

CONTENTS

METALS SCIENCE. METALLURGY

<i>Zisman A. A., Kurnakov D. V., Nesterova Ye. V., Rybin V. V.</i> The role of plastic accommodation in forming of martensite transformation structures in low-carbon steel. Modelling of phase stresses and interphase misorientations	5
<i>Kudryavtseva I. V., Pavlov V. N., Mushnikova S. Yu.</i> The research of structural transformations and mechanical and corrosive properties change in high-strength corrosion-resistant transition steel for transmission pipeline.	18
<i>Oryshchenko A. S., Slepnev V. N., Philin Yu. A., Kruglov L. G., Rozov M. G., Panina N. V., Anoshina L. A.</i> Materials and technologies development for production of castings out of titanium alloys without higher-hardness surfacing.	26

WELDING. WELDING MATERIALS

<i>Bugai A. I., Shamin S. A., Sharapov M. G.</i> Charge components effect of 48IIIИ-8H flux-cored wire on diffusible hydrogen content of deposited metal.	39
<i>Vainerman A. Ye., Belayev N. V.</i> Study of the effect of surface hardening by shot-blasting method on the serviceability of propellers welded structures out of aluminium bronze.	42
<i>Vainerman A. Ye., Chumakova I. V., Karpov V. V.</i> Welding technology study of pipes out of МНЖМц11-1.1-0.6 alloy to each other and to parts out of Бр.АЖНМц9-4-4-1 bronze and Л90 brass.	46
<i>Vainerman A. Ye., Pichuzhkin S. A.</i> Welding of copper and alloys based on it to steels (A review of literature).	52

STRUCTURAL-WORKING STRENGTH AND SERVICEABILITY OF MATERIALS

<i>Margolin B. Z., Kostylev V. I., Minkin A. I.</i> Prediction of temperature-fracture toughness dependence under brittle fracture of reactor body steels taking into consideration crack ductile undergrowth.	66
<i>Ilyin A. V., Philin B. Yu.</i> Development of a program complex giving preliminary calculations and processing of crack resistance tests results under static loading considering home and foreign regulatory documentation.	80
<i>Miroshnichenko A. I., Krasnov A. N., Petrov V. A., Timofeyev B. T., Chernayenko T. A.</i> Fracture probability assessment of WWER-100 reactor body under Standard Operating Conditions and in Emergency based on new standard approaches using statistic modelling methods.	90

TESTING AND CONTROL OF MATERIALS

<i>Kruglov B. A.</i> Use of computer modelling method to study functions of defects detectability under ultrasonic flaw detection.	102
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<i>Kruglov B. A.</i> Functions of cracks detectability under service ultrasonic testing of WWER-1000 reactor bodies using a CK187 system.....	107
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MATERIALS SCIENCE PROBLEMS OF UTILIZATION OF MECHANISMS AND STRUCTURES

<i>Gorynin V. I., Dobrenyakin Yu. P., Kosterin B. I., Nikishin G. D.</i> Nuclear submarines utilisation. Urgency, tendencies, prospects.	119
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CODIFICATION

<i>Vasilyev V. V., Ikhilchic A. R., Kirilina N. I.</i> On the problem of scientific knowledge codification.	124
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CHRONICLE

Session of the National Welding Committee of the Russian Academy of Science	129
7 th International Conference «Material in Design, Manufacturing and Operation of Nuclear Power Plant Equipment»	129

A list of articles published in the journal of science and engineering “Problems of Materials Science” in 2002 year	131
Abstracts of published articles	137

ABSTRACTS OF PUBLISHED ARTICLES

UDC 669.017.3:539.219.2

The role of plastic accommodation in forming of martensite transformation structures in low-carbon steel. Modelling of phase stresses and interphase misorientations. Z i s m a n A. A., K u r n a k o v D. V., N e s t e r o v a Ye. V., R y b i n V. V. – Problems of Materials Science, 2002, N4(32), p. 5–17

During plastic accommodation under martensite transformation in steel, evolution of phase stresses and interphase misorientations is modelled. A martensite crystal is presented as an endless plate and its sliding system, which is loaded with reactive stresses at the most under constraint of Bain deformation, is chosen as an accommodation one. As an accommodation shift is developed and phase stresses are attenuated, the model predicts the alternation of canonical orientational Nishiyami, Greninger—Troiano and Kurdjumov—Sachs relationships, one of which is recorded in accordance with specific conditions of steel transformation and composition. It is proposed to reconstruct the degree of martensite plastic accommodation and residual phase stresses by experimental interphase misorientations using the presented model.

Key words: plastic accommodation, martensite transformation, phase stresses, interphase misorientations, process modelling.

UDC 669.14.018.8:621.78:620.193.2

The research of structural transformations and mechanical and corrosive properties change in high-strength corrosion-resistant transition steel for transmission pipeline. K u d r y a v t s e v a I. V., P a v l o v V. N., M u s h n i k o v a S. Yu. – Problems of Materials Science, 2002, N4(32), p. 18–26

Chemical composition of high-strength corrosion-resistant transition steel has been developed. Mechanical and corrosive properties of the steel have been studied. Heat treatment condition has been developed to get the optimal structure and optimal combination of mechanical and corrosive properties of 07X15H4M2T steel.

