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Magnetoluminescence Studies of Mn-doped PbS Quantum Dots[1]

BIPLOB BARMAN, YUTSUNG TSAI, GEN LONG, SAVAS DELIKANLI, ATHOS PETROU, HAO ZENG, SUNY at Buffalo, Buffalo, NY — Diluted magnetic semiconductor quantum dots are interesting model systems for the investigation of carrier dopant exchange interactions. In this work, we report the carrier spin polarization studies in narrow band gap Mn-doped PbS quantum dots, a much less studied system compared to their II-VI counterparts. The PbMnS quantum dots were synthesized by hot colloidal solution technique. They are single crystalline with cubic structure. The doping concentration is 3-4% as measured by energy dispersive X-ray spectroscopy. The system is paramagnetic down to 2 K, as measured by VSM. We have recorded the PL spectra in the Faraday geometry for magnetic fields of up to 7 tesla in the 0-50 K temperature range. The PL was excited at 780 nm and the emission is centered at 940 meV with a FWHM of 100 meV. In the presence of a magnetic field the emission becomes strongly $\sigma+$ polarized (P = 35% at 4 tesla), suggesting carrier spin polarization. The polarization is temperature sensitive and decreasing sharply with increasing temperature. The polarization vanishes at around T = 40 K. The degree of spin polarization can be tuned by quantum confinement.

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