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CONTENTS

ABSTRACTS OF PUBLISHED ARTICLES

UDC 669.15'786–194.56:621.785

Alloying and heat treatment effects on the properties of cast corrosion-resistant nitrogenous austenitic steel. Tsukanov V. V., Tsyganko L. K., Shandyba G. A., Ziza A. I. – Voprosy Materialovedeniya, 2015, N 1(81), p. 7–11.

Cast nitrogenous vanadium containing steel of Cr–Ni–Mn composition with stable austenitic structure has been developed. Using precipitation hardening during heat treatment of developed steel can significantly increase the tensile strength and yield strength more than twice comparing with widely used 12Х18Н9ТЛ (12Kh18N9TL) steel grade.

Keywords: cast corrosion-resistant steel, nitrogenous austenitic steel, cast austenitic steel, precipitation hardening.

UDC 669.15–194.2:621.746.047.019:621.771.23

Analysis of structural changes in the production of low-alloyed steel sheets from cast billets. Zavalishchin A. N., Kozhevnikova E. V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 12–19.

The paper studies structure changes of low carbon microalloyed steel at different production stages. It has been shown that phase separation enrichment by alloying elements of the central zone of continuous-cast billets is inherited by hot-rolled sheet.

Keywords: low alloyed steel, cast billet, sheet metal, structural changes.

UDC 669.14.018.294.2:621.785.6

Rail steel structure and properties studied after plasma hardening. Ananiev S. P., Safonov E. N. – Voprosy Materialovedeniya, 2015, N 1(81), p. 20–26.

The paper studies components structure, hardness and reduced elastic module in the transition zone between the base metal and the tempered layer of 70 rail steel after plasma hardening by atomic force microscope and nanoindentation.

Keywords: plasma hardening, rail steel, nanoindentation, atomic force microscope, structure and phase composition.

UDC 669.245.018.44.2:669.065.5

Segregation of alloying elements in directionally solidified Re–Ru-containing Ni-based superalloys. Petrushin N. V., Elyutin E. S., Nazarkin R. M, Pakhomkin S. I., Kolodochkina V. G., Fesenko T. V., Dzhioeva E. S. – Voprosy Materialovedeniya, 2015, N 1(81), p. 27–37.

In this work, the influence of nonequilibrium conditions of directed solidification was investigated for nickel-based superalloy containing rhenium and ruthenium. The segregation of alloying elements was researched both as microsegregation into dendrite cell and as macrosegregation along casting. The castings of alloy samples (diameter 20 mm, length 100 mm) have been manufactured by slow directional solidification (~6 mm/h) at high-temperature gradient (~150°C/cm) by Bridgeman technique.

The alloy research was performed by differential thermal analysis and scanning electron microscope together with local X-ray spectral analysis. The crystal lattice constants of γ- and γ′-phases were determined by X-ray diffraction analysis at room temperature. Alloying elements such as rhenium and ruthenium are pushed aside into solid phase, both enrich dendrite core and initial part of castings. Rhenium and ruthenium also increase solidus temperature for nickel-based superalloys. On the other hand, alloying elements such as aluminum and tantalum are pushed aside in liquid phase enriching interdendritic region and final parts of castings.

It is shown that formation of over-alloying local areas in single crystal castings is microsegregation result of alloying elements mainly rhenium. The over-alloying local areas of single crystal castings could be potential reason for TCP-phases formation during heat treatment or long-time high-temperature tests. The γ/γ′-lattice misfit (mismatch of γ- phase and γ′- phase crystal lattices) is not changed in alloy for

directional solidification castings along the full length. It is explained by compensation of rhenium and ruthenium decrease by tantalum and aluminum increase along the full length of castings.

Keywords: nickel heat-resistant alloy, directional crystallization, rhenium and ruthenium alloying elements, segregation of alloying elements.

UDC 669.245.018.44:621.438

The influence of Re addition on the phase composition and mechanical properties of wrought nickel-based superalloy for GTE turbine discs. Bakradze M. M., Lomberg B. S., Ovsepyan S.V., Chabina E. B., Filonova E. V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 38–44.

