

SCIENTIFIC AND TECHNICAL JOURNAL "PROBLEMS OF MATERIALS SCIENCE"

N 4(44), 2005

Contents

METALS SCIENCE. METALLURGY

<i>Maltsev I. M.</i> Mechanical properties of metals after electric-pulse rolling.....	5
<i>Korchevskiy V. V.</i> Application of acoustic emission for determining the beginning of plastic deformation of the material of articles	12
<i>Okunev Yu. K., Rybin V. V., Slepnev V. N.</i> Prospects for the development of the production of casting of the titanium alloys and its intermetallic compounds.....	22
<i>Khimukhin S. N.</i> Electrode material from white iron, alloyed by chromium	37

FUNCTIONAL MATERIALS

<i>Askinazi A. Yu., Kuznetsov P. A., Vyvenko V. F., Bazlov N. V.</i> Use of an effect of magneto-impedance during a study of the magnetic properties of powders from the nanocrystalline alloys of the type Finemet on the basis of iron.....	43
<i>Demidov A. V., Makarov A. G., Stalevich A. M.</i> System analysis of the viscoelasticity of polymeric materials.....	50

STRUCTURAL-WORKING STRENGTH AND SERVICEABILITY OF MATERIALS

<i>Margolin B. Z., Gulenko A. G., Buchatskiy A. A., Balakin S. M.</i> Prognostication of the rate of the crack growth in the austenitic materials under conditions for creep and neutron irradiation.....	59
<i>Minkin A.I., Margolin B. Z., Kostylev V. I.</i> Prognostication J_R -curves for the material of the anticorrosive cladding of the reactor vessels of the type WWER on the basis of the model of ductile fracture.....	69

CORROSION. PROTECTION OF METALS

<i>Malyshev V. N.</i> On the influence of the special features of formation of titanium carbides at temperatures of austenitizing on the appearance of tendency of steel grade X18H10T to the intercrystalline corrosion ..	78
---	----

A list of articles published in the journal of science and engineering "Problems of Materials Science" in 2005 year	87
--	-----------

Abstracts of published articles	91
--	-----------

ABSTRACTS OF PUBLISHED ARTICLES

UDC 621.77:539.4

Mechanical properties of metals after electric-pulse rolling. Maltsev I. M. – Problems of Materials Science, 2005, N 4(44), pp. 5–11.

The properties of the metals of technical purity after electric-pulse deformation during the rolling are investigated. After rolling of such metals with their transmission through the area of deformation of the pulse current of high density their strength and plastic properties rise with an increase in the degree of deformation. Change in the ultimate stress with tension and relative elongation of metals and maximum specific strain energy occurs in the case of the manifestation of the insignificant thermal effect, which associates electric-pulse deformation during the rolling.

Key words: the metals of technical purity, electric-pulse deformation, rolling, strength, the plasticity.

UDC 620.179.17:539.374

Application of acoustic emission for determining the beginning of plastic deformation of the material of articles. Korchevskiy V. V. – Problems of Materials Science, 2005, N 4(44), pp. 12–21.

The expression is obtained, which connects the parameters of continuous acoustic emission with the residual deformation. The results of studies are represented for correlation between precision elastic limit and stress of appearance of continuous AE. It is shown that the application of an acoustic-emission method as the indicator of residual deformations makes it possible to determine the load of the appearance of residual deformations of the order 0,001%.

Key words: acoustic emission, plastic deformation, precision elastic limit.

UDC 669.295:621.74.002.6

Prospects for the development of the production of casting of the titanium alloys and its intermetallic compounds.

Okunev Yu. K., Rybin V. V., Slepnev V. N. – Problems of Materials Science, 2005, N 4(44), pp. 22–36.

The analysis of the contemporary technologies of castings from titanium alloys and its intermetallic compounds is made with the use of vacuum arched lining ovens. The prospect for application for these purposes of vacuum induction ovens with cold crucible, possessing a number of advantages in comparison with the most common (at present) equipment, is shown. The induction smelting of titanium makes it possible to use in practice all technological methods of control by quality and by structure of casting, well recommended itself during casting of less reactive metals. The results of domestic and foreign works are examined on creation of the new technologies, which include different forms of power, physical and physical chemistry action on the crystallizing fusion of titanium alloys and intermetallic compounds and facilitating an improvement in their structure and properties. The data are cited, which confirm the possibility of applying the inexpensive and relatively simple electroslag melting during casting of titanium alloys and intermetallic compounds of titanium.

Key words: titanium alloys, intermetallic compounds, casting, the technology of production, prospect for the development.

UDC 669.131.2:669.046.516:621.3.032.22

Electrode material from white iron, alloyed by chromium Khimukhin S. N. – Problems of Materials Science, 2005, N 4(44), pp. 37–42.

