Nanocomposites and nanomaterials

Optical and electrochemical properties of CdTe and CdHgTe nanocrystals in aqueous solution.

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CdHgTe semiconductor nanocrystals (NCs) with the emission in the near-infrared regions have attracted interest due to their potential applications in the field of biological tissue imaging, solar cells, active materials for telecommunication etc. The most common method to prepare such materials is doping of CdTe NCs. Therefore, an understanding how dopants modify the band gaps structure of CdTe NCs is highly desirable.

The series of thioglycolic acid-stabilized CdHgTe NCs were prepared in aqueous solution using CdTe NCs precursors [1] and their band gaps structure were investigated by the combination of spectrometry and cyclic voltammetry (CV) measurements.

The Hg^{2+} ions substitute Cd^{2+} ions at the surface of the NCs forming a CdHgTe alloy in the near-surface region [2]. Upon the addition of Hg^{2+} ions into CdTe NCs surface we observed bathochromic shift of the PL peaks to the near-infrared regions of the spectrum 700-1000 nm (Fig.1***a***). The absorption peaks also shift to the longer wavelengths and becoming less pronounced (Fig .1***b***). Moreover, a Stokes shift of more than 200 nm was observed.

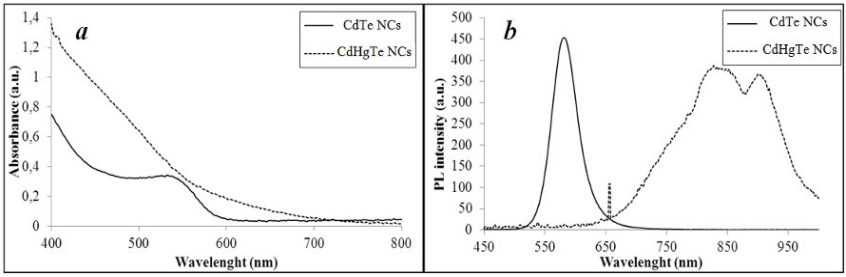

Fig. 1. Absorption (***a***) and PL (***b***) spectra of thioglycolic acid-stabilized CdTe and CdHgTe NCs.

A CV method was developed to determine band structure of the CdHgTe NCs. It was found that for the Hg^{2+}-doped CdTe NCs the oxidation peak shifts to the

negative direction due to a shift the top of the valence band edge towards lower energies. However, in this case, the effect is caused by the formation of extra energy level above the top of the CdTe QDs valence band level.

1. *Rogach A. L., Harrison M. T., Kershaw S. V., Kornowski A., Burt M. G., Eychmüller A., Weller H.* Colloidally Prepared CdHgTe and HgTe Quantum Dots with Strong Near-Infrared Luminescence // Phys. Stat. Sol.-2001. **(b)224**.P. 153-158.

2. *Harrison, M. T., Kershaw, S. V., Burt, M. G., Rogach, A. L., Kornowski, A., Eychmüller, A., Weller H.* Colloidal nanocrystals for telecommunications. Complete coverage of the low-loss fiber windows by mercury telluride quantum dot // Pure Appl. Chem.-2000.-**72(1-2)**.P. 295-307.