The influence of Re addition in the range 0.5–2.5 wt.% on the structural-phase composition and mechanical properties (tensile strength, long-term rupture strength and impact strength) of wrought nickel-based alloy EK151-type has been investigated. Re concentration, which provides the highest mechanical properties rate and stability of the phase composition, has been established.

Keywords: nickel-based wrought heat-resistant alloy, rhenium alloying, structural phase composition.

UDC 669.27/29.018.25:539.538

Comparative analysis microabrasive wear traditional submicron carbide and tungsten carbide WC–8Co–1Cr_3C_2. Dvornik M. I., Mokritsky B. Ya., Zaitsev A. V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 45–51.

The paper compares the microabrasive wear resistance and microstructure of the submicron cemented carbide WC–8Co–1Cr3C2, obtained by the authors on improved technology, with commercial hard alloys. WC–8Co–1Cr_3C_2 alloy combines improved strength (1666 MPa), hardness (90.5 HRA), and microhardness (16.8 GPa), due to the uniformity of structure and small average grain size (0.66 μm). A simple superiority in hardness of the alloy TiC–TaC–WC–Co and in microhardness of the TiC–WC–Co alloy does not achieve excellence in microabrasive durability over submicron cemented carbide WC–8Co–1Cr_3C_2. In addition the resistance of WC–8Co–1Cr_3C_2 alloy against microabrasive wear exceeds the resistance of medium-grained and submicron WC–Co alloys with lower hardness and microhardness.

Keywords: submicron tungsten carbide, microabrasive wear, microhardness, wear resistance.

UDC 621.762.2

MAX-phases in system Ti–Al–N manufactured by powder metallurgy. Teslina M. A., Ershova T. B., Vlasova N. M., Astapov I. A. – Voprosy Materialovedeniya, 2015, N 1(81), p. 52–59.

The ceramic-metal material in system Ti–Al–N production by methods of powder metallurgy has been studied. The influence of heat treatment on intermetallic alloys composition, structure and properties has been researched by methods of the X-ray difraction and metallography. It is shown that using titanium shavings as one of the components leads to formation of layered Ti_2AlN nitride. With an increase of temperature up to 1300–1400°C the main phase is layered Ti_2AlN nitride, and the relative maintenance of the phase Ti_3Al decreases.

Keywords: powder metallurgy, titanium shavings, metal ceramics, MAX-phases, composition, structure, properties.

UDC 678.7

New aramid fibers Rusar NT for reinforcing constructional AFRP (aramid fiber reinforced plastics). Zhelezina G. F., Voinov S. I., Chernykh T. E., Chernykh K. U. – Voprosy Materialovedeniya, 2015, N 1(81), p. 60–70.

The characteristics of new aramid fibers Rusar NT and constructional AFRP based on them were investigated. It is shown that AFRP based on Rusar NT have increased resistance to moisture absorption, compared to AFRP based on serial fibers SVM and Rusar, have high stability properties under heat and humidity aging and satisfy the aircraft requirements for corrosion safety and flammability.

Keywords: AFRP, aramid fibers, polymer composites, moisture absorption.

UDC 621.791.042.4

The history of the development and application of electrodes with fluor-calcium coating. Gorynin I. V., Wikhman V. B., Baryshnikov A. P. – Voprosy Materialovedeniya, 2015, N 1(81), p. 77–94.

75 years ago a team of the welding laboratory of Central Research Institute for Materials created electrodes coated by fluor-calcium (basic type) UONI-13. The vast majority of modern electrodes produced both in this country and abroad for alloy steels and special alloys welding is based on electrodes UONI-13 series coated by fluor-calcium. So far, these electrodes are widely used and continue to be a significant part of the industrial production of electrodes in this country. The paper deals with the history of the unique welding materials.

Keywords: electrodes coated by fluor-calcium, creation history, development prospects.

UDC 669.15'786–194.56:621.791.052

The structure and properties of thick plate welded joints of new nitrogen-bearing austenitic steel used in conditions of high static and alternating loads and corrosive environment. Kostina M. V., Mouradian S. O., Kalinin G. Yu, Fomina O. V., Blinova E. N., Kostina V. S., Shatalov A. V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 95–107.

