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ABSTRACTS OF PUBLISHED ARTICLES

UDC 669.14.018.41:621.74.002.6

Development of cold-proof economical-of-alloy steel for thick-wall castings. H o m i a k o v a N. F., P e t r o v Yu. N., M u r u n o v A. I., Z a r u b i n G. A., S m i r n o v a G. P. – Problems of Materials Science, 2000, N 2(22), p. 5–13.

Martensitic-bainitic hardenability of the cold-proof chromium-nickel-molybdenum steel in forgings up to 500 mm in thickness has been investigated. An optimal chemical composition of the cold-proof economical-of-alloy steel grade 18XH3Д2МФЛ(АБ-2ЛТ) for thick-wall castings has been chosen.

Key words: cold-proof economical-of-alloy steel, martensitic-bainitic hardenability, thick-wall castings, mechanical properties.

UDC 669.14.018.295:629.12.037

High-strength corrosion-resistant martensitic-austenitic steel of 06X15H4ДМЛ grade for heavily stressed screw propellers of icebreakers and ice ships. D i t i n A. A., K a m y s h i n a K. P., P e t r o v Yu. N., L e m u s N. D. – Problems of Materials Science, 2000, N 2(22), p. 13–19.

The process ($\alpha \rightarrow \gamma$) of reversible transformation in tempering of hardened high-strength corrosion-resistant martensitic-austenitic castable steel of 06X15H4ДМЛ grade and an influence of the remaining austenite on the complex of mechanical properties have been investigated.

Key words: high-strength corrosion-resistant martensitic-austenitic castable steel, screw propellers, heat treatment conditions selection, ($\alpha \rightarrow \gamma$) reversible transformation, mechanical properties, corrosion fatigue resistance.

UDC 669.15—194:621.039.531

An influence exerted by alloying and impurity elements on slowing down kinetics of the WWPR vessels materials induced radioactivity. R y b i n V. V., R i a d k o v L. N. – Problems of Materials Science, 2000, N 2(22), p. 20–35.

A model of calculation of neutron flux-assisted induced radioactivity and of its slowing down in time, occurring after interruption of irradiation, is offered and substantiated for the materials of nuclear reactor vessels. Formulae are derived and calculations are made for the use in native reactor building of the reactor vessel materials, such as steels 15X2HMΦAA and 15X2MΦAA, and for advanced low-activated steels of 15X2B2ΦAA type. The value of steel activation is shown to be dependent on the alloying and impurity elements content of this steel. The elements C, Cr, W, V don't exert a decisive influence on the value of steel activation; it is Nb, Mo, Cu, Co, Ni that exert the greatest influence on its residual activation after holding up to 100 years. The limits are fixed of impurities decontamination of the nickel-free tungsten-containing reactor vessel steels with a view to obtain maximal rate of drop in induced radioactivity, bringing it closer to the rate of drop in pure-iron induced radioactivity.

Key words: reactor vessel, low-activated steels, induced radioactivity, drop kinetics, alloying and impurity elements, content.

UDC 678.067–419:629.12.011

Three-layered polymeric and metal-polymer composites with the middle one-third body-reinforced layer for the ship's hull frame-less panels and shells.

F r o l o v S. E. – Problems of Materials Science, 2000, N 2(22), p. 36–45.

Three-layered polymeric composites with outer layers of glass-reinforced plastic and metal-polymer materials with heterogeneous (glass-reinforced plastic and steel) load-carrying layers and with the middle one-third layer (filler) of rigid gas-filled polymers, body-reinforced on the polymeric pseudohoneycombs- and glass-reinforced plastics/steel goffers-base, have been developed. Mechanical properties of body-reinforced polymeric composites in the middle one-third layers and those of three-layered polymeric and metal-polymer composites have been investigated.

High bending strength and hardness of three-layered materials allows transition to the ship's hull panels and shells frameless construction. The use of load-carrying layers or metal goffers as part of three-layered compositions assures the possibility of welding the constructions together.

Key words: polymeric and metal-polymer composites, make-up, structure, three-layered composition, mechanical properties, ship's hull panels and shells.

UDC 678.067–419:629.12.011

Polymeric and sandwich-type composites with the middle layer of multi-ply reinforced syntactic foams for ship's hull structural members.

F r o l o v S. E. – Problems of Materials Science, 2000, N 2(22), p. 45–54.

New compositions and structures of polyester and epoxy syntactic foams (based on the glass and sol hollow microspheres with layerwise pseudohoneycombs and interlayer reinforcement), on whose base there have been produced polymeric and metal-polymer sandwich-type compositions under short-term failure conditions, are offered.

The results obtained enable to believe that a new promising direction in improvement of materials and structural members, which will make it possible to go over to manufacture of the ship's hull easily producible zero- or low-framing planes and shells, is found.

Key words: polymeric and metal-polymer composites, compositions and structures, sandwich-type composites, mechanical characteristics, ship's hull planes and shells.

UDC 678.067:534.113

Iterative method of determination of elastic and dissipative characteristics of polymer composites. Part I. Theoretical foundations.

