Nanocomposites and nanomaterials

Metal-semiconductor nanocomposites based on porous InP

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Porous materials and porous semiconductors in particular show much promise for different applications such as photonics, optoelectronics, sensorics etc. due to possibility simply tuning their properties and large surface-to-volume ratio. In contrast to porous silicon and the composites based on por-Si which are well investigated, the porous III-V semiconductors are poorly studied [1,2]. In this work we propose a facile and cheap method for the fabrication of a new class of nanocomposite materials, viz., ordered porous III-V semiconductor layers with metal nanoparticles incorporated into the pores.

In a first step porous InP with different thickness have been prepared from n-type (100) single crystals by anodization in 5% HCl electrolyte in the galvanostatic regime. Metal was incorporated in porous layer in electrochemical cell by two different techniques: from the solution of the Au salt and using spherical Au nanoparticles with SiO_2 shell. SEM investigations show that we can fabricate both ordered and disordered porous layers of essentially different morphology, with layer parameters varied in a very wide range: porosity was from 10% to 70%, diameter of pores was in the range 50 - 200 nm and porous layer thickness was 5 - 90 μm. The InP porous layers appear as a system of cylindrical cavities or embedded tetrahedrons demonstrating a horizontal-plane correlation between neigbouring pores. Surface of the sample is “decorated” with metal particles, whereas the cleavage image exhibits that the metal nanoparticles also fill pores.

1. *Dmitruk N., Barlas T., Serdyuk V.* A^3B^5 Porous Semiconductors: Electrochemical Technology, Structure and Optical Properties // Physics and Chemistry of Solid State.-2010.-**11**.-P. 13-33.
2. *Barlas T.R., Dmitruk N.L., Serdyuk V.A.* Characterization of porous polar semiconductors by their optical spectra in the region of phonon and plasmon-phonon excitations // Opt. Spectrosc.-2012.-**112**.-P. 233-242.