ABSTRACT AND REFERENCES

APPLIED PHYSICS. MATERIALS SCIENCE

THE RESEARCH STANDS ON THE BASIS OF THE TYPICAL GAMMA-SPECTROMETRIC COMPLEX (p. 4-9)

Oksana Pop, Mikhail Stets, Vladimir Maslyuk

Multifunctionality of typical gamma-spectrometric complexes, which should solve various tasks of applied nuclear gamma-ray spectrometry is considered. These tasks include:

- defining nuclide and element composition of matter;
- developing the system for determining metrological registration factors of gamma-radiation of bulk samples;
- developing the background stabilization and reduction system;
- developing the internal security system.

The description of the developed and existing research stands that solve these tasks at the gamma-spectrometric complex of the Institute of Electron Physics of the NAS of Ukraine is given. It is shown that these systems act as autonomous research stands that typically exist as independent units.

The fact of efficiency of multifunctionality of gamma-spectrometric complex allows to conclude on the possibility to implement functional completeness in the gamma-spectrometric complex as a system.

Operation of research stands allows to make the process of improving gamma-spectrometric complex indicators in whole and in specific cases constant.

Results are related to typical gamma-spectrometric complexes, which are in the majority. Therefore, our results can be used in practice in many analytical laboratories.

Keywords: nuclear gamma-ray spectrometry, gamma-spectrometric complex, research stand, metrology, standardization, ordinal scales, security, background.

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EFFECT OF TREATMENT MODE ON FATIGUE RESISTANCE OF MATERIAL AND THICKNESS OF THE HARDENED SURFACE (p. 10-14)

Aleksandr Zheldubovskiy, Aleksandr Serditov, Yurii Klyuchnikov, Pavel Kondrashev, Gleb Moiseenko

The vast majority of modern machine parts operate under cyclic loads, leading to, as a rule, failure, caused by the material fatigue. In this regard, the fatigue resistance of materials is one of the most important criteria for evaluating the structural strength of many parts of engineering structures. It is important that the process of exhaustion of cyclic life of metals, even at uniform stress state proceeds not uniformly in terms of volume of metal, but is initiated and develops more intensively in its surface layer. Under non-uniform stress state, role of the surface increases in connection with the presence of stress gradient. That's why, the most profound and systematic summarization of works, carried out in this direction, is aimed at performing a comprehensive analysis of changes in the properties of the surface layer of materials under active loading. However, investigated patterns of the surface microhardness change in the process of fatigue are usually qualitative and informative in nature. However, it should be noted that it is relevant to conduct studies, intended for obtaining quantitative estimates of the mentioned laws in order to develop fatigue failure criteria as a basis for improving calculation methods. This, in turn, requires developing a methodology for studying the surface layer behavior features and selecting the appropriate instrumental methods and tools. Analysis of a priori information indicates the need to investigate the microhardness, taking into account formation laws of the hardened surface layer, using different technological modes of surface treatment of metallic materials. In the present paper, the microhardness measuring method, characterized by a fairly high level of reproducibility of the obtained results and their experimentally justified correlation with the mechanical properties of the material is used. The developed method allows to determine the parameters of realized and residual life of the material.

Thus, the research results, presented in the paper are of both scientific and practical interest. The authors have proposed the microhardness measuring methodology, characterized by a high level of reproducibility of the obtained results, which allows to determine the parameters of realized and the residual life of the material.

Keywords: failure of the sample, kinetics of the layer, failure conditions, and realized and residual life, microhardness.

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EFFECT OF INTERALATED LITHIUM ON ELECTRONIC STRUCTURE OF TALC (p. 15-19)

Oksana Balaban, Bohdan Lukiyanets, Stepan Syrotyuk

In order to characterize the process of intercalation the electronic states (partial and total density of states) of talc, the Fermi level, the potential energy minima are evaluated within the projector augmented wave method (PAW). It is shown that the p-states of O mainly form the valence band while s- states of Si, O, Mg mainly form the conduction band of the talc. The calculated band gap is 5,08 eV. Total energy of the talc with the penetrated lithium into these minima is analyzed. It is obtained that the thermodynamically stable state of the talc/Li system is realized with lithium in the van der Waals gap of the talc structure. This fact coincides with experimental data according to which a guest penetrates exactly into the van der Waals gap during intercalation process. The lithium atom intercalated into the minima of the initial talc potential energy causes the reduction of the band gap and increase in the Fermi energy. These results will be used in the industrial production of batteries.