The paper studies micro- and fine structure, mechanical properties of sheet metal welded joints of 10 mm and 20 mm thickness from the new corrosion-resistant high-strength austenitic steel 04Kh20N6G11M2AFB using welding wire Sv-09Kh16N25M6AFS, Sv-10Kh20N18M3AFS and Sv-10Kh19N23G2M5FAT.

Keywords: high-strength austenitic stainless steel, thick plate welded joints, microstructure, microstructure, mechanical properties.

UDC 669.14.018.41:621.791.053

On the influence of non-metallic inclusions on the viscosity of low-alloyed weld metal at low temperatures. Pimenov A.V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 108–110.

The paper studies the relationship between the phase composition, morphology and quantity of non-metallic inclusions and a viscosity of the weld metal and the composition of the sintered flux as regards the automatic submerged arc welding of cold-resistant steels. There were established functional dependences determining the effect of non-metallic inclusions dimensional characteristics on the impact energy of weld metal at –40°C.

Keywords: cold-resistant steel, non-metallic inclusions, weld metal viscosity.

UDC 669–15194.52:621.791.052:621.78

Improving the cold resistance of weld metal in steel 09G2SA-A due to coagulation of cementite during post-weld vacation. Olenin M. I., Gorynin V. I., Galyatkin S. N., Vorobyova N. Yu., Markova Yu. M., Khantalin A. E. – Voprosy Materialovedeniya, 2015, N 1(81), p. 111–119.

The paper studies the effect of aging of supersaturated ferrite on the brittle fracture resistance of welded joints of 09G2SA-A steel. It is shown that overaging ferrite phase and carbides coagulation cementite type in the process of post-weld tempering provides two-threefold increase in the viscosity values of the heat affected zone of welded joints at low temperatures.

Keywords: 09G2SA-A steel, welded joints, post-weld tempering, cementite coagulation, cold resistance.

UDC 621.791.75.019

The impact of technological welding conditions on the physics and mechanical properties of **metal of different zones of welds low-alloy steel**. Gorkunov E. S., Saraev Yu. N., Zadvorkin S. M., Putilova E. A. – Voprosy Materialovedeniya, 2015, N 1(81), p. 120–126.

The microstructure and microhardness distribution of welded joints made by different modes of welding: DC and adaptive pulsed arc have been studied. The influence of adaptive pulse arc welding on the structure and mechanical properties of the welded joint has been analyzed. The paper determines the influence of elastoplastic deformation under the uniaxial tension on the magnetic characteristics of metal from different zones of welded structures (base metal, weld metal and heat affected zone) made of 09G2S steel at welding under different technologies. Magnetic parameters, uniquely changing in the elastic region of deformation, which can then be used to develop techniques for non-destructive testing of welded joints, have been described.

Keywords: welded joints, adaptive pulse arc welding, mechanical properties, elastoplastic deformation, non-destructive testing.

UDC 621.791.75

Management of structure and properties of welded joints of responsible technical systems by adaptive pulse-arc welding. Saraev Yu. N., Bezborodov V. P., Grigorieva A. A., Lebedev V. A., Maksimov S. Yu., Golikov N. I. – Voprosy Materialovedeniya, 2015, N 1(81), p. 127–132.

Currently, traditional arc welding processes has almost exhausted its technological capabilities. However, the development of industrial production urgently requires the development and effective application of new technical solutions that would greatly expand the limits of the use of traditional power sources when creating permanent joints. Such opportunities are provided by pulse technological processes of welding and new specialized equipment developed in the last decade by the famous scientific schools of the CIS and the world's leading centres of welding production. Authors' approach to the development and application of pulse-arc welding is based on the implementation of the control algorithms, allowing the possibility of stabilization of the instantaneous values of the basic technological parameters at intervals of melting and transfer of every drop of electrode metal. This is possible due to the presence of channels of feedback controlling the state of the control object on the main instantaneous values of the process parameters, in particular, arc voltage, welding current, average power of each micro cycle, the energy expended in melting the individual droplets of the metal electrode. When modifying weld grinding its structure, increase of physical-mechanical and performance properties.

Keywords: weld, mechanical properties, structure, pulse mode, strength, ductility, hardness.

UDC 621.791.92:620.193

Influence of phase composition and heat treatment on isolated corrosion of weld cladding for hydraulic cylinders rods. Golyakevich A. A., Orlov L. N., Student M. M., Pokhmurskaya G. V., Chervinskaya N. G. – Voprosy Materialovedeniya, 2015, N 1(81), p. 133–142.

