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Galperin V. A., Pavlov A. A., Polomoshnov S. A., Shaman Yu. P., Shamanaev A. A. *Study of Electrical Characteristics of Structures Based on Topological CNT Arrays* 2

Resistive elements based on carbon nanotubes (CNTs) can serve as a part for different sensors. However, the creation of elements based on the topological array of CNTs with reproducible geometrical and electrophysical parameters remains a challenging scientific and technological problem. In this paper showing the results of studies on the synthesis of topological arrays of CNT with the use of technology of "combined catalyst". The use of low concentrations of injected organometallic compounds in solution in hydrocarbons for the (CVD) synthesis of CNTs in combination with the use of ultrathin films of catalytic metals allow to minimize deficiencies previously developed methods of CNTs synthesis. In the present work in the development of this technique we study the influence of size effects of topological elements of different shape on the electrical characteristics of CNT arrays.

Keywords: carbon nanotubes, cluster, catalyst

Basaev A. S., Galperin V. A., Pavlov A. A., Tsigantsov A. V., Shaman Yu. P., Shamanaev A. A. *Effect of Oxidation of Catalyst on the Growth of Carbon Nanotubes* 6

The developed theory of the thermodynamics of formation of metal nanoclusters and conducted experimental studies had allowed the analyze of the possible influence of structure and substrate material on the results of the subsequent synthesis of nanotubes on them. Showing a significant effect of the substrate annealing in an oxygen atmosphere at a height of synthesized CNT array.

Keywords: carbon nanotubes, cluster, catalyst

Galiev G. B., Vasil'evskii I. S., Klimov E. A., Pushkarev S. S., Ruban O. A. *The Use of Metamorphic Technology for Fabrication of HEMT Nanoheterostructures InAlAs/InGaAs on GaAs and InP Substrates with Different InAs Content in the Active Region* 8

MHEMT nanoheterostructures $\text{In}_x\text{Al}_{1-x}\text{As}/\text{In}_y\text{Ga}_{1-y}\text{As}$ with different InAs content in the active region (about 49 % and more then 70 %) on GaAs and InP substrates were formed by MBE. Metamorphic buffer $\text{In}_x\text{Al}_{1-x}\text{As}$ varied in thickness and in composition and also it's construction was modified by introduction of strained superlattices, but linear dependence of InAs content x on metamorphic buffer thickness was maintained. It was demonstrated that nanoheterostructures on GaAs substrates can have electron mobility and concentration of two dementional electron gas in quantum well InGaAs comparable with that of nanoheterostructures on InP substrates due to choice of suitable metamorphic buffer construction.

Keywords: metamorphic buffer, metamorphic nanoheterostructures, molecular-beam epitaxy, mismatched superlattices, strained superlattices

Senichkin A. P., Bugaev A. S., Yachmenev A. E. *Current-Voltage Characteristics of Nanothreads System of Tin Atoms Inserted in Gallium Arsenide Crystal* 11

The decoration of Sn atoms on atomic terraces edges of vicinal GaAs crystalline surface during delta — doping was established with help of electron diffraction. This fact was used to create the new nanostructure — the system of conductive nanothreads of Sn atoms inserted in one plane in GaAs crystal by means of molecular beam epitaxy method. The current — voltage characteristics anisotropy of nanostructures measured in directions along and across nanothreads was revealed.

Keywords: nanostructures, quantum wires, quantum threads, molecular beam epitaxy

Verner V. D., Lukanov N. M., Saurov A. N. *Principles of Designing of Bipolar SHF Transistor Structures with Extremely Narrow Emitter Region* 13

The constructive and technological features of manufacturing a bipolar SHF self-aligned and fully self-aligned transistors structure on silicon were designed. These transistors structures with extremely narrow emitter region are presented as a suitable for monolithic low-noise wideband amplifier and radio frequency 10—160 GHz ICs. The new method of sedimentation (or selective etching) and anisotropic etching of various layers is developed, using initial one (vertical or inclined) the plane of formation setting a basic relief of self-formation for all structure.

