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ABSTRACTS OF PUBLISHED ARTICLES

UDC 669.017.3:669.14.018.293

Phase transformations, structure and evaluation of hardening of shipbuilding steel of normal, increased and high strength. Khlusova E. I. – Problem of Material Science, 2004, N 2(38), p. 5–23.

Studied were the regularities of phase transformations in low-carbon shipbuilding steel as a function of alloying and cooling rate at g Á a-transformation. Considered were structural peculiarities of low-carbon shipbuilding steel of different categories of strength and evaluation of hardened condition depending on contribution of structure elements.

Key words: low-carbon shipbuilding steel, continuous cooling transformation diagrams, structure formation, hardened condition.

UDC 621.785.72:669.14.018.293

Carbide transformations at tempering of low-carbon shipbuilding steels and their influence on mechanical properties. Khlusova E. I. – Problem of Material Science, 2004, N 2(38), p. 24–37.

Presented is the analysis of the state of the art of carbide phase formation in structural steel. Investigated were peculiarities of carbide phase formation in low-carbon shipbuilding steel of different strength category and their influence on mechanical properties. It is shown that formation of fine-dispersion carbide phase of Me_7C_3 type in the process of tempering provides a high resistance to brittle fractures. Recommendations are given on creation of steel with a present complex of properties.

Key words: low-carbon shipbuilding steel, carbide phase, structure formation, mechanical properties.

UDC 669.15—194.2:621.771

Influence of production process on structure and properties of steel of F40 category of improved weldability. Gus'kov O. P., Legostaev Yu. L., Motovilina G. D., Khlusova E. I. – Problem of Material Science, 2004, N 2(38), p. 37–46.

Studied were peculiarities of microstructure of low-carbon F40CB steel of improved weldability as a function of technological parameters such as cogging down degree at the last passage and at a temperature of a strip winding into a roll. Determined was the interrelation between an obtained structure and mechanical properties of steel. It is shown that the increase in cogging down degree in last passages and decrease in a temperature of winding into a roll results in a decrease of a ferrite grain size from 5 to 2,1 mm, increase of dislocations density, more even distribution of pearlite. In this case prevented is recrystallization of ferrite and formation of carbide large deposition in the area of interphase boundaries. Structure of this kind provides practically 2-fold increase in both strength characteristics and impact energy on transverse specimens at test temperature –60°C. Recommendations on provision of necessary mechanical properties are developed.

Key words: low-alloy steel, controlled rolling, winding temperature, pearlitic strips, cold resistance.

UDC 669—419.4:621.791.18

Microstructure of bimetallic joint: titanium alloy–titanium orthorhombic aluminide (diffusion welding). Rybin V. V., Semenov V. A., Semenov A. N., Filin Yu. A., Okunev Yu. C., Grinberg B. A., Yolkina O. A., Kar'kina L. E., Patselov A. M., Volkov A. Yu., Popov A. A., Illarionov A. G. – Problem of Material Science, 2004, N 2(38), p. 47–60.

Bimetallic joint of titanium orthorhombic aluminide with structural titanium pseudo-a-alloy of ПТ3В grade was obtained by means of diffusion welding. Investigated was phase composition and microstructure of the obtained bimetallic joint at different distances from contact surface. Revealed was a multilater nature of the diffusion zone. Phases creating layers were identified. It is shown that properties of the joint depend on peculiarities of phase composition and structures generated quite close to the contact surface. In joints with a good complex of mechanical properties near to the contact surface there are no long interlayers of brittle ordered intermetalloid phase. Besides, disordered phases based on body-centered cubic lattice are generated on both sides of the contact surface and along the surface which were absent in the initial state of both alloy ПТ3В and orthorhombic aluminide of titanium. Reasons for generation of the revealed structural conditions and their influence on mechanical properties of bimetallic joints are discussed.

Key words: bimetallic joint, diffusion welding, titanium alloy, orthorhombic aluminide of titanium, phase composition, microstructure, mechanical properties.

