

INFLUENCE OF HUMIDITY ON THE LUMINESCENCE PROPERTIES OF CdS NANOCRYSTALLS

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Features of semiconducting crystals which distributed in a polymeric matrix, are caused both their individual properties, and their interaction with a matrix. As nanocrystals are characterized by the large surface-volume ratios state of surface nanocrystals and demarcation nanocrystals - matrix essentially check their nanocrystals electronic and optical properties [1,2]. Nanocrystals which luminescence depends on state of a surface can be used as luminescent probes for visualization of the surface interactions.

In this work the results of investigation luminescence properties of CdS nanocrystals, grown by the method of chemical reaction of $\text{Cd}(\text{NO}_3)_2$ and Na_2S water solutions in gelatin are represented.

As since the water is attending in synthesis process of nanocrystals and besides of it could be absorbed from the ambient air, then there is the interest to investigate the influence of adsorption molecules on its luminescence. The emission spectra of fresh grown sample has two broad bands $\lambda_{max} = 520 - 540$ nm and $\lambda_{max} = 690 - 720$ nm. It is characterized, that the relation of intensities emission significantly on composition reactive components. It was obtained, that with the increasing of concentration of Na_2S relative of concentration $\text{Cd}(\text{NO}_3)_2$ the long - wave band $\lambda_{max} = 720$ nm is dominated. It was observed that the band $\lambda_{max} = 720$ nm is the most sensitive to surface influences. In order to clarification the influence of water molecules on the nanocrystals luminescence the samples of CdS were placed in humid atmosphere with the relative air humidity 90%. It was founded out that after in the humid air the intensity of long - wave band increased more than in one order.

After that it was carried out the treatment of samples as well as in air and in vacuum under the pressure 10^{-4} Torr. The experiment was shown that the thermal treatment on the air under $T = 370$ K is not influenced essentially neither on intensity nor band contour.

It was observed, that during passing through colloidal CdS nanocrystals of dry air, the intensity of luminescence is not changed. But, if passing humid air, than effect, which ascribed above, will be observed. We noticed too, that the intensity of luminescence increased if the samples were stored under atmospheric conditions in dark. It is evidence that probably photoactivation processes not influenced on luminescence efficiency of our samples.

On the basis of the above results, we included that water molecules adsorbed to the surface of quantum dots and passivate surface traps, which were the centers of non radiating recombination. The fact that for water desorption is necessary the high treatment in vacuum is evidencing about chemisorption OH^- groups on the CdS nanocrystals surface.

Reference:

1. Alexander Eychmuller *J. Phys.* (2000) pp. 6514-6528.
2. Vorontsova, M.; Skobeeva, V.; Smyntyna V. *Journal of Physical Studies.* 8, (2004), pp. 1-4.