Mechanisms of excitonic emission in ultrathin CdSe layers embedded in ZnSe.

Łukasz Owczarczyk, Vitalii Yu. Ivanov, Joerg Debus, Matthias Salewski, Maciej Wiatr, Grzegorz Karczewski and Marek Godlewski

1Institute of Physics Polish Acad. Sci., 02-668 Warsaw, Al. Lotników 32/46, Poland
2Experimentelle Physik 2, TU Dortmund, 44221 Dortmund, Germany
3Dept. Mathematics and Natural Sciences College of Science, Cardinal S. Wyszyński University, Warsaw, Poland

Ultrathin layers of CdSe grown by ALE-MBE technique on the 1,5 μm thick (001) ZnSe MBE grown layer on the GaAs substrate, and covered by 400 nm ZnSe cap layer. Stresses relaxation of this system lead to creation of the systems of CdSe nano-islands with average thickness about 2,6 nm extended up to 30 nm in the interface plane. This nanostructures show a number unique properties, first of all - high quantum efficiency (QE) of excitonic emission in the blue- green spectral region even at room temperature.

In current communication we present results of studies of CdSe/ZnSe nanostructures using PL, PLE (Fig.1), time-resolved PL, spin-flip Raman (SFR), and ODMR spectroscopy methods. In temperature dependence of integral PL intensity (shown in the insert of Fig.1) a strong enhancement in the range of 160-200 K has been observed. This dependence could be explained by Fano-resonances between continuum of electron states in CdSe nano-islands and discreet exciton states of quasi-bulk ZnSe layer. This is evident also by peculiarities of PLE spectra. Mechanisms of energy transfer will be discussed based on the results of time-resolved PL, SFR and ODMR measurements.

![Figure 1](image_url)

Fig.1. PL and PLE spectra of 3ML CdSe/ZnSe sample at T=10K. Temperature dependence of integral PL (in the insert) was measured at excitation energy 2.75 eV.

This work was supported in the part by Polish National Science Center “Harmonia” Grant and EAgLE EU Project FP7-REGPOT-2012-2013-1 (Project Number: 316014)