

CONTENTS

Gaponov S. V. *Extreme Ultraviolet Lithography — Future of the Nanoelectronics* 2

The questions of development of lithography with use of extreme ultraviolet radiation with length of the wave 13,5 nm are considered.

Despotuli A. L., Andreeva A. V., Rambabu B. *Nanoionics of Superionic Conductors — the Basis for the Creation of Novel Devices for MST* 5

A new class of superionic conductors (SIC) — advanced superionic conductors (ASICs) with the activation energy of ionic conductivity $E \approx 0.1$ eV — is marked out. A new direction of nanoionics — nanoionics of ASICs — is proposed. Nanosystems of solid state ionic conductors are divided into two classes differing by opposite influence of surface layer disordering on ionic conductivity σ_i and E : I) nano-systems on the basis of compounds with an initially small σ_i (large values of E); II) nanosystems on the basis of ASICs (nano-ASICs). It is proposed that a fundamental challenge of nanoionics — conservation of fast ion transport (FIT) in nano-ASIC-should be solved by the creation of structure-ordered (coherent) ASIC/indifferent electrode (InEI) heteroboundaries. In the work for nano-ASICs are introduced: (i) a characteristic parameter $P = d/\lambda_Q$ (d — the thickness of a layer of ASIC with disordered crystal structures in the area of a hetero-boundary, λ_Q — the screening length for mobile ions in the bulk of ASIC, and (ii) a criterion of the conservation of FIT. It is shown that in nano-ASICs at the leveling of Fermi levels, the contact potentials V at the ASIC/InEI coherent heterojunctions satisfy the condition $V \ll k_B T/e$. The possibility for the creation of nanoionic supercapacitors (NSC) with submicron sizes on the basis of ASIC/InEI coherent heterojunctions and specific capacity $\sim 10^{-4}$ F/cm², work frequencies $\sim 10^8$ – 10^9 Hz for a 5 Gbit capacitor DRAM, hybrid sources of energy and power of microsystem technology and wireless sensor networks is pointed out.

Barhotkin V. A., Minakov E. I. *Intellectual Gauges of Vibration* . 14

In work necessity and some ways of intellectualization of gauges are considered (examined) by example of one of problem for gauges of vibration.

Kosmodemyanskaya G. N., Sorokina S. I. *Features of Definitions of a Pressure Field in a Clearance at Driving Microcapsule in Pipes of a Small Diameter* 17

The field of pressure in a clearance is created at forward movement of the inclined microcapsule along an axis of a pipe of a small diameter with viscous liquid. The method of the equivalent equation, as one of analytical methods of the decision of the non-uniform equations of the second order in private derivative with variable factors is used.

Starkov V. V. *Micro-Fabrication Using Oxidized Porous Silicon* 24

On an example of manufacturing of a matrix SiO₂-probes and silicon electrodes of micro-fuel cell elements the technology of micro-fabrication with application oxidized macroporous silicon is offered.

Landyshev A. V., Lavrentyev A. A., Landyshev V. A. *Electron-Probe Researches of Micromodular, Thermoelectric Blocks* 28

Electron-probe methods were used to research of chemical interaction on contacts of micromodular thermoelectric blocks on the basis of alloys of structure Bi₂Se_{0.3}Te_{2.7} and Bi_{0.48}Sb_{1.52}Te₃. Products of interaction and kinetic parameters of their growth are determined. It is shown, that chemical interaction creates conditions for evolution of cracks in contacts and to growth of internal electric resistance of the block. On the basis of the received data the forecast of its durability and reliability is done.

Shilov I. P., Grigorjants V. V., Kochmarev L. Ya., Klyuchnik N. T., Jakovlev M. Ya. *High Aperture Optical Fiber Structures Based on Silica Doped by Fluorine Produced in Microwave Plasma at Low Pressure* 33

Optical fiber structures (SiO₂-F/SiO₂-composition) with high numerical aperture up to 0,30 produced in the microwave plasma at low pressure are examined. The waveguide type H₁₀-mode microwave plasmotron as a plasma source is used. Some properties of the high aperture preforms and lightguides based on silica doped by fluorine are investigated. The main applications of these structures are presented.

Darintsev O. V., Migranov A. B. *The Manipulation Microrobototechnical Systems and Problems of Manufacture Hybrid MEMS* 38

Questions of use manipulation microrobototechnical systems for assembly and packing hybrid microsystems are considered. The basic problems of manufacture MEMS into which touch, control, executive and information functions are integrated are described. The brief analysis of a modern condition of microassembly technologies is given. Features of realization of known microtechnological systems are generalized.

Lokhin V. M., Man'ko S. V., Romanov M. P., Gartsev I. B., Koliadin K. S. *The Trends in the Mini- and Micro- class Unmanned Aerial Vehicle Development* 44

The article presents a survey of the existing and promising models of compact UAVs, together with an analysis of the major trends and problems in their development.

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