CONTENTS

The tendencies in nanoelectronics development are considered in a long term perspective. The conclusion made is that within the period after 2015 the deep-sub-voltage nanoelectronics (DSVN), i. e. integrated circuits (ICs) of ~ 10^{11}—10^{12} cm^{-2} component density operating near the theoretical limit of energy consumption per 1 bit processing, will find wide application. The outstripping development of DSVN in Russia as a prospective national task and as an indispensable condition for a successful participation of the country in the global technological race is substantiated. The challenges of micron sized high-capacity capacitors for DSVN and technologies connected with DSVN are analyzed. It is shown that applications involving autonomous nano- and microsystems require storage devices with capacity density $\delta_C > 50$ $\mu F/cm^2$ which cannot be achieved with traditional design capacitors. Theoretical estimates and experimental data on innovation impulse micron-sized supercapacitors on the base of advanced superionic conductors (nanoionic supercapacitors) with $\delta_C > 100$ $\mu F/cm^2$ are presented. It is also shown that the lower time limit of nanoionic supercapacitors recharging would be ~ 10^{-7}s if the problem of thermal overheating of ICs with a component density of ~ 10^{12} cm^{-2} will not be solved. The potential world market of high-capacity sub-voltage storage devices is estimated.
Keywords: deep-sub-voltage nanoelectronics, nanoionic supercapacitors.

The technology of synthesis of a bamboo-like carbon nanotube is developed. The emission properties of bamboo-like carbon nanotube are experimentally studied. Electrostatic properties are theoretically investigated. It is shown, that there is an optimum step of the crosspiece for a tube at which emission properties of a tube improve that is accompanied by decrease in potential of ionization.
Keywords: bamboo-shaped nanotubes, growth of bamboo-shaped nanotubes, electrostatic and electron emission of bamboo-shaped nanotubes.

Fundamental and applied aspects of application of elementary balances method to calculation of non-stationary temperature fields of nanostructures are considered. The basic possibility of application of this method to construction of mathematical models of thermal processes in nanostructures is shown. The singularities arising at construction of such models are revealed. The main things from these singularities consist in necessity enough the exact account of structure of a disposition nanoparticles, passage to nanodimensions in thermal parameters and powers of a thermal emission, a diminution of characteristic time of course of thermal processes up to nanolevel and an essential diminution, in comparison with a macrolevel, factors thermal conductivity in an environment in relation to interior factors of thermal conductivity between nanoparticles. Algorithms and the supporting software are developed, allowing is automated to solve problems of calculation and the analysis of non-stationary temperature fields of nanostructures. The computer experiments confirming received theoretical outcomes and working capacity mathematical, algorithmic and the software are lead.
Keywords: nanostructures, temperature fields, elementary balances metod, mathematical models, thermal processes.

The SYNOPSYS Sentaurus technological computer-aided design (TCAD) platform's optical field profile, DC current-voltage diagram and small-signal frequency responses simulation procedure and results of superhigh-speed pin-type photodiode heterostructures based on compound semiconductors of $Ga_{1-x}In_xAs$, $Ga_{1-x}In_xAs_yP_{1-y}$ in the spectral range of 1,3...1,6 μm for updating and promising telecom fiber-optic and microwave radar systems photonic component base are highlighted.
Keywords: compound semiconductors, super-high speed pin-photodiode, technological computer-aided design.

Possible technology ways to produce capacitor elements of ferroelectric random access memory (FeRAM) are consider: chemical solution deposition, physical vapour deposition, chemical vapour deposition, atomic layer deposition. Technology and material prospects of FeRAM are discussed.
Keywords: active dielectrics, ferroelectrics, ferroelectrics random access memory, lead zirconate titanate, chemical solution deposition, misted source chemical solution deposition, physical vapour deposition, chemical vapour deposition, atomic layer deposition, nanostructeres.

Design and producibility problems as concerns thin-film capacitive MEMS structures, which are capable to measure electrode temperature, are submitted. Practical realization of such MEMS structures in thin-film capacitive pressure transducers is presented. Such implementation makes it possible to reduce the dependence of steady-state and transient temperatures.
Keywords: thin-film capacitive MEMS structures, temperature, vibration, lead, electrode temperature measurement.

A design of a GaAs bymorph microbeam MEMS piezoelectric actuator is proposed. The calculation of the dependence of the beam deflection on the applied bias is carried out. A piezoelectric actuator consisting of a 2 μm thick microbeam with dimensions 100 × 15 μm is fabricated. The measured by the interferometer dependence of the beam deflection on the applied bias is in good agreement with the calculated one.
Keywords: bimorph, piezoelectric actuator, microbeam.

Developing, production and tuning features of small-sized vibrating gyroscope with beam-type bimorph sensitive element made from piezoelectric ceramics have researched.
Keywords: gyroscope, piezoelectric ceramics, bimorph.

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