The paper investigates the corrosion resistance of weld cladding obtained by flux-cored arc welding using a 3%NaCl aqueous solution. To select the optimal composition of flux cored wire layers for the hydraulic cylinders rods for mining equipment the authors used cored wires with different contents of chromium (up to 14–20% mass.), nickel, molybdenum, vanadium, niobium, manganese and silicon. The isolated corrosion is typical for cladding layers and corrosion pits are band oriented. The simultaneous presence of up to 30% ferrite and austenite in a cladding layer promotes its corrosion resistance.

Keywords: cladding layers, corrosion resistance, isolated corrosion, corrosion current, phase composition.

UDC 669.14'71:621.791:629.5

Welded steel-aluminum compound for hull structures of surface vessels. Pavlova V. I., Pimenov A. V., Osokin E. P., Poliakova I. N., Zaitsev D. V., Ivanova M. V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 143–157.

The paper presents the results of the development of the shipbuilding layered composite material aluminum–steel to ensure the design and construction of steel-aluminum vessel construction of new projects of the national fleet.

Keywords: welded steel-aluminum compounds, layered composite material, solid phase welding, fusion welding.

UDC 669.14.018.295:629.5

Use of new high-strength steels in Arctic shipbuilding industry. Pirinen M., Kah P., Martikainen J. – Voprosy Materialovedeniya, 2015, N 1(81), p. 158–165.

New high-strength steels have been developed in the last decade to decrease vessel weight. Using these steels takes a lot of research to make sure that welded structures have sufficient strength and ductility at low temperatures. Many vessels, like icebreakers, will be used in harsh and cold environments. One way to reduce, for example, the use of filler material, work and welding time is to use narrower grooves for which new processes have been developed. Narrow gap submerged arc welding, narrow gap tandem welding, narrow gap plasma arc welding are examples of this. New welding processes using

MIG/MAG welding have been developed by welding machine companies. The Finnish company Kemppi Oy has developed wise processes. The wise process has been used to weld a 35-degree groove with Finnish made high-strength steels PC E500 TMCP, S500 G2M and Russian made high-strength steel F500W. A welding procedure test was performed to make sure that with this process a 35-degree groove can be used to weld these high-strength vessel steels.

Keywords: high-strength steels, low temperatures, narrow grooves, submerged arc welding, tandem welding, plasma arc welding.

UDC 669.14.018.41:621.791

New methods of cold-resistant steels welding. Yakushin B.F., Shvaneva Yu. Yu. – Voprosy Materialovedeniya, 2015, N 1(81), p. 166–170.

The objects of the study are new types of economically alloyed low carbon steels developed for shipbuilding. The purpose of the study is to search for new ways of automatic welding, cold resistance of welded joints approximating to those of the base metal.

Keywords: cold resistance, fine grain, grain growth, heat affected zone, segregation at the boundaries, fusion zone embrittlement, heat input welding with hot additive.

UDC 669.14.018.41:621.791.722

Electron beam welding technology of cold-resistant steel constructions. Alexandrov N. V., Kurta S. N., Vovchenko N. V., Martianov A. L. – Voprosy Materialovedeniya, 2015, N 1(81), p. 171–178.

The technology of electron beam welding of cold-resistant steels type AB, allowing us to obtain a quality connection to the high toughness of the weld metal at –60°C. Studies have shown promising applications of electron beam welding for welded structures operating in the Arctic. *Keywords*: cold-resistant steel, electron beam welding.

UDC 621.791.72:621.039.5

Special conditions of welding for nuclear equipment. Kazakov Yu. V., Tabakin E. M., Ivanovich Yu. V., Kaplin A. V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 179–186.

Results of work on the sealing of nuclear equipment in remote radiation protective cells have been given. The paper shows argon arc welding by butt fusion and research for optimizing welded joints design. Research results and arc welding equipment under high pressure and pulsed laser welding in vacuum have been established.

Keywords: argon arc welding, small-sized nuclear equipment, vacuum-assisted pulsed laser welding.

