Influence of Strain on Magnetic Ion Relaxation Studied by ODMR

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The relaxation of single manganese ion in CdTe quantum dot which is strongly confined and strained system is much faster than relaxation in highly diluted limit of unstrained (Cd,Mn)Te bulk crystal [1,2]. This observation opens the question of the role of strain in spin relaxation of magnetic ions. The systematic studies for quantum well system of well-defined strain should cast more light on that problem.

Here we report time resolved Optically Detected Magnetic Resonance (ODMR) studies of single (Cd,Mn)Te/(Cd,Mg)Te quantum wells. The Mn content equal about 0.3% was chosen to assure sufficient Zeeman effect and negligible direct ion-ion interactions. The strain in QW was defined by content of Mg in buffer layer, in the range from 0 to 30%. Samples were mounted on holder with antenna to provide microwave radiation in a wide range of frequencies from 10 to 25 GHz We performed measurements at pumped liquid helium temperature in a cryostat placed inside a superconductive magnet with magnetic field up to 3T. For magnetic fields and microwave frequencies corresponding to paramagnetic resonance the heating of the magnetic ions system was observed by decrease of the giant Zeeman shift of photoluminescence lines related both to neutral and charged exciton recombination. Dynamics of magnetic ions disorientation induced by pulse of microwave excitation was measured by probing photoluminescence excited by short laser pulses with variable delay. The measurements were performed for series of samples of different Mg content in buffer layer which result in different strain in QW. Strain was checked by analysis of the heavy-light hole splitting of the excitonic transitions observed either in reflectivity or PLE spectra.

We discuss strain dependence of magnetization dynamics in QW system, which is intermediate between less strained bulk and more strained quantum dots. We find that the relaxation is significantly shortened in the presence of the strain in the structure.

[1] Goryca, M., et al., *Physical Review B* **92.4** (2015): 045412.
[2] Strutz, T., A. M. Witowski, and P. Wyder, *Physical Review Letters* **68.26** (1992): 3912.