Magnetic control of light-matter coupling for a single InAs quantum dot embedded in a microcavity

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We report the design, fabrication and optical investigation of the magnetically tunable single quantum dot – micropillar cavity system. Unlike other studies where cavity-quantum dot spectral resonance was achieved by temperature tuning, we demonstrate that Zeeman effect of excitons confined in a single quantum dot is an efficient method to tune the quantum dot-cavity coupling simply by varying the magnetic field. The tuning range of single quantum dot exciton transitions can be as large as ~0.7 meV, which is much larger than the cavity mode linewidth (~0.3 meV). This enables us to tune the quantum dot emission into resonance with the fundamental cavity mode easily. An enhancement of the quantum dot emission due to the Purcell effect was also observed. Our results provide an alternative for realizing cavity-quantum dot based single photon devices.