Keywords: constructive and technological features, SHF self-aligned and fully self-aligned transistor structure, extremely narrow emitter region, basic relief of self-formation for all structure, silicon, radio frequency ICs with 10—160 GHz

Ponomarev D. S., Vasil'evskii I. S., Galiev G. B., Klimov E. A., Khabibullin R. A., Kulbachinskii V. A. *The Band Structure Modeling and Effective Electron Mass Calculations in Composite Quantum Wells InGaAs with GaAs/InAs Nanolayers* 16

The band structure and the electrophysical properties in InAlAs/InGaAs/InAlAs/InP heterostructures were studied both theoretically and experimentally in composite quantum wells InGaAs with InAs and GaAs nanoinclusions. The Shubnikov — de Haas measurements were carried out to determine m^* with contribution of electron energy spectrum nonparabolicity. A novel design of the heterostructure with two symmetrically InAs nanoinclusions in the quantum well allows to decrease m^* by 26 % in comparison with the lattice-matched quantum well $\text{In}_{0.53}\text{Ga}_{0.47}\text{As}$.

Keywords: HEMT, nanoelectronics, nanoheterostructure, MBE, A3B5 semiconductors

Kozlov A. V., Korolev M. A., Polomoshnov S. A., Tikhonov R. D., Cheremisinov A. A., Shamanaev S. V. *Design and Circuit Configuration Methods Improve the Sensitivity of Bipolar Magnetotransistors for Precision Control of Micro-Mechanical Elements Displacement* 19

It is established with the help device-technological modeling and full-scale experiment that the relative sensitivity on a current dual-collector lateral bipolar magnetotransistors (BMT) is defined by layout of electrodes, an alloying of the well forming basis, the circuit of switching-on with the general potential of basis and a substrate, an operation mode near to saturation, value of resistance of collectors loading.

Keywords: device-technological modeling, bipolar magnetotransistors, sensitivity

Khabibullin R. A., Vasil'evskii I. S., Ponomarev D. S., Galiev G. B., Kulbachinskii V. A. *Electron Mobility in Combination Doped Transistor Nanoheterostructures AlGaAs/GaAs/InGaAs/GaAs/AlGaAs with High Electron Density: Modeling and Experiment* 21

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Keywords: nanoheterostructures, UHF electronics, molecular beam epitaxy

Sigov A. S., Lazarev A. P., Abramov A. V., Bityutskaya L. A., Bogatkov E. V., Tuchin A. V. *Spin States of Nanoclusters of Transition Metals Silicides* 25

Dimensional magnetic properties of nanoclusters of transition metal (Ni, Co, Fe, Mn) silicides, which are explained by transition of 3d-metals from low-spin to high-spin states near the surface of the nanostructures, have been revealed during computer simulation by DFT B3LYP (6—31(dp)G) method. The simulation results are considered as the theoretical basis of the magnetic properties of self-organized nanostructures of nickel silicide, which were obtained experimentally using a localized gas discharge.

Keywords: density functional theory, dimensional magnetic properties, nanoclusters of transition metal silicides, localized gas discharge, spintronics

Gromov D. G., Kozmin A. M., Polomoshnov S. A., Shuliatyev A. S., Shamanaev S. V. *ZnO Thin Film Formation Condition Optimization for MEMS Integrated Device Use* 27

ZnO thin film investigation results is presented for MEMS integrated device use. ZnO:Ga films has been formed by magnetron sputtering in argon environment without substrate heating. It is shown that specific resistance and stability of ZnO:Ga thin film depends significantly on thickness, solar radiation effect, external environment. The investigation results complex indicates that ZnO thin film instability is caused by processes of generation and healing of oxygen vacancies creating donor level in ZnO band-gap. The deposition in oxygen environment or the following annealing in similar environment is necessary for the formation of ZnO film with piezoelectric properties. The ZnO film property stability increase can be achieved by means coating protecting against external gas environment.