R y a b o v V. M., Y a r t s e v B. A. — Problems of Materials Science, 2000, N 2(22), p. 55–61.

The method of determination the elastic and dissipative characteristics of orthotropic polymer composites is developed. Initial values of the real and imaginary parts of complex Young's and shear moduli are determined through first natural frequencies and loss-factors of bending and twisting vibrations for specimens cut the angles $\theta = 0^\circ, 45^\circ, 90^\circ$, and those of the main complex moduli are further corrected on the base of natural frequencies and loss-factors of higher tones of vibrations.

Key words: polymer composites, rods, stiffness characteristics, dissipative characteristics, bending vibrations, twisting vibrations, natural frequencies, loss-factors.

UDC 678.067:534.113

Iterative method of determination of elastic and dissipative characteristics of polymer composites. Part II. Experimental errors minimization. R y a b o v V. M., Y a r t s e v B. A. — Problems of Materials Science, 2000, N 2(22), p. 61–70.

The influence of rod's length on the natural frequencies and loss-factors of bending-twisting vibration of anisotropic rods, cut at from orthotropic plate at the angle to reinforcement direction, is developed. Asymptotic method is suggested.

The influence of orientation errors of rod samples from orthotropic polymer composite materials on accuracy of their elastic and dissipative characteristics determinations is estimated. There are recommendations for selection of the rational geometrical sample sizes to minimize the error of defenition of real and imaginary parts of main complex Young's and shear moduli in this paper.

Key words: anisotropic rods, bending-twisting vibrations, natural frequencies, loss-factors, asymptotic method, error.

UDC 678.067:534.113

Iterative method of determination of elastic and dissipative characteristics of polymer composites. Part III. Experimental verification. R y a b o v V. M., Y a r t s e v B. A. — Problems of Materials Science, 2000, N 2(22), p. 70–76.

A number of first natural frequencies of bending, twisting and bending-twisting vibrations for specimens cut from GFRP plate at the angles $\theta = 0^\circ, 15^\circ, 30^\circ, 45^\circ, 60^\circ, 75^\circ, 90^\circ$ to reinforcement direction were obtained experimentally. Initial values of the real and imaginary parts of complex Young's and shear moduli were determined through first natural frequencies and loss-factors of bending and twisting vibrations for specimens cut at the angles $\theta = 0^\circ, 45^\circ, 90^\circ$ with the assumption that the Poisson's ratio is a real. Initial values of the real and imaginary parts of the main complex moduli were further corrected on the base of natural frequencies and loss-factors of higher tones of vibrations. The validity of obtained results was confirmed by correspondence between calculated and experimental data by natural frequencies and loss-factors for specimens cut at the angles $\theta = 15^\circ, 30^\circ, 60^\circ, 75^\circ$.

Key words: polymer composites, rods, stiffness characteristics, dissipative characteristics, bending vibrations, twisting vibrations, natural frequencies, loss-factors.

UDC 621.791.034

An influence of the argon-helium mixture components composition on characteristics of the welding burners shielding flow. S h a r a p o v M. G. — Problems of Materials Science, 2000, N 2(22), p. 77–83.

An influence of the argon-helium mixture components composition on characteristics of the welding burners gas shielding has been investigated. Theoretically obtained relationships reflecting a decrease in the flow shielding properties versus an increase in helium concentration of the mixture have been verified by experiment. It has been shown that the burners used for argon-arc welding can not be recommended for welding in the argon-helium mixtures, as far as at high helium concentration of the mixture there may arise disturbances in the weld shielding.

Key words: welding burners, weld gas shielding, argon-helium mixtures, helium concentration, protection efficiency.

UDC 539.375.5

Plastic tearing and unstable fracture conditions in materials with the ductile-brittle temperature transition. Ilyin A. V., Mizetsky A. V. – Problems of Materials Science, 2000, iss. 2(22), p. 84–104.

A model for description of plastic tearing conditions and of those for the plastic tearing-unstable fracture transition, accompanied by changing of a fracture mechanism, is offered. The results of computational modelling of these processes and the experimental data corroborating the model basic assumptions are presented. Proceeding from the offered approach, the scale effect observed at tests for fracture toughness and an influence of the thickness on the unstable crack propagation condition are described. These results may be used in substantiation of the criterion for unstable fracture as a limiting state in the brittle strength calculations.

Key words: material structural strength, fracture toughness, crack propagation conditions, ductile-brittle transition, crack moving out, unstable fracture, scale factor, process modeling.

UDC 669.21/23:629.12

An increase in efficiency of the use of precious metals in shipbuilding industry. Novikova L. F., Smirnov B. N. – Problems of Materials Science, 2000, N 2(22), p. 105–108.

An analysis of the use of precious metals in producing of articles at the shipbuilding enterprises has been performed.

Problems of the possibility of reprocessing the precious metal scrap, being available at enterprises carrying out ships'reclaiming, and scrap resulting from the wear of sophisticated computer facilities and communication facilities have been examined.

Key words: precious metals, salts, alloys and pastes based on them, electroplating, brazing, fusing into, spraying, precious metals scrap and waste, scrap reprocessing.