UDC 621.791.042 (204.1):669.14.018.8

Technology of mechanized underwater self-shielded flux-cored welding of high-alloy corrosion-resistant steel of type 18-10. Kakhovskyi M., Maksimov S. – Voprosy Materialovedeniya, 2015, N 1(81), p. 187–191.

The paper presents self-shielded flux-cored wire providing the required chemical composition and mechanical properties of the weld metal according to standards GOST 10052-75 and international requirements for underwater welding ANSI / AWS D3.6-92 (class B). The basis for welding without human participants to ensure the future automation in dangerous working conditions has been created.

Keywords: mechanized underwater welding, high-alloy corrosion-resistant steel, self-shielded flux-cored wire, mechanical properties.

UDC 621.791.042(204.1)

Underwater wet flux-cored welding. Parshin S. G., Levchenko A. M., Khomich P. N., Antipov I. S. – Voprosy Materialovedeniya, 2015, N 1(81), p. 192–198.

Cored wires pilot batch for mechanized underwater wet welding has been developed. Studying welded joints metal, it have been found that flux cored wires PPS-SP have uniform shell and core melting, provide atomized transfer, and satisfactory formation of welds under the water in the bottom, horizontal and vertical spatial positions. The paper notes that under underwater welding of carbon steel wires PPS-SP silicon and manganese contents in the weld metal reduces, weld metal hardness increases to 190–

210 HV, its average tensile strength and yield strength of welds with wire PPP–SP increases compared with analogue PPS–AH1 wire.

Keywords: underwater wet welding method, carbon steel, cored wire, mechanical properties of weld metal.

UDC 621.791.042(204.1)

Sealing of heat exchangers by wet welding at a depth of 200 m. Maksimov S. Yu., Lebedev V. A., Lendel I. V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 199–204.

Self-shielded flux-cored wire and welding technology at depths up to 200 m in 20% aqueous solution of a special coolant FXC2 based on propylene glycol have been developed. The developed technology allows increasing the reliability of the heat exchanger, to reduce costs and time lost while sealing, to use the mounting area reasonably.

Keywords: self-shielded flux-cored wire, wet welding, heat exchangers, sealing pipes.

UDC 621.791.042.4:621.643

Efficiency increase of arc welding of the magnetized pipelines with coated electrodes during repair works. Kiselev A. S., Gordynets A. S., Dediukh R. I., Saraev Yu. N., Golikov N. I. – Voprosy Materialovedeniya, 2015, N 1(81), p. 205–209.

It has been proposed to apply an alternating rectangular current in arc welding with coated electrodes for magnetized parts. The possibility of arc welding stabilization under perturbing influence of a magnetic field with induction 40...100 mT has been shown. The influence of parameters of welding conditions and the magnitude of the magnetic field on the mechanical properties of the obtained compounds has been investigated. The possibility of obtaining high-quality welded joints has been experimentally proved.

Keywords: arc welding of magnetized parts, magnetic blast, alternating rectangular current, mechanical properties of welded joints.

UDC 621.791.75:621.643

Experience in the development and practical application of adaptive pulsed-arc welding methods for the construction and repair of the main pipelines. Saraev Yu. N. – Voprosy Materialovedeniya, 2015, N 1(81), p. 210–218.

The operational reliability of highly responsible welded structures is directly tied to the stability of the energy parameters of technological processes of their production. However, a large number of disturbing factors (elevated and changing gap, changing spatial position of the weld pool, step change of departure electrode and others) significantly impedes the formation of defect-free welded joints. One of the ways to reduce the dependence of the stability of technological process from disturbing factors is the use of pulse technology. However, this direction does not always produce the desired result, since the welding process is not under active control of disturbing influences in a complex electrodynamic system: power supply – arc – welding bath – product.

The adaptive pulsed welding and overlaying technology (APT) give more opportunities in the provision of quality and performance of highly responsible welded joints. The essence of this approach is the adaptive control of energy change parameters of the technological process in their instantaneous values: arc current, voltage, energy used for melting, and transfer of every drop of electrode metal. Due to the presence of feedback in such electro-dynamic system the full control over the stability of thermal energy and process parameters, as well as the characteristics of mass transfer of electrode metal to provide the required performance is provided. This approach is original and has no analogues in world practice.

Keywords: welding, methods, adaptive, pulsed-arc, electrode metal, pipelines, development, design, transfer of electrode metal.