Keywords: ZnO, specific resistance, piezoelectricity, thin film, magnetron sputtering

Troyan P. E., Danilina T. I., Grebneva Yu. Yu., Kulinich I. A. *Formation of MIM-Cathodes with Nanopointed Lower Electrode*. 31
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Keywords: MIM cathode, nanopoints, electron-beam lithography, template, current-voltage characteristic

Amelichev V. V., Kasatkin S. I., Polomoshnov S. A., Reshetnikov I. A., Tikhonov R. D., Cheremisinov A. A., Shamanaev S. V. *Microsystem of the Control Two Component Magnetic Inductance Vector Based on Nanoscale Magnetoresistive Structures*. 33
Manufacture and research of two-coordinate sensors of a magnetic field with usage of non-isotropic magnetoresistors (AMP) with a pole barber in two variants of topology is led. It is installed that value allocation magnetoresistors on a plate influences an imbalance of output voltage of Wheatstone bridge and practically independent on sensitivity. Compact topological layout magnetoresistors reduces a disbalance of Wheatstone bridge.
Keywords: non-isotropic magnetoresistors, Wheatstone bridge, disbalance of voltage

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There carried out simulation of a sensitive pressure element with ANSYS Program under the finite-element method. There displayed a 3D-model of a sensitive pressure element, illustrating values of mechanic stress and sensitive element membrane deformation. The sensitive element is realized in a cobbled unit of the primary pressure transducer. There shown technical features of the cobbled unit.
Keywords: pressure sensor, pressure transducer, membrane type, silicon-on-ceramics structure

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Keywords: microaccelerometer, sensing element, inertial mass, resonant frequency, quality factor, air damping

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Keywords: ISFET, pH, silicon nanowire, sensitivity

Kozin I. A., Postnikov A. V., Morozov O. V. *Dynamics Study of Micromechanical Devices with Surface Metallization*. 43
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Keywords: the MEMS device, metallization, quality factor, loss of energy of the micromechanical device

Uvarov I. V., Naumov V. V., Aminov M. K., Kupriyanov A. N., Amirov I. I. *Analysis of Resonance Characteristics of Metal Micro- and Nanobeams*. 45
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Keywords: metal micro- and nanobeams, multi-layer beams, electrostatic actuation, resonant frequency

Prokofiev I. V., Tikhonov R. D. *Nano- & Microsystems to Monitor Vehicle Trajectory Parameters*. 48
The article tells about the opportunity to apply MEMS & NEMS structures to monitor vehicle trajectory parameters. There described designs of magnetic-resistive sensors, as well as magnetic sensors coupled with accelerometers.
Keywords: magnetic sensor, magnetoresistor, accelerometer, AMR

Matveenko O. S., Gnatyuk D. L., Galiev R. R. *GaAs Nano-heterostructures Integrated Antennas*. 50
There is rapid advance in research and manufacture of compact UHF devices based on active integrated antennas. These devices are basic to data transmission, navigation and communication systems and allow to make various ultra-compact sensing devices for positioning, velocity control and security alarm systems etc. In this article, 5 GHz and 10–12 GHz active antennas with integrated low noise amplifiers fabricated on PHEMT AlGaAs/InGaAs/GaAs quantum well structure are presented.
Keywords: PHEMT, quantum well, antenna, low noise amplifier

Amelichev V. V., Gavrilov R. O., Kasatkin S. I., Reznov A. A., Reshetnikov I. A., Saurov A. N. *Shaped Magnetoresistive Biosensor Microchip for Registration of Magnetic Nanobeams*. 52
The design of the shaped magnetoresistive biosensor microchip for registration of magnetic nanobeams an array of sensors, placed on a silicon chip. Organization of a sample array which allows to minimize the required number of pins of the microchip is described. Complex combined technology is developed that allows the formation of a single crystal thin membranes, the active elements semiconductor and thin-film magnetoresistive nanostructures.
Keywords: biosensor devices, biomaterial, integrated technology, magnetic nanobeams, magnetoresistive sensor, thin-film structure

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