Nanooptics and photonics

Aditional stabilization and luminescence of magic CdSe nanoclusters

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The work is dedicated to the synthesis of ultra-stable (so-called "magic") semiconductor CdSe nanoparticles $(CdSe)_{33}$, $(CdSe)_{34}$, study of peculiarities of their of absorption and luminescence spectra. Also we study different ways to increase luminescence and accordingly quantum yield. They have several advantages over quantum dots such as ultra-small sizes and therefore easier to introduce into cells. Particularly, the study of electronic processes in these nanoparticles facilitates their further use as biological labels.

For preparation such chemicals were used: cadmium sulfate ($3CdSO_4*8H_2O$), dodecylamine $CH_3(CH_2)_{11}NH_2$ - 95%), selenium (Se) powder, sodium sulfite (Na_2SO_3), and solvents methyl, toluene, distilled water. Chemical reaction occurs at ambient pressure and atmosphere. By adding toluene to the solution with Cd and Se precursors, the micelles move up in the toluene where they transform into reverse micelles. Inside of its limited volume the creation of size-selected CdSe nanoparticles takes place. Within a few minutes toluene turns to stable homogeneous bright yellow containing surfactant covere nanoparticles of CdSe, whereas the water remain colourless. So, we have two-phase solution : water and toluene. Using this method it is possible to prepare macroscopic quantities of nanoclusters. Prepared particles had good luminescent and very strong absorption peak therefore the total reaction yield is high. Futher addition of chemical reagents (for example, triphenylphosphine) to the prepared solution could provide better passivation of nanoparticles that will enhance their quantum yield.

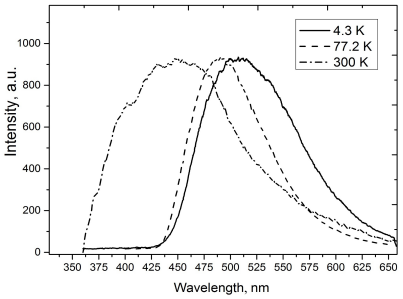

Figure 1. Spectra of photoluminescence of CdSe nanoparticles

Low temperature luminescence of magic CdSe nanoparticles has been studied for the first time. It's helps to avoid photo-etching of nanoparticles under laser irradiation. For semiconductor nanoparticles typically luminescence spectra consist of two bands, but our luminescence spectra has only one broad band which go from excitation wavelength to near infrared. The shape of luminescence

spectrum and possibilities of increase of quantum yield of luminescence are under discussion.