The influence of the concentration of carbon and chromium is investigated on the microstructure, the phase composition, the mass transfer and the erosional properties of the white iron, utilized as the anodic materials for the electric spark alloying. In the anode material due to high rate of cooling in obtaining by the casting method the structures of hardening are formed. The optimum quality of coating is noted during the use of cast irons of the eutectic composition.

Key words: white cast iron, electric spark alloying, anodic materials, eutectic composition, alloying with chromium.

UDC 621.762:539.213:620.179.141

Use of an effect of magneto-impedance during a study of the magnetic properties of powders from the nano-crystalline alloys of the type Finemet on the basis of iron. Askinazi A. Yu., Kuznetsov P. A., Vyvenko V. F., Bazlov N. V. – Problems of Materials Science, 2005, N 4(44), pp. 43–49.

The influence of heat working on magnetic permeability of powder from the amorphous alloy of the system Fe–Cu–Nb–Si–B (5БДСР) is investigated on the basis of the method of measuring the real and imaginary components of magnetic susceptibility in the weak alternating magnetic field of kilohertz range. It is established that heat working at a temperature 470°C leads to a two-time increase of magnetic permeability due to formation of nano-crystalline structure in the powder. It is shown that formation of optimum nano-crystalline structure in the process of the heat working at the frequency over 1 kHz occurs at a temperature on 40°C lower than the temperatures of crystallization of the amorphous alloy.

Key words: the amorphous alloy of the system Fe–Cu–Nb–Si–B, heat working, magnetic permeability, the nano-crystalline structure.

UDC 678.5:620.178.156.6

System analysis of the viscoelasticity of polymeric materials. Demidov A. V., Makarov A. G., Stalevich A. M. – Problems of Materials Science, 2005, 4(44), pp. 50–58..

The mathematical model of the viscoelasticity of polymers is proposed, based on the distribution of the relaxing and delaying particles on the internal time of relaxation and delay, which corresponds to the probability law of Cauchy. The formulated optimization criteria make it possible to carry out a selection of the mathematical model, which most reliably describes the deformation processes of polymers. Their computerization contributes to the introduction of the developed procedures of the prognostication of nonlinear- hereditary viscoelastic processes.

Key words: polymeric materials, mathematical model, viscoelasticity, deformation processes, the methods of prognostication.

UDC 669.15—194.56:621.039.531:539.219.2

Prognostication of the rate of the crack growth in the austenitic materials under conditions for creep and neutron irradiation. Margolin B. Z., Gulenko A. G., Buchatskiy A. A., Balakin S. M. – Problems of Materials Science, 2005, N 4(44), pp. 59–69.

The engineering approach is proposed, which makes it possible to forecast the rate of growth in the crack under conditions of creep and neutron irradiation. The calculated analysis of the stress-strained state at the crack apex under creep conditions is executed. Calculations are carried out regarding the influence of the intensity of the neutron flux and dose of preliminary irradiation (fluence) on the rate of growth in the crack.

Key words: austenitic materials, the rate of growth in the crack, creep, neutron irradiation, the method of prognostication.

UDC 621.791.92:621.039.524.4:539.55

Prognostication J_R -curves for the material of the anticorrosive cladding of the reactor vessels of the type WWER on the basis of the model of ductile fracture. Minkin A. I., Margolin B. Z., Kostylev V. I. – Problems of Materials Science, 2005, N 4(44), pp. 69–77.

The method of prognostication J_R -curves is presented for material of two-layered anticorrosive austenitic cladding of the reactor vessels of the type WWER on the basis of the model of ductile fracture. The parameters of the model of ductile fracture are determined according to the results of the tests of the small size samples of two types (smooth cylindrical and cylindrical with notch). The comparison of forecasted J_R -

curves is carried out in the range of temperatures from 20 to 300°C with the experimental data, obtained in the samples of the type SE(B).

Key words: the material of anticorrosive cladding, reactor vessel, the model of ductile fracture, testing of samples, the method of the prognostication.

UDC 620.196.2:669.14.018.8:661.66

On the influence of the special features of formation of titanium carbides at temperatures of austenitizing on the appearance of tendency of steel grade X18H10T to the intercrystalline corrosion.
Malyshev V. N. – Problems of Materials Science, 2005, N 4(44), pp. 78–86.

With the use of data about behavior of carbon in carbides of titanium of variable composition TiC_x the dependences are obtained, which determine the activity of carbon and possible reduction in its concentration in the solid solution, caused by precipitation of carbides TiC_x at temperatures of austenitizing of steels of the type X18H10T, and making it possible to estimate the degree of potential tendency of steel having concrete composition to intercrystalline corrosion.

Key words: steel, carbides of titanium, austenitizing, solid solution, the activity of carbon, tendency toward intercrystalline corrosion.