NANOSCIENCE AND NANOTECHNOLOGY

A general frame for modeling the electrical propagation along graphene nanoribbons, carbon nanotubes and metal nanowires

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Computer Modelling & New Technologies 2015 19(1A) 8-14

A general frame is proposed to model the propagation of electrical signals along nano-interconnects, either made by carbon nanotubes, graphene nanoribbons or metal nanowires. In the typical operating conditions of the next generations of integrated circuits, the electrodynamics of the nano-interconnects may be conveniently described by means of a semi-classical transport model, based on the modified Boltzmann transport equation. From this model we derive here a generalized non-local dispersive Ohm's law, which can be regarded as the constitutive equation for the material. From the knowledge of the conduction and valence subbands, it is possible to define an equivalent number of conducting channels, which affects the circuit parameters of such interconnects. The study of the dispersion introduced by the generalized Ohm's law gives a clear explanation to the different propagation properties of nano-interconnects made by carbon materials and conventional metals.

Keywords: Carbon Nanotubes, Graphene nanoribbons, Metal nanowires, Nano-interconnects, Transmission lines

Research into boron-carbon nanotube modified by alkaline metal atoms

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Computer Modelling & New Technologies 2015 19(1A) 15-18

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Keywords: boron-carbon nanotubes, ionic-built covalent-cyclic cluster model, quantum chemical calculations, adsorption, metal superlattice

Adsorption of polyethylene, polypropylene, polyvinyl chloride monomer units on the single-walled carbon nanotube surface

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Computer Modelling & New Technologies 2015 19(1A) 19-22

The paper presents the results of research into the interaction mechanism between single-walled carbon nanotubes and most common polymers that results in the formation of stable polymer based nanotube reinforced composites. Nanotubes used as reinforcement provide strong as well as plastic polymer based nanocomposites that have a promising field of commercial application. The main characteristics of the interaction process between the nanotube (6, 6) and monomers of the polymers under study are defined. Calculations are performed by applying DFT method and B3LYP functional.

Keywords: carbon nanotubes, polyethylene, polypropylene, polyvinyl chloride, adsorptive interactions, polymer based nanocomposites, reinforcement, density functional theory method

Superfine drug-eluting polyvinyllpyrrolidone based coating for biliary stents

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Computer Modelling & New Technologies 2015 19(1A) 23-28

Conduct the analysis of available type B residual current device in the market, compare their functions and technical characteristics, research their operation principle and feature, then purpose the corresponding solution. Finally, develop a prototype and conduct the test. There are three samples. They are ABB RC223 residual current release, which can be combined with the Tmax T4 four-pole circuit-breaker in the fixed or plug-in version, Socomec earth leakage relay RESYS B 475 and Bender residual current monitor RCMA470LY

Keywords: residual current device (RCD), ABB RC223, circuit-breaker

Theory of near-field detection of core-gold nanoshells inside biosystems

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Computer Modelling & New Technologies 2014 19(1A) 29-34

Metal nanoshells composed by a dielectric core with a thin gold layer are stimulating growing interests due to the unique optical, electric and magnetic properties exhibited by the local field enhancement near the metal – dielectric core interface due to strong local plasmon resonance and the high tunability of such resonance as a function of shape and core-material. These

unique characteristics have found promising applications in a wide range of areas, such as biosensing, optical communication and medicine. In this paper, we developed a theoretical and numerical simulation based on a near-field approach to study the possibility to identify nanoshells inside mouse cells. Taking advantage from the characteristic near-infrared transparency window of many biological systems, i.e. the low light absorption coefficient of biological systems between 750-1100nm, we show the possibility to identify and detect 100-150nm diameter gold nanoshells inside the animal cells.

Keywords: Gold nanoshells, Mie theory, SNOM, animal cells, Near-infrared

Nanocarbon electromagnetics in CNT-, GNR- and aerogel-based nanodevices: models and simulations

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Electromagnetic properties of nanocarbon systems are essential for the creation of various nanoelectronic devices. Our major attention is focused on CNTs, graphene nanostructures (e.g., GNR and GNF), graphene-based aerogels (GBA) and CNT-based aerogels (CNTBA) as the basis for high-speed nanoelectronics and prospective nanosensors. Special attention is paid to fundamental properties of CNTs, GNRs and various CNT-Me, GNR-Me, CNT-graphene interconnects. Nanosystems of 3D GBA and CNTBA are regarded as complicated systems made up of basic nanocarbon interconnected elements. Technological interest to contacts of CNTs or GNRs with other conducting elements in nanocircuits, FET-type nanodevices, GBA and CNTBA is the reason to estimate various interconnect resistances, which depend on chirality effects in the interconnects. Simulations of electromagnetic properties in interconnects have been performed to evaluate integral resistances, capacitances and impedances of various topologies (1D, 2D and 3D) in nanodevices, including their frequency properties (GHz&THz).

Keywords: CNTs - carbon nanotubes, GNR – graphene nanoribbons, CBA – Carbon Based Aerogels, Carbon Nanoporous Materials, Carbon-based nanocomposites