Keywords: talc, electronic properties, intercalation, lithium, ABINIT, PAW, potential energy minima.

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SOLID-PHASE SPECTROPHOTOMETRY DETERMINATION OF Hg (II) USING HROMAZUROL S (p. 20-24)

Elizaveta Kostenko, Elena Butenko

The following optimal interaction conditions of mercury with hromazurol S in the phase of polymeric anion exchanger AV-17´8–C1 are determined: maximum extraction (85 %) of Hg (II) is achieved at pH 1 within 20 minutes of phase contact from the volume of 50 cm^3. Quantitative sorption is also possible with 500 cm^3 of the solution. The concentration factor is 1667 cm^3/g. The detection limit is 20 mkg/dm^3. Mercury (II) is virtually not adsorbed by anion exchanger AV-17´8-C1. Baer's law is fulfilled within the concentration range of mercury (20–100) mkg/dm^3 ($V=50\ sm^3$). $l_{опт}$ = 580 nm. Complexation of Hg (II) with SF HAZ is affected by: 1:1000 – Cu (II), Zn (II), Cd (II), Zr (IV), Fe (III); Pb (II), Co (II), Al (III) l.z.m., Br^-, SO_4^{2-}, F^-, NO_3^-, 1:10 – Sn (IV).

The complexation chemistry in the studied system is considered. Ratio of components in the complex - Hg:HAZ-A=1:1 is defined. Conditional stability constant of complex $lgb_1 = 8.1 \pm 0.7$ is calculated.

The obtained data were used for developing the new method for SPS determination of mercury in food and environmental objects, which does not yield to the best standard methods in respect of sensitivity, selectivity and expressness, and outstrips them in respect of the experiment simplicity. The method is tested for fungi analysis. Data validation is carried out by the "introduced-found" method. Convergence of the results, obtained using the new and standard (AAS) methods validates them.

Keywords: solid-phase spectrophotometry determination, toxic metals.

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EFFECT OF GALLIUM ARSENIDE TECHNOLOGY ON THE FORMATION OF INTEGRATED CIRCUIT STRUCTURES (p. 25-32)

Stepan Novosyadlyy, Lubomyr Melnyk

Despite the apparent success of silicon technology, further development of the modern electronics industry will heavily depend on the development of new materials interfaces, in particular, gallium arsenide (semiconductor structures based on compounds $A^{III}B^{V}$). Some characteristics of devices made from these materials have great advantages (e.g. high-speed performance and compatibility with light and laser diodes), but the technology of forming the structures is very sensitive to the properties of the semiconductor interface. These interface properties at the atomic level can determine the types of the microelectronic and optoelectronic devices and circuitry based on them, which can be made on the basis of such semiconductor materials.

Electrical properties are one of the most important aspects of the interface. Electrical characteristics of the interface are defined by the relative placement of electronic levels on both sides of the interface, the electronic states at the interface itself and the interface behavior under the action of the applied voltage, current and temperature.

For example, in the metal-semiconductor contact systems (MSC) the position of the Fermi level in metal towards the edge of the conduction band and valence band of the semiconductor is an important parameter that determines the height of the Schottky barrier and the volt-ampere characteristic (VAC). At the same time, for the ohmic contacts the voltage loss at the metal-semiconductor interface at high-level current injection must be very small.

Keywords: doping, impurities, tunneling, interface, recombinations, heterojunction, implantation, activation, coating.

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MODELING SPATIAL-POLARIZATION PARAMETERS OF SPECTRAL CHARACTERISTIC OF CUTT-OFF OPTICAL FILTERS (p. 32-38)

Vasil Petsko

The paper gives the summarized changes in parameters of transmission spectra of multilayer interference structures (BIS) of cut-off optical filters depending on the polarization and incidence angle of parallel radiant fluxes relative to the normal to their surface. The model is developed and the effect of the transition region with irregular distribution of the refractive index on the spectral characteristics of the cut-off filters depending on the angle is investigated. The obtained results are particularly relevant for determining the effectiveness of using convergence or divergence of radiation fluxes in optical systems in the presence of BIS. The identified features of spectral characteristics of partially irregular films with different types of refractive index distribution within the section and mathematical modeling of their structure allow to extend the applicability of films of non-crystalline materials in the practice of designing and manufacturing cut-off optical filters.

