C O N T E N T S

ABSTRACTS OF PUBLISHED ARTICLES

UDC 669.74

Investigation, development of technologies, manufacture and tests of manganese alloys of ores from the Urals and Komi Republic deposits. Gorynin I. V., Grishchenko L. V., Guts A. V., Brusnitsin Yu. D. — Problems of Materials Science, 2000, iss. 1(21), p. 5–17.

A short review has been taken of main results of investigations into: ore concentration and determination, in terms of metallurgy, of importance of manganese-ore concentrates from the Urals and Komi Republic deposits; development of procedure for melting the manganese alloys, trying-out this procedure in producing pilot lots at the Klyuchevskiy ferroalloy works; the organization and carrying out of tests of new alloys under lot production of welding electrodes at shipyards and plants of other industrial branches of Russian Federation.

Key words: manganese alloys, manganese-ore concentrates, ore concentration, importance in terms of metallurgy, melting procedure.

UDC 621.73:669–412:621.039.536.2

Conceptual evaluation of technical and economical advantages of making large-size forgings of the hollow ingot. Berezhko B. I., Orlova V. N., Romanov O. N., Hokhlov A. A. — Problems of Materials Science, 2000, iss. 1(21), p. 17–22.

A possibility of making the nuclear reactor vessel shells of hollow ingots instead of forging-grade ones has been considered. It has been the Japanese and French companies' experience that eccentric and axial liquation in hollow ingots is less developed at the expense of accelerated crystallization of the liquid metal. The chemical composition of hollow ingots is more homogeneous (including indices by sulfur, phosphorus, carbon), which ensures an improved isotropy of properties.

Conceptual evaluation has been made of technical and economical advantages of making large-size forgings from extra large ingots on the basis of home country and foreign countries experience. Under existing industry operating conditions the large-tonnage hollow ingots should be poured from the bottom in the open air. It has been offered to use steel shells with refractory mass between them. Inner space of the ingot should be cooled down by compressed air.

Key words: hollow ingot, axial and eccentric liquation, "cords".

UDC 621.762:669.018.95

The use of powder metallurgy methods for development and manufacture of heat-resistant sealing materials. Vinogradov S. Ye., Rybin V. V., Shekalov V. I. — Problems of Materials Science, 2000, iss. 1(21) p. 22–26.

Experiments have been carried out to determine apparent porosity and the Young's modulus of materials manufactured by the powder metallurgy method on the basis of copper, nickel and iron, for definition of expediency of their use as heat-resistant sealing materials in multi-purpose pipeline fittings — mainly in shipbuilding and power engineering.

The absence of apparent porosity and the Young's low modulus of copper and nickel assure good leak-proofness and running-in afility. In the course of investigation of an influence, exerted by the iron and aluminum oxides additions on the copper-base alloy heat resistant, it has been established that the best results (3–4 times increase in the strength of copper at 800°C) are achieved with dispersion-strengthening additions of Al_2O_3.

Key words: sealing material, powder metallurgy, dispersion-strengthened material, apparent porosity, Young's modulus, pipeline fittings, shipbuilding, power engineering.

UDC 669.017:539.219.3

Diffusion wave in inhomogeneous rod. C h a s h n i k o v V. F. — Problems of Materials Science, 2000, iss. 1(21), p. 27–30.

The problem of diffusion in inhomogeneous rod under the edge arbitrary conditions is solved. Numerical solution of a transient process and analytical solution of an equation of stationary state have been obtained. The results of calculations are evidence of the fact that under certain conditions there exists diffusion of a wave nature.

Key words: inhomogeneous rods, diffusion wave, impurity atoms, calculation procedure.

UDC 621.791.92:539.219.2:621.039.536.2

Determination of residual stresses and strains caused by reactor vessel cladding and postwelding tempering. K o s t y l e v V. I., M a r g o l i n B. Z. — Problems of Materials Science, 2000, iss. 1(21), p. 31–49.

Residual stresses and strains design procedure, allowing for the formation of stressed-strained state in the reactor vessel under cladding as well as for stress, relaxation processes in the course of postwelding tempering, has been offered. Verification of the offered procedure has been performed by means of comparison between experimental and calculated data on residual stresses. On the grounds of the offered procedure there has been made a complex of calculations on analysis of residual stresses and strains in the reactor vessel types ВВЭР-440 and ВВЭР-1000. On the basis of generalization from made calculations there been offered engineering procedure, making it possible to determine residual stresses and strains in the reactor vessel depending on the temperature and duration of postwelding tempering.

Key words: reactor vessel, cladding, stressed-strained state, postwelding tempering, residual stresses and, design method.

UDC 662.767

Investigation of catalytically active γ-Al_2O_3-base oxide compositions aimed at an increase in efficiency of hydrocarbon fuel-combustion processes. V i n o g r a d o v a T. S., G o r e l k i n D. N., S a m o d e l k i n Ye. A., F a r m a k o v s k y B. V. — Problems of Materials Science, 2000, iss. 1(21), p. 50–56.

The results of tests of the Al–Al_2O_3–РЗМ–CuO–Cr_2O_3 system catalytically-active materials are presented. Specific surface area of catalytic layer makes up 25–35 m^2/g, catalytic activity of ion-plasma sprayed specimens in the carbon monoxide and methane oxidation reaction approaches that of palladium sprayed contacts (50% by carbon monoxide at temperatures from 280 to 320°C, over 50% by methane at a temperature of 600°C).

Test results have confirmed compliance of materials basic parameters to technical requirements and good prospects of the use of developed catalytically-active materials with amorphous and microcrystalline structures in terms of an increase in efficiency of the hydrocarbon fuel, shipboard engine installations burut gas purification and conversion.