UDC 669—419.4:621.791.13

The microstructure of a bimetallic titanium–orthorhombic titanium aluminide joint (explosive welding). Rybin V. V., Sidorov I. I., Grinberg B. A., Antonova O. V., Volkova N. P., Inosemtsev A. V., Salishchev G. A. – Problem of Material Science, 2004, N 2(38), p. 61–71.

A bimetallic joint of the orthorhombic titanium aluminide and the titanium of technical grade obtained by explosive welding has been studied. The phase composition and the structure of a bimetallic joint have been studied by the X-ray diffraction, the metallography and the scanning electron-microscopic methods. It has been revealed that phase transformations a_2 Á O and b(B_2) Á O may occur during explosive welding though the phase composition of materials under study as a whole undergoes only insignificant changes as a result of explosion. Different versions of the investigated heterophase structure phase transformations under shock-wave loading have been considered.

Key words: bimetallic joint, explosive welding, orthorhombic titanium aluminide, titanium of technical grade, phase transformations, microstructure.

UDC 621.762:621.785.3

The phase composition and the crystalline structure $Y_3Fe_5O_{12}$ of ultradispersed powder as annealed at low temperatures. Ivannikova L. M., Solov'ev A. I., Dedov N. V., Kul'kov S. N. – Problem of Material Science, 2004, N 2(38), p. 72–77.

A study of the structure of ultradispersed powder produced by the method of plasmochemical synthesis has been carried out. It has been established that $Y_3Fe_5O_{12}$ is formed by way of the formation of $YFeO_3$ orthorhombic phase. The annealing temperature should make 1100–1200°C with a view to assure a full interaction between components and to obtain $Y_3Fe_5O_{12}$.

Key words: ultradispersed powder, plasmochemical synthesis, annealing, phase composition, crystalline structure.

UDC 621.793.7

Obtaining of wear-resistant coatings by activated gas-thermal spraying with subsequent modification. Belotserkovsky M. A., Azizov R. O., Cucareko V. A. – Problem of Material Science, 2004, N 2(38), p. 77–87.

Structural condition, durometric and tribotechnical properties of gas-thermal coatings obtained by the steel wire activated spraying with subsequent modification by ion-beam nitriding and chemical heat treatment have been investigated. It has been established that ion-plasma nitriding ensures forming the surface layers of gas-thermal coatings 5 to 40 mm thick, with the hardness ranging from 6500 to 15000 MPa. Coatings of steels 40X13 and X18H10T show an increase in wear resistance up to 8 times. As a result of chemical heat treatment the modified layers 100–200 mm thick (carbonitriding, the microhardness is 6500–7700 MPa) and 300–320 mm thick (boriding, the microhardness ranges up to 16000 MPa) are formed on coatings. After boriding, the coatings of steel Св-08 show an increase in wear resistance about 100 times under dry coating conditions. A positive influence of chemical heat treatment on gas-thermal coating-to-base bond strength has been recorded.

Key words: wear-resistant coatings, gas-thermal spraying, modification, chemical heat treatment, coating-to-base bond strength.

UDC 621.791.92:669.715'24

Electroslag deposition of Ni_3Al based thermal-resistant alloy on steel for the strengthening of steel hot working tools. Sokolov G. N., Zorin I. V., Tsurihin S. N., Arisova V. N., Lysak V. I. – Problem of Material Science, 2004, N 2(38), p. 87/098.

A new method of depositing in the sectional current-carrying crystallizer has been studied. The possibility to obtain by means of depositing with electro-neutral composite rod a high-quality nickel-aluminide based alloy for the strengthening of heavily loaded metallurgical tools, which undergo a cyclic temperature-power influence at temperatures up to 1100°C, has been established. The deposited metal consisting of the g'-Ni_3Al primary phase, CrNiMoZr intermetallics, WC, Mo_2C, Ta_2C, Cr_7C_3 carbides and a solid solution of g-Al in nickel is shown to have a sufficient level of running characteristics in welding and one of operating properties.

