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ЗАВОДСКАЯ ЛАБОРАТОРИЯ

ДИАГНОСТИКА МАТЕРИАЛОВ

ЕЖЕМЕСЯЧНЫЙ НАУЧНО-ТЕХНИЧЕСКИЙ ЖУРНАЛ ПО АНАЛИТИЧЕСКОЙ ХИМИИ, ФИЗИЧЕСКИМ, МАТЕМАТИЧЕСКИМ И МЕХАНИЧЕСКИМ МЕТОДАМ ИССЛЕДОВАНИЯ, А ТАКЖЕ СЕРТИФИКАЦИИ МАТЕРИАЛОВ

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ABSTRACTS

UDC 543.866

Amperometric Biosensor Based on Alkaline Phosphatase and Carbon Nanotubes for Determination of Some Mycotoxins*Medyantseva É. P., Kh. Mai Tkhi Tkhan, Varlamova R. M., Tarasova E. Yu., Sakhapova G. R., Nikolaeva O. V., Budnikov G. K.*

A new amperometric biosensor based on modified with carbon nanotubes planar platinum electrodes and immobilized enzyme — alkaline phosphatase — is developed to determine mycotoxins. Analytical characteristics of their determination are compared for modified and non-modified biosensors. The techniques of mycotoxin determination in food using alkaline phosphatase based enzyme sensors providing the MPC level and below with S_r no more than 0.072 are presented.

Keywords: amperometric biosensors; alkaline phosphatase; carbon nanotubes; mycotoxins.

UDC 543.084/.085

Modernization of MGA-915 Atomic Absorption Spectrometers for Analysis of Rocks and Sediments as Suspensions*Zakharov Y. A., Okunev R. V., Haibullin R. R., Irisov D. S., Sadykov M. F.*

Technical solutions and devices providing to use an MGA-915 commercial atomic absorption spectrometer with electrothermal atomization (intended for analysis of simple liquid samples) in direct analysis of solid samples in the form of suspensions are presented. An excessive non-selective absorption upon atomization is eliminated. The range of determinable concentration is expanded using calibration with simple aqueous solutions. Examples of direct As determination in the state standard samples of rock black slate and sediment are given for different methods of suspension preparation. Determined concentrations range within 0.3 – 120 mg/kg, $S_r \leq 11\%$.

Keywords: atomic absorption spectrometer; electrothermal atomization; graphite furnace; multistep probe atomization; analysis of suspensions; arsenic; rocks; sediments.

UDC 543.423.1

On the Possibility of Reducing the Depth of the Surface Layer of Tested Material Upon Hydrogen Determination in Titanium Alloys Using Emission Spectral Method*Barasheva T. V., Davydov D. M., Letov A. F., Tishin I. G.*

A possibility of hydrogen determination in 10 – 15 μm coatings of titanium alloys using emission spectral method is demonstrated. Reduction of the depth of the metal layer of samples is achieved by changing the angle of the counter electrode sharpening and the use of aluminum instead of copper as a material for electrode manufacture.

Keywords: emission spectral analysis; hydrogen determination; electrical erosion of the sample; counter electrode; titanium alloys.

UDC 543.257.1:546.13

Control of Chlorine in Dusty Waste of Ferronickel Production*Bebeshko G. I., Muravyeva I. V., Chemleva T. A., Filichkina V. A.*

A simple and selective method of ionometric determination of chlorine in powdered waste of ferronickel production is introduced. The method allows the control the efficiency of the sulfate-chlorinating roasting by the chlorine content in the waste. Mathematical modeling and design of the experiment are used specify the optimum conditions of chlorine determination. The validity of the method is confirmed by the method of additives and varying sample mass. Concentration of chlorine to be determined ranges within 0.5 – 10 % wt.

Keywords: ferronickel production; dusty waste; methods of analytical control; ion-selective electrode for chlorine; ionometric method for chlorine determination; mathematical simulation and experiment design.

UDC 669:620.18

Distribution Function of the Polycrystalline Microstructure Stress-Strain States*Rekov A. M.*

Statistical characteristics of the fields of plastic deformation and stress-strain states of polycrystalline grains under uniaxial tension,

compression and plane strain are determined experimentally using 10 – 100 μm grade grid. Density distribution of the Nádai – Lode random parameters and coefficients of the transverse strain in the microstructure are constructed.

Keywords: grade grid; distribution laws; plastic deformation tensor; stress-strain state of grains; polycrystal grains; statistical analysis; microstrain (mezostrain).

UDC 620.186.1

Method of Accelerated Phase Analysis of Multiphase Materials

Salikhov A. R., Parkhimovich N. Yu., Imaev M. F.

We propose a graphical method of analysis of the phase composition of the multiphase material based on ranking of point EDS spectrum data for certain chemical elements. It is shown that this approach provides quick and efficient analysis of large amounts of data and accurate identification of phases due to visibility and easy implementation. The method was successfully used for phase identification in the deformed high-temperature superconducting (HTSC) ceramics Bi(Pb)2223.

Keywords: energy dispersive spectroscopy (EDS); phase composition; ceramics Bi(Pb)2223.

