-up-and-reactor steel welded combination as heterogeneous electrochemical system are considered, and data on characteristics of resistance of different areas of this combination to evolution of corrosion-fatigue cracks in the form of special diagrams of their cyclic crack resistance are generalized.

Key words: welded combination, corrosion-resistant build-up, reactor steel, corrosion damage liability, diagrams of cyclic crack resistance.

UDC 620.194.2:621.791.92

The use of methods of corrosion failure mechanics for assessment of crack resistance of shell steels and corrosion-resistant build-ups. Nikiforchin G. N., Timofeev B. T., Tsirol'nik O. T., Fedorova V. A., Sidor P. Ja. – Problems of Materials Science, 2007, N 3(51), pp. 227–236.

The results of studies of corrosion-mechanical strength of reactor materials both from point of view of analysis of methodical features of experiments and from point of view of interpretation of their results are presented.

Key words: shell steels, corrosion-resistant build-up, corrosion-mechanical strength, experimental methods.

UDC 621.791.052:539.431

Studies of stresses and of strength of welded joints on shells and rotors of turbine power plants. Mahutov N. A., Gadenin M. M. – Problems of Materials Science, 2007, N 3(51), pp. 237–252.

Practice of studies of stressed-and-strained states, thermo-mechanical stressed states, limiting-permissible states experienced by materials of welded joints on major elements of shells and rotors of turbine power plants.

Key words: rotors of turbine power plants, welded joints, stressed-and-strained state, strength, service life, survivability.

UDC 621.039.531:539.43

Neutron exposure fatigue of structural materials. Filatov V. M. – Problems of Materials Science, 2007, N 3(51), pp. 253–264.

Neutron exposure fatigue of structural materials in intra-shell arrangements of light-water reactors is studied.

Key words: light-water reactors, intra-shell arrangements, structural materials, neutron exposure, fatigue.

UDC 621.791.052:539.431

Taking accounts of stress concentration in assessments of fatigue of butt welded joints of pipes as they are in service. Tashkinov A. V. – Problems of Materials Science, 2007, N 3(51), pp. 265–271.

A procedure for calculation of stresses in butt welded joint of pipes with regard to distinctive stress concentrators (zones where the weld reinforcement or reverse bead blends with the parent metal, concavities in weld root) and misalignment of abutting edges is presented.

Key words: pipes, butt welded joints, stress concentrators, calculation procedure.

UDC 669.15–194.53:621.791.052: 539.431

Low-cycle fatigue and cyclic creep of pearlitic- and austenitic-class steels and their welded joints in complex stressed state. Giginjak F. F., Timofeev B. T. – Problems of Materials Science, 2007, N 3(51), pp. 272–285.

Presented are the results of experimental studies of viscoplastic properties of 15X2MΦA, 15X2HMΦA, 10ГН2MΦA pearlitic steels in the temperature range from 20 to 350°C and of 09X18H9, 08X18H10T-ВД austenitic steels under repeated loading under complex stressed state conditions at 20–650°C as well as of their welded joints. Check was made whether the earlier designed procedure for calculation of durability under pulsating soft loading under complex stressed state conditions is applicable to the studied steels.

Key words: pearlitic steels, austenitic steels, viscoplastic properties, complex stressed state, calculation of durability.

UDC 669.14.018.29:620.194.2

Effect of surface impregnation in low-melting-point solutions medium on corrosion cracking of structural steels. Sokolov A.G., Artemiev V.P. – Problems of Materials Science, 2007, N 3(51), pp. 286–292.

The effect of nickel-containing coatings (surface impregnation from low-melting-point solutions medium) on corrosion resistance of steel products and on their resistance to corrosion cracking in hydrogen sulfide-containing media is studied.

Key words: structural steels, nickel-containing coatings, corrosion resistance, corrosion cracking in hydrogen sulfide-containing media.

UDC 621.039.53

Effect of addition of lithium and tin on properties of steel in lead and lead-bismuth melts. Sokolov A. G., Timofeev B. T. – Problems of Materials Science, 2007, N 3(51), pp. 293–299.

Processes resulting from interaction of lead and lead-bismuth melts with steels are studied.

Key words: lead and lead-bismuth melts, interaction with steels, lithium and tin addition, heat-transfer medium, self-fluxing.

UDC 669.15`26–194:621.039.534.25:534.25:539.376

Rate of creep in heat-exchange tubes made of 9% chromium steel in the contact with liquid lead at a temperature of 530-550°C. Kashtanov A. D., Markov V. G., Leonov V. N. – Problems of Materials Science, 2007, N 3(51), pp. 300–308.

The rate of creep in heat-exchange tubes made of 9% chromium steel in the contact with liquid lead at a temperature of 530–550°C is studied.

Key words: chromium steel, heat-exchange pipes, rate of creep, liquid lead.

UDC 621.039.534:539.431

Kinetics of crack growth under repeated loading in the contact with liquid lead at a temperature of 360-420°C. Kashtanov A. D., Markov V. G., Leonov V. N. – Problems of Materials Science, 2007, N 3(51), pp. 309–319.

The effect of liquid-metal lead heat-transfer medium on kinetics of crack growth in 10X15H9C3E chromium-nickel steel and in 10X9HCMΦE chromium-martensitic steel is studied.

Key words: liquid-metal lead heat-transfer medium, austenitic chromium-nickel steel, chromium-martensitic steel, repeated loading, kinetics of crack growth.

UDC 621.791.052:539.56

Character and methods of testing of welded joints for resistance to brittle failures. Lanin A. A., Anan'eva M. A., Galiatkin S. I., Zelenin Ju. V. – Problems of Materials Science, 2007, N 3(51), pp. 320–326.

Studied are the structure, properties and tendency to local brittle failures in the neighborhood of weld of welded joint metal working as a part of high-temperature power-generating units of NPP. Methods of testing of welded joint for resistance to brittle failures are presented.

Key words: high-temperature power-generating units of NPP, local brittle failure, neighborhood of weld, welded joint metal.