Key words: electroslag deposition, sectional current-carrying crystallizer, composite additional rod, nonconsumable hollow electrode, a model of slag movement and mass transfer, thermal cycles, nickel aluminide, phase composition, intermetallics, carbides, thermal cycling, high-temperature hardness.

UDC 621.791:[669.35'71+669.14]

An investigation on the characteristic features of welding Бр.А9Ж4Н4 grade of aluminum bronze to АБ2-ПК steel. Vainerman A. E., Pichuzhkin S. A. – Problem of Material Science, 2004, N 2(38), p. 99–107.

The possibility to make high-quality weld joints of aluminum bronze of Бр.А9Ж4Н4 grade and type АБ2-ПК steel with the use of additional bronze wire has been investigated. It has been established that the use of additional wire of bronze grade Бр.АМц9-2 in welding is more expedient since this ensures the more strength of weld joint as against wire of МНЖКТ5-1-0,2-0,2 alloy.

Key words: welding, aluminum bronze, steel, additional wire, mechanical properties, welding procedure.

UDC 621.791.65:[669.14+669.295]
Making joints of steels and titanium alloys by fusion welding. Baranov A. V., Vainerman A. E., Chumakova I. V., Chernobaev S. P.– Problem of Material Science, 2004, N 2(38), p. 108–125.

Analytically treated reference data on fusion welding of steel to titanium are set forth, the results of investigations on procedure for welding steel to titanium through pad interlayers to make test samples are presented.

The developed welding procedure is a fundamental in nature and makes it possible to obtain high-quality joints of the above-mentioned heterogeneous metals on test samples. In future this welding procedure may be used to work out procedure for making welded structures of steel-to-titanium or steel-to-titanium based alloys.

Key words: fusion welding, steel, titanium, pad interlayers, welding procedure.

UDC 669.15’786—194:620.193.73
An investigation on the influence of nitrogen on austenitic steel pitting resistance. Mushnikova S. Yu., Legostaev Yu. L., Har’kov A. A., Petrov S. N., Kalinin G. Yu. – Problem of Material Science, 2004, N 2(38), p. 126–135.

An investigation has been carried on the nitrogen content influence (in the concentration range 0,25–0,60%) upon some electrochemical characteristics of pitting resistance (pitting formation and repassivation potentials) in a 3,5%NaCl solution of corrosion-resistant austenitic chrome-manganese-nickel steels: three chemical compositions with different ratios of manganese to nickel are available.

It is shown that pitting resistance depends on the nitrogen content in solid solution and the chrome nitrides presence considerably enhances susceptibility to pitting. Analysis algorithm for nitride- and carbide-stabilizing elements (i.e. niobium and vanadium) concentration is proposed. It is advisable to exert final thermal effects on nitrogen-containing steel beyond the chrome nitride- and carbide-formation temperature region with a view to increase pitting resistance.

Key words: corrosion-resistant nitrogen-containing austenitic steel, pitting in chloride solutions.

UDC 620.179.14:539.213
The method of routine monitoring of magnetosoft materials magnetic properties by means of the pancake coil system. Kuznetsov P. A., Askinazy A. Yu., Farmakovsky B. V. – Problem of Material Science, 2004, N 2(38), p. 136–143.

Owing to a fact that various batches of amorphous alloys essentially differ in structure, an appreciable spread of magnetic properties originates which has an effect on the material capability to shield magnetic fields. For the solution of such problems as reduction of the magnetic field level and creation of effective systems for electromagnetic protection of maintenance facilities and biological objects, amorphous alloys should be selected as per the results of alloy batch qualification for magnetic permeability. Measuring procedure based on application of the pancake coil system making it possible to inspect amorphous alloys for quality both by shielding and by magnetic properties is proposed. Standard procedures for quality control of tapes of amorphous alloys are more complicated and less flexible in comparison with the procedure in question.

Key words: amorphous alloys, magnetic properties, routine monitoring method, the pancake coil system.