Poster session I

Rabi chain based terahertz nanoantennas

G. Slepyan [1], Y. Yerchak [1], S. A. Maksimenko[1], A. Hoffmann [2], F. G. Bass[3]
[1]Institute for Nuclear Problems, Belarus;
[2]Institut fur Festkorperphysik, Technische Universitat Berlin, Germany;
[3]Department of Physics, Bar-Ilan University, Israel

The new type of terahertz nanoantennas is proposed. It is based on the Rabi-waves predicted in the earlier work of the authors [G.Ya.Slepyan et all, Phys.Rev.B81, 085115, (2010)] and corresponds to the wave of quantum transitions propagating in the assembly of coupled quantum dots (QDs) excited by the light wave traveling along the antenna. The terahertz component of emission is stimulated by the tunnel current induced on the Rabi frequency by the motion of quantum transitions over the QD-system. Three concrete examples of nanoantennas have been considered: single wire, single ring, 2D-array. The ordinary antenna characteristics (radiation patterns, etc.) are calculated. As a result, it was shown that emitting characteristics of such antennas are electrically tunable via the varying of intensity and phase velocity of the light wave. The antennas have been considered are promising for a lot of practical applications in nanoelectronics and nanophotonics due to the ability of electrical antenna scanning.

NOTES

Quantum Chemical Simulation of The Structure of The Endohedral Backminsterfullerene Derivatives

E. Dikusar[1], V. Potkin[1], V. Zelenkovskii[1], A. Pushkarchuk[1,2], A. Khrutchinsky[2], S. Kuten[2], S. Kilin[3]
[1]Iinstitute of Physical Organic Chemistry NASB, Belarus;
[2] Institute for Nuclear Problems, BSU, Belarus;
[3]B.I. Stepanov Institute of Physics NASB, Belarus

Metallofullerene cluster can be presented as a super-atom that possess an electropositive metal nucleus and an electronegative fullerene case. These clusters have a good perspective for application as molecular conductors, magnetics and ferroelectrics. The most important areas of the cluster practical application are NMR tomography and radio-medicine, particularly, a novel kind of the beam therapy and medical nano-robot creation. This binary technology was designed for a selective attack to a tumor. It uses agents that are tropic to the tumor containing specific nuclides (10B, 113Cd, 157Gd etc.). The nuclide ingests neutrons and emits secondary radiation resulting in the tumor cells death. Fullerene based nanocluster derivatives and their analogs can be used for the selective shipping of the nuclides of interest to tissues and organs affected.
Neutron capture therapy action targets a tumor by selective reagent concentrating as opposed to neutron or proton therapy where beam targets organs affected, which can be resulted in radiation sickness. Neutron capture technology excludes this damage because of neutron radiation dose does not exceed the normal tissue tolerance, but is enough to kill the tumor. Realization of this technology needs a seek of 10B-rich boron-containing or 157Gd-rich gadolinium-containing agents that have to concentrate in tumors with contents of more than 20 mkg/g tumor for 10B and 5.5 mkg/g tumor for 157Gd. 157Gd has the largest capture section of thermal neutrons (44000 barn) including 113Cd (25000 barn) and 10B (750 barn). One of the perspective way for selective shipping of boron-, cadmium-, gadolinium- and other element-organic compounds as well as 6Li2H to affected tissues and organs can be the use of carborane, backminsterfullerene, carbon nanotube and their analogue based nanocluster derivatives.

NOTES