

Dayneko S. V., Artem'ev M. V., Nabiev I. R., Tedoradze M. G., Chistyakov A. A. *Solar Cell Based on Hybrid Heterostructures from Organic Semiconductors and Quantum Dots* 2

Semiconductor quantum dots (QDs) are characterized by high extinction coefficients adjustable by varying the nanoparticle size and a high quantum yield of charge generation. QDs have the advantage of efficient charge transfer from them to organic semiconductors.

We have developed hybrid materials based on semiconductor organic semiconductors polyimide (PI) or poly(2-methoxy-5(2'-ethyl) hexoxy-phenylenevinylene) (MEH-PPV) and CdSe QDs. The photovoltaic efficiency of optimized PI—QDs structures approaches that of the best performing systems based on the MEH-PPV. Incorporation of QDs in MEH—PPV has been demonstrated to increase the photovoltaic efficiency of the system by 50 %, thus allowing the development of novel QD-based inorganic/organic hybrid materials with considerably improved photovoltaic properties.

Keywords: hybrid materials, nanocrystals, photovoltaics, photoluminescence, organic semiconductor, solar cell

Korostelev V. F., Khromova L. P., Bol'shakov A. E. *Formation of Nanostructures Reinforced with Quasicrystalline Phases in Order to Improve the Physical and Mechanical Properties of the Alloy B96Ц*. 7

This article describes how to the interactions of atoms and their associations, initiated by the pressure to 500 MPa on the molten metal at a temperature of 150...200K more than the crystallization temperature. Based on the analysis of the results calorimetric, dilatometric, X-ray diffraction and metallographic studies using data from the measurement of mechanical properties, and the possibility to improve the elastic properties of the alloy B96Ц. This result was achieved due to the formation of nanostructures reinforced with non-equilibrium quasicrystalline phases.

Keywords: reinforcing the non-equilibrium phases, quasicrystals, improvement the properties of the alloy

Eroshkin P. A., Romanko V. A., Sheshin E. P. *Low-Power X-Ray Tubes with Emission Cathode Nanostructured Carbon Materials*. 11

The principles of X-ray tubes functioning and constructions are presented. The history of the X-ray equipment development and the prospects for further improvement are highlighted. The comparison of the properties of the X-ray tubes with hot cathodes and with field-emission cathodes is given.

Keywords: X-ray tube, field emission, nanostructured carbon materials

Despotuli A. L., Andreeva A. V. *Model, Method and Formalism of New Approach to Description of Ionic Transport Processes on Solid Electrolyt/Electronic Conductor Blocking Heterojunctions* 16

The new dynamico-kinetic approach for the detailed description of processes of fast ionic transport (FIT) in area of ideally polarized heterojunctions of solid electrolyte/electronic conductor (SE/EC), which are functional elements of perspective devices of nanoelectronics and nano(micro)systems, is offered in nanoionics. The approach includes: (i) structure — dynamic model (C—DM) which treats from uniform positions both fast and slow processes in the SE/EC area as a movement of mobile ions in the potential relief distorted on heteroboundary; (ii) method of the "hidden" variables describing on a sub-nanometer scale the FIT processes in terms of concentration of mobile ions on crystallographic planes in the area of thin structure of double electric layer (DEL); (iii) physical and mathematical formalism which operates with the hidden variables and is based on a principle of detailed balance and the kinetic equation in the form of the particle conservation law.

Keywords: dynamico-kinetic approach in nanoionics, solid electrolytes, advanced superionic conductors, ideally polarized heterojunction, double electric layer thin structure, hidden variables, detailed balance

Gridchin V. A., Lobach O. V. *Calibration of Heat Flux Sensor Thermopiles*. 22

In the article, calibration of thermocouples of a heat flux sensor is discussed. The structure of interest contains a bulk micromachined silicon membrane. Aluminium -polysilicon thermocouples are made on the planar face of membrane by means of surface micromachining. Two integrated resistors are asymmetrically located relative to thermocouples with the goal of calibration of the last one. Possibility of linear and square-law coefficients definition of thermo-emf is shown in the scope of this paper. Finite-element model efficiency for the task of temperature field determination within the chip of the heat flux sensor is assessed.

