Paramagnetic quantum dots InP@ZnS, doped with manganese ions

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Colloidal quantum dots doped with paramagnetic ions (PQD) represent a new class of functional materials for spin photonics. Photoinduced arrangement of dopant ion spins is possible in such systems. This unusual effect is caused by strong exchange interaction of an electron and a hole, due to their localization in a space smaller than the size of the exciton. As a result the spins of the electron (1/2) and hole (3/2) are directed in the same direction in the ground state of the exciton in the PQD. Thus, the exciton created by photon absorption has a magnetic moment equal to 2 and causes the magnetization of the PQD.

In our work we studied the spectral and luminescent properties of the PQD including the excitation-luminescence matrices, the luminescence decay kinetics and transient absorption spectra. A new long-wavelength band attributed to the Mn ion emission is a characteristic feature of the luminescence spectra of PQDs (Fig. 1A). The average lifetime of the Mn^{2+} ion emission (272 ns) is much longer than that of the intrinsic emission of InP nuclei (59 ns) (Fig.1B).

The experimental data confirm incorporation of Mn^{2+} into the InP crystal lattice, which is promising for development of photocontrolled magnetic devices.

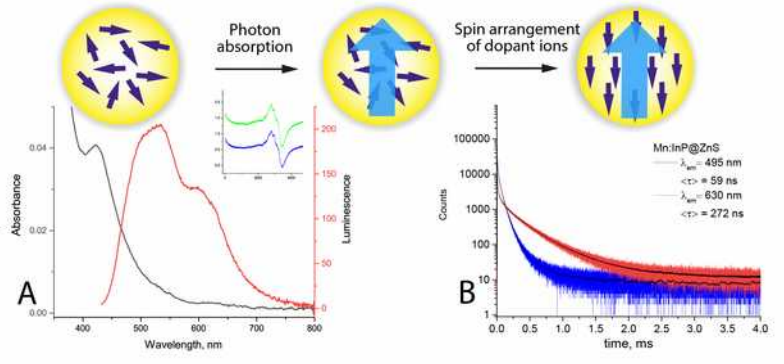

Fig. 1. A) Absorbance (1) and luminescence (2) spectra of Mn:InP@ZnS PQDs (In:Mn= 1,25:1) in *n*-hexane. EPR spectra are in the inset. B) Luminescence decay curves of Mn:InP@ZnS PQDs in *n*-hexane probed at 495 and 630 nm.

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