Key words: high-strength corrosion-resistant steel, chemical composition, mechanical and corrosive properties, heat treatment.

UDC 669.295:621.74.002.6

Materials and technologies development for production of castings out of titanium alloys without higher-hardness surfacing. O r y s h c h e n k o A. S., S l e p n e v V. N., P h i l i n Yu. A., K r u g l o v L. G., R o z o v M. G., P a n i n a N. V., A n o s h i n a L. A. – Problems of Materials Science, 2002, N4(32), p. 26–38

Higher-hardness surface layer of titanium castings has been investigated for its removal technology development and for reduction in liquid titanium contamination using the foundry waste.

Development work on the reduction of oxidizing medium detrimental effect on castings with remaining at the most conditions of a process chart currently used in shops and equipment for making packed molds out of fused magnesia has been carried out. The efficiency of mold and rods surfaces coating with Na, Mg, Ca halogenide solutions with refractory and titanium inert oxide (Y_2O_3) and metallic fillers available for production has been studied.

On the whole, the technology of higher-hardness layer removal from the surface of cast pieces includes: the decrease in titanium castings roughness, heat treatment to relieve casting stresses, sand-blast cleaning and etching of castings to remove the residual higher-hardness layer. In working conditions specimens and pilot castings of different thickness have been made.

Key words: titanium alloys castings, higher-hardness layer, molds, interaction processes.

UDC 621.791.042:669.788

Charge components effect of 48III-8H flux-cored wire on diffusible hydrogen content of deposited metal. Bugai A. I., Shamir S. A., Sharapov M. G. – Problems of Materials Science, 2002, N4(32), p. 39–42

Causes of diffusible hydrogen higher content of metal deposited with 48III-8H flux-cored wire have been studied; recommendations for its content decrease by precalcination of charge components are presented.

Key words: welding, flux-cored wire, deposited metal, hydrogen.

UDC 621.79.023.3

Study of the effect of surface hardening by shot-blasting method on the serviceability of propellers welded structures out of aluminium bronze. Vainerman A. Ye., Belayev N. V. – Problems of Materials Science, 2002, N4(32), p. 42–45

Effect of surface hardening by shot-blasting method on the serviceability of propellers welded structures out of aluminium bronze after repairing of casting defects has been studied.

Key words: propellers, defects, hardening, welded structures, shot-blasting, serviceability

UDC 621.791.754'293:669.35

Welding technology study of pipes out of MHЖMц11-1.1-0.6 alloy to each other and to parts out of Бр.АЖНМц9-4-4-1 bronze and Л90 brass. Vainerman A. Ye., Chumakova I. V., Karпов V. V. – Problems of Materials Science, 2002, N4(32), p. 46–52

A technology of argon-arc non-consumable electrode d-c welding of rotary butts of pipes 30-100 mm in diameter with the pipe wall 2-5 mm in thickness out of MHЖMц11-1.1-0.6 alloy using welding wire of MHMцАЖВТН640-2-1.5-1.4 grade and pipes out of this alloy with welded parts out of Бр.АЖНМц9-4-4-1 bronze and Л90 brass using welding wire of MHЖКТ5-1-0.2-0.2 grade has been worked out. This technology provides defect-free welded joints.

Key words: argon-arc welding, pipes butts, welded joints, bronze and brass parts, welding wire.

UDC 621.791:669.35

Welding of copper and alloys based on it to steels (A review of literature). V a i n e r m a n A. Ye., P i c h u z h k i n S. A. – Problems of Materials Science, 2002, N4(32), p. 52–65

A review of literature data about welding of copper and alloys based on it to carbon and high-strength steels and also about welded joints technologies and properties is presented.

Key words: copper, copper alloys, carbon steels, high-strength steels, welding, technologies, welded joints properties.

UDC 669.15–194:621.039.536.2:539.4

Prediction of temperature-fracture toughness dependence under brittle fracture of reactor body steels taking into consideration crack ductile undergrowth. M a r g o l i n B. Z., K o s t y l e v V. I., M i n k i n A. I. – Problems of Materials Science, 2002, N4(32), p. 66–79

Based on a stochastic model of brittle fracture and on a deterministic model of ductile fracture put forward before by the authors, basic regularities of brittle fracture after crack ductile growth have been studied. Investigations were carried out as applied to 15X2HMΦA-A reactor body steel in its initial and embrittled conditions. For different temperatures, dependencies of brittle fracture probability on stress intensity coefficient and crack ductile undergrowth have been calculated. Prediction of temperature-crack resistance dependence under brittle fracture of material in its initial and embrittled conditions has been done both with and without considering crack ductile growth. The main factors controlling given dependencies have been studied. Results obtained have been correlated with tests data on compact specimens of CT type.