UDC 669.295:621.791

Welding of high-strength titanium alloys of large thicknesses for use in marine environments. Leonov V. P., Mikhailov V. I., Sakharov I. Yu., Kuznetsov S. V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 219–228.

The paper presents manual narrow grooves welding of large thickness marine high-strength titanium alloys using special flat devices (nozzle burners), double-sided electron beam welding and welding technology producing combined high-strength titanium alloys of large thickness (over 200 mm). Electron beam welding technology with filler wire in the vertical and horizontal position of the seam have been developed to fill the gap. The technology for repair of welded joints of titanium alloys of large thicknesses by electron-beam melting has also been developed. The mentioned technologies have been implemented at the shipbuilding sites and have passed interdepartmental tests.

Keywords: marine high-strength titanium alloys, manual narrow grooves welding, double-sided electron beam welding.

UDC 669.71'72:621.791.75

Pulsed arc welding with consumable electrode of semi-finished aluminum-magnesium alloys in a wide range of thicknesses. Zykov S. A., Pavlova V. I., Osokin E. P. – Voprosy Materialovedeniya, 2015, N 1(81), p. 229–239.

The paper shows results of pulsed arc welding with consumable electrode of semi-finished rolled aluminum-magnesium alloys in a wide range of thicknesses. It allows obtaining high-quality welded joints comparable to those made by MIG (and at cryogenic temperatures), providing corrosion resistance no worse than the base metal; increasing the performance of the welding process by 3–5 times compared with MIG.

Keywords: aluminum-magnesium alloys, pulsed arc welding with consumable electrode, weld joints properties, use in the manufacture of structural

UDC 669.71:621.791.725

Technological peculiarities of aluminum alloys welding by high-power fiber lasers. Voronchuk S. D., Krivorotov V. I. – Voprosy Materialovedeniya, 2015, N 1(81), p. 240–244.

The article presents the results of aluminum alloys welding by high-power fiber lasers. Quality indicators of laser welded joints have been investigated.

Keywords: aluminum alloys, fiber laser welding, weld quality.

UDC 621.791

Computer design of pulse technological processes. Dmitriev A. I., Saraev Yu. N., Nikonov A. Yu., Grigorieva A. A. – Voprosy Materialovedeniya, 2015, N 1(81), p. 245–250.

The paper presents an approach of adaptive pulse technology management of welding and overlaying process on the basis of the adjustment of selected algorithm depending on the current state of the control object. A key element of this approach is the use of computer design methods, and numerical models of the implementation process. We considered two sample stages of creating an integrated model of pulsed welding and overlaying processes, presenting the results of research on macro- and microscopic scales. It is noted that the proposed approach gives an opportunity not only to reduce the time of development of optimal control algorithms of pulsed processes, but also to reduce the costs associated with conducting expensive research.

Keywords: adaptive pulse technology, computer engineering, multiscale methods, optimization of control algorithms.

UDC 621.791.725

Vacuum assisted laser beam welding. Sokolov M., Salminen A. – Voprosy Materialovedeniya, 2015, N 1(81), p. 251–255.

Researchers have renewed interest in vacuum assisted welding processes as a possible way to achieve deeper penetration welds without increasing required laser power or lowering the welding speed. The study investigates the laser beam welding in partial vacuum. High power autogenous disk laser keyhole welding of low alloyed steel SM400A was carried out with closed square butt joint configuration with 16 kW laser power and 1 m/min welding speed in partial vacuum conditions with atmosphere pressure of 0.1 kPa. Geometry, quality and hardness characteristics of the welds were investigated. The results indicate that a significant increase in penetration depth can be achieved with vacuum assistance.

Keywords: laser welding, high power laser, deep penetration, low pressure welding, structural steel.

UDC 669.295:621.791.042

Centrifugal rollers overlaying in mineral insulation production. Orlov L. N., Goliakevich A. A., Khilko A. V., Kuzubov A. A. – Voprosy Materialovedeniya, 2015, N 1(81), p. 256–258.

Cored wire and overlaying submerged technology for AN26 centrifugal rollers as part of the production lines of mineral and basalt insulation have been developed.

Keywords: surfacing, centrifugal rollers, mineral insulation, cored wire, overlaying technology.

