Magneto - Optical Properties of CdMnTe Nanoparticles Dispersed in the Polymer Matrix

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Semiconductor nanoparticles doped with magnetic ions represent an new class of materials - diluted magnetic semiconductors (DMS) [1]. Their unique optical, electronic, and magnetic properties have a potential applications in the field of spintronics and nanomagnetics [2,3]. The defining feature of a DMS is the spin-exchange interaction, which arises between delocalized charge carriers and localized spins on magnetic impurity ions embedded within the semiconductor. These s, p - d exchange interactions are responsible for the giant Zeeman splittings of the bands and excitons states and give rise to the so-called giant Faraday rotation effect [1]. Among these nanomaterials the most experimentally studied are Mn-doped II-VI based DMSs type of CdSe:Mn or ternary solid solutions type of $Cd_{1-x}Mn_xSe$.

In this work, we present results of investigation of magneto-optical properties of Mn-doped semiconductor CdTe nanoparticles prepared by different physical methods. Among physical techniques we have chosen ball milling or mechanical synthesis and pulsed laser ablation in liquids using combined targets. All the samples were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), optical absorption, magnetophotoluminescence, and Faraday rotation spectroscopy.

In magnetic field up to 7 T shift of the photoluminescence structure towards long wavelength was observed due to the strong spin-exchange interaction between band carriers and magnetic ions. The linear magnetic field dependence of the Zeeman shifts and Faraday rotation for nanoparticles with low mangan content suggest of increase of the role pairs and antiferromagnetic interaction between Mn^{2+} ions.

1. Furdyna J. K. and Kossut J. Diluted Magnetic Semiconductors // Academic Press, New York – 1988 – **25**.
2. Hedin E.R., Joe Y.S. Spintronics in Nanoscale Devices // Pan Stanford Publishing: Singapore, 2013.
3. Awschalom D.D., Bassett L.C., Dzurak A.S., Hu E.L., Petta J.R. Quantum Spintronics: Engineering and Manipulating Atom-like Spins in Semiconductors // Science. – 2013. – 339. – p. 1174-1179.