UDC 631.3.004.67:621.35.035.4

Determination of Microstructure Parameters of Electrochemical Coatings from Their Dilatation

Gur'yanov G. V. and Kisel' Yu. E.

The dependences of the strength properties of iron coatings on the parameters of the metal microstructure upon electrodeposition and heat treatment characterized by dilation are determined. The effect of high-temperature impact on the strength and structure of the coatings is studied. It is shown that dilatation can be used as a control parameter of the strength properties of iron.

Keywords: composite electrochemical coatings; electrolytic alloys; the structure; mechanical properties; wear resistance; dispersed phase.

UDC 666.635:620.162:620.193.21

Methodology for Rapid Testing and Forecasting of the Biological Stability Facade Materials

Koss L. S., Lesnykh N. F., Fedorenko E. Yu.

Criteria of the stability of the materials to biodamage and biocorrosion characterizing the dynamics of changes in the morphology and wettability of materials upon operation in a humid climate are determined proceeding from the data of experimental study. The developed method for assessing the biological stability of facade materials proved to be rather effective and can be recommended to use in designing new products with high biological stability.

Keywords: facade materials; climatic destruction; biological stability; stability of the surface structure.

UDC 620.178.15:620.178.2

Determination of the Fracture Toughness of 15Kh2NMFA Hull Plate by Kinetic Indentation Method

Bakirov M. B., Morozov E. M., Belunik I. A., Krut'ko E. S.

Reference-free method of the fracture toughness determination based on kinetic indentation is proposed. The method is based on an iterative computation of the specific work of indentation which is taken as a fracture toughness of test material at a certain depth of indentation. This method provides estimation of the degree of embrittlement of the materials in long-operated structures using periodic full-scale non-destructive testing. The examples of using the technique in analysis of steel nuclear reactor vessels are given.

Keywords: kinetic indentation; fracture toughness; aging of metal; reference-free control of the mechanical properties.

UDC 620.172.2:620.178.15

New Similarity Parameters in Transition from Indentation Diagrams to Tensile Diagrams

Bulychev S. I., Kravchenkov A. N.

The problem attributed to the lack of methodical accuracy of approximating functions for diagrams of plastic deformation in tension and indentation is solved. The diagrams to be compared are presented at different stages of deformation, each of them being described with a sim-

ilar exponential function. Using the obtained similarity parameters and their analytical expressions we managed to eliminate the methodical error of transition from the indentation diagrams to tensile diagrams upon testing with spherical indenter.

Keywords: stage of deformation; strain hardening coefficient; uniform deformation; indentation diagrams; transition functions.

UDC 620.1.63.4

Brittle Fracture Resistance of the Metal in Technical Devices of Petrochemical Industry

Kuznetsov K. A., Korchagin A. P.

It is shown that the impact toughness values obtained for the samples with a U-shaped notch at a temperature of +20 and –40°C should not be applied to the samples with other type of the notch. Impact toughness is a characteristic of the material and depends on many factors: on the nature and degree of plastic strain upon production of the blanks (sheets and structural shapes, forging, etc.), conditions and modes of their heat treatment, the degree of thermal aging during subsequent operation, etc. Therefore, the critical temperature of brittleness, even for the same steel, but for different technical devices, changed in a wide range. The results of determining the critical temperature of brittleness in the control cuttings obtained from the material of 30000 m³ tanks, 600 m³ spherical tanks, rolled billets of vessels, ammonia storage tanks, reactor for polyethylene production, PMTP-150 field pipeline and other technical devices both in as supplied and overaged conditions.

Keywords: impact toughness; brittle fracture; critical temperature of embrittlement; petrochemical production.

UDC 620.178.162

Testing of Sheet Materials Using Elastomers

Tomilov M. F. and Tomilov F. Kh.

Methods of testing sheet materials implemented with elastic media in conditions of different stress states are described. A method of testing the samples of sheet materials for uniaxial tension illustrating the advantages and effectiveness of using elastomers is given as an example. Considered test methods are used in developing the technologies of shaping parts from sheets using elastic media.

Keywords: test method; elastomer; sheet materials; stress state.

Reformation of the Accreditation System in the Russian Federation

Shipov S. V.

The problems of creating a unified national system of accreditation in Russia are considered. The main stages and directions of this work are described. The necessity of further development and improvement of the system is demonstrated.

Keywords: accreditation; certification bodies; testing laboratories; national accreditation system.

Evaluation of the Network of the Centers for Collective Use of Scientific Equipment

Kachak V. V., Maslennikov A. M.

A network of the centers for collective use of scientific equipment (CCU) founded in the Russian Federation is presented. A new approach to assessment of the efficiency and effectiveness of their activities is developed.

Keywords: centers for collective use; CCU monitoring; evaluation of the activities; evaluation criteria.

UDC 620.192.6

Calibration and Verification of Biochemical or Bioanalytical Measuring Instruments Using SSS of the Substance Content in Biological Matrix

Kulyabina E. V., Kulyabina T. V.

Issues of the choice between developing of a universal standard sample for metrological support of the several types of analyzers and specific standard samples for each type of bioanalyzer are considered. A multicomponent test mixture used to control the stability of the chromatograph parameters is considered as an example of a successful model sample.

Keywords: bioanalytical measuring instruments; verification; calibration; SSS; test mixture.