Key words: catalytically-active materials, powdered composites, plasma spraying, transition and rare-earth metals oxides.

UDC 662.767

Investigation of the surface layers of fluor-containing materials. A m m a s M. M., L y s i t s i n Yu. V., P o d s e k a e v A. V., T u r k b a e v A., H r a m t s o v s k y I. A. — Problems of Materials Science, 2000, iss. 1(21), p. 57–62.

A possibility of application of ellipsometric and waveguide-spectroscopic methods for restoration of the low-mode waveguide layers optical profile on the surface of fluor-containing glasses has been studied. Method of process monitoring of integral optical elements has been offered and theoretically based. A comparison made between the results obtained by optical and nuclear-physical methods has shown that the formation of a waveguide layer on the surface of fluor-containing glasses is connected with an increase in refractive index, arising from the surface layer hydrolytic decomposition.

Key words: fluor-containing materials, surface layers, optical profile, ellipsometric and waveguide-spectroscopic methods, technical control method.

UDC 666.192:535.51

Application of method of sectionalization in checking the oxide coatings on ferrites. A l e x e e v S. A., K r y l o v a N. A., M i r o n o v A. O., T u r k b a e v A., H r a m t s o v s k y I. A. — Problems of Materials Science, 2000, iss. 1(21), p. 62–64.

By means of experiments there have been investigated the properties of oxide coatings of titanium, aluminium, silicon, produced at ferrite half-blocks by the method of high-frequency reactive spraying.

Experimental substantiation of change in partial oxygen-pressure inside the chamber in producing homogeneous oxide films is presented. The results obtained in the course of experiments may be applied in practice by process engineers, engaged in spraying of pure materials with the beams of inert gases under different conditions, in the oxygen atmosphere in particular.

Key words: oxide coatings, ferrites, high-frequency reactive spraying, film structure, methods of investigation, experimental analysis.

UDC 621.025: 535.51

Characteristic features of measurement of the dielectrics and semiconducting materials rough surface parameters. A k o l z i n P. G., K o l o s o v S. V., G o l o d n o v D. V., T u r k b a e v A., H r a m t s o v s k y I. A. — Problems of Materials Science, 2000, iss. 1(21), p. 65–68.

A problem of determination of the rough surface parameters within the framework of methodological approaches to heterogeneous media of Drude–Bohrn and Rayleigh–Raiss theories has been solved. A necessity for an allowance for the substrate physico-chemical parameters, with a view to avoid mistakes in qualitative assessment of the absorption surfaces, has been confirmed.

Key words: semiconducting materials, dielectrics, surface roughness, substrate, physico-chemical parameters, methodological approach.

UDC 621.791.042.4:669.14.018.41

Ways of raising the welding-running characteristics of electrodes with main type of coating, meant for welding high-strength and cold-resistant steels. G e z h a V. V., B a r y s h n i k o v A. P., G r i s h c h e n k o L. V., S h a r a p o v M. G. — Problems of Materials Science, 2000, iss. 1(21), p. 69–77.

A review has been taken of electrodes with main type of coating used in Russia and abroad, meant for welding of low-alloy steels which assure high cold resistance of the weld metal. Main directions and ways of raising the welding-running characteristics of electrodes and mechanical properties of the weld metal have been considered.

Key words: welding electrodes, low-alloy steels, weld metal cold resistance, main type of coatings, welding-running characteristics, competitiveness.

UDC 621.791—112.81:669.715

An influence exerted by artificial heat removal on the value of longitudinal and transverse shortening strains in welding light-sheet structures of aluminium alloys. L o p a t i n N. I. — Problems of Materials Science, 2000, iss. 1(21), p. 77–87.

Procedure for design of welding strains with due account of an influence of artificial heat removal at the stages of designing welded structures to a precision, being sufficient for practical application, is offered.

Key words: light-sheet structures, aluminium alloys, welding strains, artificial heat removal, design procedure.

UDC 621.791.92:669.35’71’24

Researches carried out for development of bronze wire for steel cladding. V a i n e r m a n A. Ye., T c h u m a k o v a I. V. — Problems of Materials Science, 2000, iss. 1(21), p. 87–92.

Special wire of aluminium-nickel bronze for steel cladding has been developed. An amount of iron, being necessary for assurance of corrosion resistance, goes to the clad metal from steel.

Key words: steel products, cladding, iron-free aluminium-nickel wire.

UDC 621.793.:669.5

An increase in processability of assembly-repair operation with the aid of applying of thermochemical zinc coatings on threaded fastenings. K a b a n o v Ye. V., D u d i n a L. K., G r u z d e v a Ye. Yu., H r o m u s h k i n K. D. — Problems of Materrials Science, 2000, iss. 1(21), p. 93–99.

A possibility has been studied of the replacement of protective electroplates (zinc and environmentally hazardous cadmium) by diffusion zinc coating which is applied by the thermochemical method on threaded fastenings meant for use in marine corrosive environment.

Unscrewing parameters (tightening effort and friction factors) are shown to be similar for routine disassemblies of threaded fastenings with diffusion zinc coating and with cadmium electroplate. Diffusion zinc coating of this kind is sufficiently plastic even in the absence of lubrication and does not have scorings and thread jammings. Corrosive resistance of this coating while its operation in marine environment is 3-5 times as high as corrosive resistance of zinc electroplate and 2 times as high as that of cadmium one.

Key words: thermochemical diffusion coating, threaded connections, unscrewing parameters, corrosive resistance.