Key words: reactor steel, brittle fracture, crack resistance, crack ductile growth, regularities of brittle fracture, dependence calculations.

UDC 539.219.2.001.4

Development of a program complex giving preliminary calculations and processing of crack resistance tests results under static loading considering home and foreign regulatory documentation. I l y i n A. V., P h i l i n B. Yu. – Problems of Materials Science, 2002, N4(32), p. 80–90

Working out a certification system of hull materials and their welded structures for compliance with the Russian Maritime Register of Shipping and international classification societies necessitate prompt reliable and correct determination of the base metal crack resistance parameters and welded joints. For this purpose, the program complex “Promtest+” has been worked out by CRISM “Prometey”. The program complex structure is presented and some algorithms are described.

Studies, aimed at providing design engineers with information support carried out in the context of working out the program complex algorithms, meet the general way of working out programs in CRISM “Prometey”. Studies contribute to a successful solution of the scientific and practical problems concerned and allow winning the market of modern certification tests of hull steels including tests supervised by foreign classification societies and other supervising units.

Key words: crack resistance, certification tests, international standards, program complex.

UDC 621.039.536.2:539.37:519.2

Fracture probability assessment of WWER-100 reactor body under Standard Operating Conditions and in Emergency based on new standard approaches using statistic modelling methods. Miroshnichenko A. I., Krasnov A. N., Petrov V. A., Timofeyev B. T., Chernayenko T. A. – Problems of Materials Science, 2002, N4(32), p. 90–101

The possibility of the Monte Carlo method use for calculating the reactor body fracture probability P_f has been studied in two modifications. Based on new standard approaches to the determination of the reactor body brittle strength, calculation results P_f has been given. As opposed to previous standards of strength calculations, new ones are performed by the base curve resulting from the Weibull distribution law for the given probability P_f . Besides the crack resistance distribution law, fracture probability calculation $P_f((K_{1c} - K) \geq 0)$ provides distribution functions for the basic variables characterizing limiting state: by sizes of defects (exponential law) and brittleness critical temperature shift ΔT_K parameters.

The calculation procedure is carried out in two different modifications: direct statistic modelling and modelling with the assessment of conditional probability. It turned out, that calculation results strongly depend on the choice of calculation defect type, specified probability for the base curve $K_{1c} = f(T - T_K)$ and the medium size of a detected defect.

Key words: reactor body, fracture probability, direct statistic modelling, modelling with the assessment of conditional probability, new standard approaches.

UDC 620.179.16:519.2

Use of computer modelling method to study functions of defects detectability under ultrasonic flaw detection. – Kruglov B. A. – Problems of Materials Science, 2002, N4(32), p. 102–107

Statistic computer modelling results of a manual ultrasonic metal continuity testing process have been given and their comparison with experimental data, carried out in ARRI NPP has been shown. At the correct separation of chance factors from all the affecting parameters and determination of laws and change limits for these factors, the possibility of using the computer modelling method has been established.

Key words: ultrasonic test, metal continuity, detectability functions, computer modelling.

UDC 620.179.16:621.039.536.2:539.219.2

Functions of cracks detectability under service ultrasonic testing of WWER-1000 reactor bodies using a CK187 system. Kruglov B. A. – Problems of Materials Science, 2002, N4(32), p. 107–118

Based on acoustic path equations, functions of crack models detectability in various zones of WWER-1000 reactor body under its service ultrasonic testing using a CK187 issued system are assessed by computer method. Their approximation has been given using functions of LOG-ODDS type.

Key words: WWER-1000 reactor body, ultrasonic testing, metal continuity, detectability functions, computer modelling.

UDC 623.827.002.8

Nuclear submarines utilisation. Urgency, tendencies, prospects. G o r y n i n V. I., D o b r e n y a k i n Yu. P., K o s t e r i n B. I., N i k i s h i n G. D. – Problems of Materials Science, 2002, N4(32), p. 119–123

Data on nuclear submarines utilisation in the world and in Russia have been given. Political, legal-organising, economic, technical, ecological and structural-system factors affecting the utilisation process are considered. Proposals for carrying out research and development work on improvement of applied technological deactivation processes and on development of new ones, and also for examination of utilised nuclear submarines hulls condition to assess not only actual corrosion rate but also the dynamics of development, removal and distribution of corrosion products in water areas of their storage are presented.

Key words: nuclear submarines, utilisation, deactivation, methods improvement.

UDC 681.3:001.89

On the problem of scientific knowledge codification. V a s i l y e v V. V., I k h i l c h i c A. R., K i r i l i n a N. I. – Problems of Materials Science, 2002, N4(32), p. 124–128

Basic ideas, problems and methods of scientific knowledge codification system construction of structural materials development have been studied.

The characterisation of a developed project of informational codification documenting of work results obtained in CRISM “Prometey” has been given (ICD SM). A set of parameters and packages of ICD SM required for systematisation, storage, efficient search and use of scientific and technical activity results has been presented.

Key words: scientific knowledge, codification, structural materials.