Exciton redistribution in 2D WSe_2 via external strain field for positioned quantum emitters with stable magnetic response.

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Monolayer Transition-Metal Dichalcogenides (ML-TMDs) are two-dimensional semiconductors materials exhibiting unique optical and electronic properties. In addition to their easiness in fabrication, ML-TMDs can withstand up to 20% strain without breaking, being then feasible to exploit deformations to control their transport and optical properties. Furthermore, localized excitons in ML-TMDs provide single photons with high brightness[1]. Since both impurities and spatial strain gradients induce quantum emitters (QEs) in ML-TMDs[2], dynamic control over the strain field enables to engineer the QEs properties and exploit their full potential for quantum technologies. Our piezoelectric device bursts into this context. It is a gold-covered piezoelectric material with a micro-pillars array covered by dry-transferred ML-WSe2. The QEs nucleation sites are arranged around the pillars, providing control of their position over a few microns[3]. Furthermore, deforming the piezoelectric substrate we can explore the QEs response to external strain fields. We demonstrated that the QEs energy can be precisely tuned across a spectral range as large as tens of meV without changing the multi-photon emission probability[3]. We also observed that the external strain field reversibly modifies the QEs brightness, providing theoretical simulations based on an exciton diffusion model. We found good agreement between the theory and the experimental results, confirming that strain is a valuable tool even for brightening one specific emitter rather than another[4]. We also investigated the QEs response in magnetic field. Measuring the g-factor of several single-photon lines as a function of the applied external stress, we found that despite changes in energy up to 10 meV, the variations in the g-factor always remain between the experimental errors[5]. This result ensures the robustness of the QEs spin degree of freedom, opening future possibilities in hybrid spintronic devices or photonic interfaces.

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