conferenceseries.com

J Nanomed Nanotechnol 2016, 7:4 (Suppl)
http://dx.doi.org/10.4172/2157-7439.C1.041

9th Nano Congress for Next Generation

August 01-02, 2016 Manchester, UK

Semiconductor quantum cones: Unique source of photons and electrons

Arturs Medvids
Riga Technical University, Latvia

Nanostructures are one of the most investigated objects in semiconductor physics, especially due to quantum confinement effect in quantum dots (0D), quantum wires (1D) and quantum wells (2D). A new laser technology elaborated for quantum cone formation in semiconductors is reported. A cone possesses the following unique properties: A small cone with angle $\alpha=60^o$ at the top of the cone is a quantum dot – 0D, when α=0o is transformed to a quantum well – 2D and when a long one with $\alpha<60^o$ is transformed to a quantum wire – 1D with the gradually decreasing diameter from the base till the top of the cone. Luminesce of such a quantum cone resembles rainbow. Where radii in cone are equal or less than Bohr' radius of electron, exciton or phonon Quantum Confinement Effect (QCE) takes place. Quantum cones on the surface of elementary semiconductors Si and Ge single crystals, and Si1-xGex (x=0.3 and x=0.4) solid solution were formed by fundamental frequency and second harmonic of Nd:YAG laser radiation. Strong change of the optical, mechanical and electrical properties of the semiconductors after irradiation by Nd:YAG laser are explained by the presence of QCE in quantum cones. "Blue shift" of photoluminescence spectra and "red shift" of phonon LO line in Raman spectrum are explained by exciton and phonon QCE in quantum cones, correspondently. Asymmetry of the photoluminescence band in the spectrum of Si quantum cones is explained by formation of graded band gap structure. Experimental data on quantum cones formation on a surface of Si, Ge crystals and their solid solution and their optical and electric properties are presented. Two-stage model of quantum cones' formation on the irradiated surface of the semiconductors is proposed. The first stage of the cones formation is characterized by the formation of a thin strained top layer, due to the redistribution of point defects in temperature-gradient field induced by strongly absorbed by laser radiation. As a result, p-n junction and hetero junction are formed in Ge crystal and SiGe solid solution, correspondently. The second stage is characterized by mechanical plastic deformation of the stained top layer leading to arising of quantum cones due to laser heating up of the top layer. Si quantum cone possesses the lowest work function of electron field emission due to graded band gap structure.

medvids@latnet.lv

Self-construction from 2D to 3D: One-pot layer-by-layer (LbL) assembly of Graphene Oxide (GO) sheets held together by coordination polymers

[2]**Mohamed B Zakaria** and [1]**Yusuke Yamauchi**
[1]Faculty of Science and Engineering, Waseda University, 3-4-1 Okubo, Shinjuku, Tokyo, 169-8555, World Premier International (WPI) Research Center for Materials Nanoarchitechtonics (MANA), 2National Institute for Materials Science (NIMS), 1-1 Namiki, Tsukuba, Ibaraki 305-0044, Japan.

For further development of functional materials, a smart construction of functional 2D materials to well-defined 3D constructions is crucial. The best strategy in this line is a layer-by-layer (LbL) assembly that can provide well-designed alternate layered structures in nanoscale precision from a variety of functional components. Here, we demonstrate a novel synthetic strategy which entails deposition of Ni-based cyanide bridged coordination polymer (NiCNNi) flakes on the surface of Graphene Oxide (GO) sheets, and allows precise control of the resulting lamellar nano-architecture by *in-situ* crystallization. GO sheets are utilized as nucleation sites promoting the optimized crystal growth of NiCNNi flakes. The NiCNNi-coated GO sheets then self-assembled and are stabilized as ordered lamellar nanomaterials. This approach might be applied to many other inorganic-organic hybrids for ordered layer-by-layer (LbL) architectures. Regulated thermal treatment under nitrogen yields Ni_3C-GO composite with a similar morphology to the starting material. The Ni_3C-GO composite exhibits outstanding electro catalytic activity with strong durability for the oxygen reduction reaction.

MOHAMED.Barakat@nims.go.jp