Keywords: sensor, thermopiles, calibration, finite elements method

Abrosimova N. D., Smolin V. K. *Self-Descriptiveness Increase of SOI Heterostructure Parameters Measure by Ellipsometry* 26

Consider questions of control of semiconductors heterostructure layers by ellipsometry method. Shown self-descriptiveness of developed methods.

Keywords: ellipsometry, SOI, SOS

Maltsev P. P., Lisitskiy A. P., Pavlov A. Yu., Shchavruk N. V., Poboynina N. V., Khachatryan V. D. *The Possibility of Manufacturing MEMS Varactors with Electrostatic Control in GaAs Technology*. 28

This article is devoted review of possible technical solutions of varactors, which made in the form of variable capacitors used technology micro electromechanical systems (MEMS). Validation of these solutions and the possibility their production on the substrates of gallium arsenide. The order was ensure the integration of MEMS varactors

with microwave devices on a single chip with use some technological methods. This integration will get a system on a chip (SoC), that will provide economic benefits and will reduce the size of the system.

Keywords: microelectromechanical systems (MEMS), micromachined tunable capacitor, microwave monolithical integrated circuits (MMIC), varactor, radio frequency, varactor with variable dielectric, varactor with variable overlap area, varactor with variable gap

Glukhova O. E., Kirillova I. V., Maslyakova G. N., Kossovich E. L., Zayarsky D. A., Fadeev A. A. Atomic Force Microscopy Application in Studies of Lipoprotein and Arterial Intima Interactions 34

An original methodology is developed for scanning of the arterial intima morphology using the atomic force microscopy. The probing nanolaboratory NTEGRASpectra (NT-MDT, Russia) was utilized during the process. The pictures of the coronary artery intima topology were obtained with the resolution of 1 nm. The 3D model of the "endothelial cell surface – LDL" complex. Using the ANSYS software, the deformation of LDL particle was found as well as the stress distribution at the moment of the macromolecule and endothelial surface collision. The largest normal and tangential stresses are found in the area of LDL interaction with the surface. These stresses are 2,173 and 0,053 kPa, respectively. It was shown that the LDL structure is being highly strained, which leads to the molecule compression and crease. Therefore, one can conclude that at the moment of LDL entering the intercellular hiatus the macromolecule will be suffering the overall deformations and large modification of the molecular structure.

Keywords: arterial intima, endothelium, lipoprotein, LDL, atomic force microscopy, 3D model, finite-element modeling, tangential stress, normal stress, strain

Shishkovsky I. V. SLS Design of Porous Drug Delivery System from Porous Nitinol 39

We propose the original scheme of the micro fluidic device for a drug delivery, made on the base of porous nitinol scaffold and synthesized by the layer-by-layer laser sintering method.

Keywords: microelectromechanical systems (MEMS), selective laser sintering (SLS), titanium nickel (nitinol), shape memory effect (SME), drug delivery systems (DDS), tissue engineering matrix (scaffolds)

Usanov D. A., Skripal A. V., Kashchavtcev E. O., Kalinkin M. Yu. Nanovibration Amplitude Determination Using Semiconductor Laser Autodyne with Taking into Account External Optical Feedback 43

Effect analysis of external optical feedback on waveform and spectrum of semiconductor laser autodyne signal has been performed. The method of nanovibration amplitude determination has been described. The method consists in measurement of ratio of the first spectral components of nanovibration autodyne signal to one of additional mechanical vibrations, taking into account the level of external optical feedback. It is experimentally shown that the allowance for external optical feedback can significantly improve the accuracy of nanovibration measurements.

Keywords: semiconductor laser, autodyne signal, nanovibration amplitude measurement, external optical feedback

Simakov V. V., Voroshilov A. S., Galushka V. V., Grebennikov A. I., Sinev I. V., Smirnov A. V., Syakina S. D., Kisin V. V. Smoke Aroma Recognition by Response Dynamics of Multisensor Microsystem 49

We study the dynamics of a multisensor microsystem response to the effect of exposure to air-gas mixtures of different compositions. Microsystem signal processing enhances the system sensitivity in identifying the smoke aromas from combustion of different organic substances.

Keywords: multisensor microsystem, aroma recognition, sensor response dynamics, thin films, tin dioxide

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