Photoluminescence in EuS-PbS-EuS semiconductor structures with double ferromagnetic barrier

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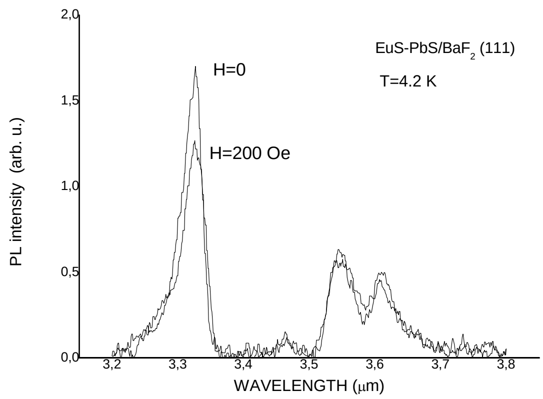
In EuS-PbS semiconductor multilayers ferromagnetic layers of EuS form electron barriers whereas nonmagnetic layers of PbS (energy gap 0.3 eV) constitute quantum wells for both electrons and holes. In photoluminescence (PL) measurements the optical transitions are in these structures observed in the infrared. They originate from the fundamental electronic transitions in nonmagnetic PbS quantum wells. In this work we examine experimentally the new spin optoelectronic idea of controlling the wavelength of the PL emission in semiconductor magnetic structures by changing the height of the ferromagnetic barriers applying low magnetic fields. We report the temperature and magnetic field dependence of the PL of 5x[EuS(5.5nm)-PbS(17.5nm)] multilayer grown by high vacuum deposition on BaF_2 substrate. The PL was excited by YAG laser with the radiation energy 1.16 and 2.33 eV and the measurements were carried out at T = 4.2 and 77 K (*i.e.* below and above the Curie temperature of EuS equal 16 K). Both the backscattering and edge emission optical experimental geometries were employed. The EuS-PbS multilayers show the characteristic PL spectra (an example is presented in the Figure) with strongly nonlinear response upon increasing the laser excitation power indicating the importance of the transfer of photoexcited electrons between ferromagnetic and nonmagnetic layers. As the optical quality necessary for such an experiment was so far achieved only for relatively broad PbS wells (above 15 nm) we expected (and apparently observed experimentally) only small red shift of about 1 meV for the high energy line of the spectrum.



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