

Investigation of properties of carbon nanotube-cadmium sulfide nanoparticle hybrids

Algaer Yu.A.^{1,2*}, Okotrub A.V.¹

¹*Institute of Inorganic Chemistry, 630090, Novosibirsk, Russia*

²*Novosibirsk State University, 630090, Novosibirsk, Russia*

**e-mail: yalgaer@gmail.com*

At present the development of hybrid nanosystems combining the properties of one-dimensional carbon nanotubes (CNTs) and quantum dots from semiconducting materials attracts considerable interest. Interaction of semiconducting nanoparticles with light is expected to have result in the electron photocurrent through CNT and localization of the hole on nanoparticle. This effect can be used for creating a new type of photovoltaic devices. Here, we present a preparation and investigation of hybrid materials from CNT and CdS nanoparticles.

CdS nanoparticles have been grown on the surface of aligned multi-walled CNTs from an aqueous solution of CdCl₂, (NH₂)₂CS (Thio), and NH₃. Scanning electron microscopy has showed that size of the nanoparticles varied from 5 to 100 nm. The synthesis conditions has preserved an alignment of CNTs in the array and uniformly decorated the CNTs with CdS nanoparticles. Continuous CdS/CNT interface indicated that nucleation and growth of the nanoparticles has taken place directly on the nanotube surface. XPS evidenced that the formed CdS particles have had the oxidized outer layer that is probably related to the reactions occurring in basic solution in the process of the nanoparticle growth.

Electroluminescence properties of CdS nanoparticles deposited at the CNT tips have been measured in the conditions of field electron emission from the CNT array. ITO glass has been used as an anode and image has been taken with a photcamera. Images exhibited a set of luminous points corresponding to individual CdS nanoparticles, which have been deposited on the CNT tips. The points have been of green and red colour and different colouring could be related to the different size of the nanoparticles.