Strong Zeeman Effect Observed in Monolayer Regimes

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Mn-doped 2D quantum structures are potential diluted magnetic semiconductors (DMS) for spintronic applications, showing strong coupling of spin states with electronic states. 2D CdSe(ethylenediamine)$_{0.5}$ containing Mn^{2+} of various concentrations (0.5-7.7%) were successively introduced to explore optical, magnetic and spin interactive properties within single atomic layers. Giant exciton dynamics are revealed by multiple internal transitions (e.g. $^4T_1 \rightarrow {}^6A_1$) phosphorescence between 580-660 nm. The time-resolved luminescence decay at 593 nm are 240 μs via exponential decay fitting. Strong *sp-d* exchange interaction of nearly isolated Mn^{2+} in 2D regimes suggests giant Zeeman effect in magnetic circular dichroism (MCD). Additionally, three anisotropic *g*-values are characterized in orientation-dependent electron paramagnetic resonance (EPR) experiments. Magnetic properties ($C=2.62\times10^{-3}$ emu·K/G, $\mu= 1.32\ \mu B$) from superconducting quantum interference devices (SQUID) suggest effective chemical doping of magnetic ions and possibilities of spintronic applications for 2D semiconductors.

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