Keywords: characteristic matrix, spectral characteristics, transmission spectrum, refractive irregularities.

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CHANGE OF CONFIGURATION, MORPHOLOGY AND ROUGHNESS OF METALS BEING ELECTRODEPOSITED AT THE FORCE INFLUENCE (p. 39-43)

Oleg Girin, Igor Zakharov

The aim of the work was experimental verification of validity of the phenomenon of phase formation through a stage of liquid state in metals being electrodeposited. The idea of the work was based on the known fact that the main difference between solid and liquid states of metal is the value of fluidity. Therefore, if phase formation of metal during electrodeposition passes a stage of liquid state than changes of configuration, morphology and roughness of its surface at the external force influence parallel to the crystallization front should be expected. Configuration of the formed deposit should have anisotropic form elongated in the direction of the force influence. Surface morphology of such deposit should be smoother and its surface should have lesser roughness in comparison with the deposit electrodeposited in usual conditions. To realize the idea of the work the electrochemical cell for obtaining of metals being electrodeposited at the external force influence in conditions of restrained deposit formation was developed and constructed. On the basis of model experiments the effects of formation of anisotropic configuration of the deposit of metal being electrodeposited, smoothing of morphology and decrease of roughness of its surface under the influence of the external force directed parallel to the crystallization front were established. The obtained result proves the validity of the phenomenon of phase formation through a stage of liquid state in metals being electrodeposited.

Keywords: phase formation, metal being electrodeposited, liquid state, configuration, morphology, roughness, electrochemical cell.

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ALGORITHM OF STRETCHING ADJUSTMENT OF LEATHER WITH MINERAL FILLING (p. 43-47)

Oksana Kozar, Viktor Konoval, Boguslaw Wozniak, Andriy Olenich

The ability of the skin to the formation and preservation of form in service depends on its ability to stretch and balance of the elastic and plastic (permanent) deformation. The values of the components of the deformation of the skin with the mineral content in the test mode, one full cycle "loading - unloading - rest" indicates that the type of mineral filler significantly affects the elastic- plastic properties of the skin.

Dependence of residual elongation of tested leather with repeated uniaxial stretching on the degree of hydration of the skin, stretching size and number of repeated stretching have been considered in this paper. Experimentally confirmed hypothesis and mathematical model of stretching adjustment of the leather with multisycle stretching and fixing of material in a stretched state . Patterns of change and the quantitative value of the residual elongation of skin samples with montmorillonite dispersion mineral content have been obtained. The most appropriate treatment process of tricyclic stretching mode and optimum humidification have been proposed. It has been proved that after 2-3 fold prior stretching of the leather the strength is not reduced , but rather strengthens, the value of

which depends on the relative size of tensile and relative amount of dampening material before stretching .

Keywords: leather, shoes , natural minerals, formation, residual deformation, shape stability, quality.

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ОТ АВТОРА

Я, Пилькевич Игорь Анатольевич, соавтор статьи «Виявлення радіозакладних пристроїв з використанням радіометру», опубликованной в «Восточно-Европейском журнале передовых технологий» №5/5(65) 2013 (с. 44–48) приношу свои извинения Убайчину А. В. (Томский государственный университет систем управления и радиоэлектроники, Россия) в связи с тем, что в названной статье не было указано его авторство в отношении результатов экспериментальных данных. Прошу считать этот факт недостаточной внимательностью при подготовке мною статьи для опубликования.

Прошу рассмотреть возможность подачи статьи в новой редакции, после согласования мною всех неучтенных аспектов с Убайчиновым А. В. – представителем коллектива учёных Томского государственного университета систем управления и радиоэлектроники, принимавших участие в проведении экспериментальных работ и получении результатов экспериментов, приведенных в опубликованной статье.