J Material Sci Eng 2015, 4:3
http://dx.doi.org/10.4172/2169-0022.C1.032

Two optical bistability domains in composites of metal nanoparticles with nonlinear dielectric core

Sisay Shewamare and V N Mal'nev
Addis Ababa University, Ethiopia

It is shown that the local field in metal spherical particles with a dielectric core in an external varying electric field has two maxima at two different frequencies. The second maximum becomes more important with an increment in the metal fraction. Due to the nonlinear dielectric function of the core, the composite of these inclusions may have two optically induced bistability domains at different frequencies. At rather high metal fraction, two bistability domains merge and form one entire bistability domain. The parameters of these domains are studied numerically. The paper focuses on the second bistability domain, which has not been discussed in the literature so far. This domain exists in a comparatively narrow frequency range and its onset fields are lower than those of the first bistability domain. The lowest bistability onset fields are obtained in the entire domain. This peculiarity of the optical induced bistability in the metal composite with small dielectric cores can be attractive for possible applications.

sisayshewa20@yahoo.com

Novel 3D meso-structures with quantum architecture produced by self-arrangement of nanowires (Mesoscopic physics)

G V Strukov and G K Strukova
Russian Academy of Sciences, Russia

The architecture of novel 3D- mesoscopic structures obtained via self-organization of growing metallic nanowires has been investigated. Seashell-, fungus- or lotus leaf-shaped structures are reproducibly formed by means of programmable pulse current electrodeposition on porous membranes. Nanostructured mesostructures of various metals (Ag, Cu,Pd, Rh, Ni), alloys (PdNi, PbIn), and topological insulator Bi_2Se_3 were obtained. The sample size was reached several mm. SEM investigation has revealed that the frame of the metallic "seashell" presents a hierarchical system with elements of fractal self-similarity at the nano- and micro-levels. The frame is a volumetric multilayer net composed of conical bundles of nanowires as building blocks. TEM study showed that the Pd-Ni nanowires have periodic bulges ("beads"), a V-shaped branching, and a unique structure kind of a "Finemet", i.e., the amorphous matrix with nanocrystallites dispersed therein. In perspective, the proposed technique can be used as a 3D printer for the purposeful synthesis of new materials for medicine (sensors), catalysis, nanodevices based on mesostructures with the complex quantum nanoarchitecture.

Biography

G V Strukov completed his PhD at the age of 33 years from The Institute of Chemical Physics Academy of Sciences, Chernogolovka, Moscow region. He is the Senior Researcher Scientist at the Institute of Solid State Physics of Academy of Sciences of Russia. He has published more than 60 papers in reputed journals.

strukgalina@gmail.com