UDC 621.791.042(204.1)

Welding source for wet underwater flux cored welding. Vladimirov A. V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 259–262.

The paper considers equipment complex, welding cored wire and mechanized wet underwater welding and cutting technology developed by joint efforts of Rosveld Ltd., E.O. *Paton* Electric *Welding Institute* and TM VELTEK Ltd.

Keywords: wet underwater welding, welding equipment, flux cored wire, welding and cutting technology.

UDC 621.791.754

New materials for building up welding made for titanium alloys fittings of deep-sea submersibles. Leonov V. P., Mikhailov V. I., Groshev A. L., Shatalov V. K., Fatiev I. S. – Voprosy Materialovedeniya, 2015, N 1(81), p. 263–268.

The paper considers a new manufacturing method of filler materials for building up welding of sealing reinforcement. It allows remedying a deficiency of the existing filler materials and increasing the fitting reliability. Filler material made of titanium welding wire subjected to micro-arc oxidation in specially designed electrolytes. The authors also investigate the durability of the buildups.

Keywords: titanium alloys, building up welding, sealing reinforcement, filler materials, micro-arc oxidation, wear resistance.

UDC 621.791.754

Weldability of nanostructured electrode wires in arc welding in an inert and active environments. Parshin S. G., Levchenko A. M., Antipov I. S., Maistro A. S. – Voprosy Materialovedeniya, 2015, N 1(81), p. 269–274.

The paper studies weldability of electrode materials with nanocomposite coatings based on copper matrix and dispersed phase of chlorides and fluorides of alkali and alkaline earth metals. The tests have shown that in arc welding in an inert atmosphere of argon drip transition frequency is increased up to 45 times. The use of nanostructured electrode wires allow to achieve sustainable and atomizing jet of metal transfer, increase of the arc stability and penetration depth.

Keywords: arc welding, nanostructured electrode wire, welding characteristics.

UDC 621.791.042

Sanitary and hygienic characteristics of welding flux-cored wires used in shipbuilding. Orlov L. N., Sharapov M. G., Volynets V. L. – Voprosy Materialovedeniya, 2015, N 1(81), p. 275–277.

The paper presents results of cored wires comparative tests for the purpose of hygienic assessment of materials used in shipbuilding. It is shown that the new cored wire provides reduction of the intensity and the specific discharge of *solid component* of the *welding fumes (SC*WF) and manganese oxides and fluorine compounds decrease in fumes contents compared to wire 48PP-8H and does not concede foreign analogues such as PZ6113S.

Keywords: welding, flux-cored wire, comparative tests, hygienic assessment.

UDC 621.791.03(204.1)

Prospective welding, cladding and cutting equipment in shipbuilding and ship repair. Lebedev V. A. – Voprosy Materialovedeniya, 2015, N 1(81), p. 278–283.

The paper discusses newly developed promising devices for welding, cladding and cutting carried out in E.O. *Paton* Electric *Welding Institute*, which can be successfully used in the shipbuilding and repair technologies.

Keywords: welding, cladding, arc welding, mechanized equipment, semi-universal equipment, pulse feeding, underwater welding.

UDC 621.791.03(204.1)

Electrical equipment for mechanized systems for underwater wet welding. Lebedev V. A. – Voprosy Materialovedeniya, 2015, N 1(81), p. 284–288.

The basic technical design decisions for electrical mechanized automatic and semiautomatic equipment for underwater wet welding have been examined.

Keywords: underwater welding, electrical equipment, mechanized systems, commutatorless motors.

UDC 621.791.75.03

Production of small-sized welding equipment for the welding, installation and repair work in conditions of low environmental temperatures. Saraev Yu. N., Lebedev V. A., Gladyshev O. M., Fediukin S. V. – Voprosy Materialovedeniya, 2015, N 1(81), p. 289–292.

The paper considers the development and production of small-sized welding equipment performing welding and repair works at low environmental temperatures, in extreme and special conditions. The production of promising welding equipment inverter type in Russia implementing high-tech solutions developed by leading scientific schools of Russia and Ukraine has been analyzed.

Keywords: welding, inverter, welding and repair works, pulsed arc welding, extreme conditions, low environmental temperatures.