Angular Emission Properties of Transition Metal Dichalcogenides under Uniaxial Strain

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Abstract

Transition Metal Dichalcogenides (TMDs) exhibit unique optical and electronic properties, making them promising candidates for flexible technologies, as their properties can be tuned by applying strain. This study investigates the effects of uniaxial strain on light emission in 2-dimensional TMDs. Specifically, we examine changes in the angular and spectral photoluminescence (PL) of monolayers under 3-point bending. While similar studies have been conducted in the past [1,2], our research differs by combining angular (k-space) measurements for each strain level. Our results show that while increasing strain leads to a redshift in the exciton and trion energies as reported previously [2], the amplitude of the PL does not decrease as expected but behaves quite erratically. To elucidate the unexpected trend of the PL, spectrally-resolved k-space measurements [3] were performed, revealing an underlying interference pattern resulting from waveguide modes supported by the thin dielectric substrate on which the TMD monolayer is supported and strained.

References

[1] F. Wang et al., 2D Mater 7, (2020) 045022
[2] H. J. Conley et al., Nano Lett 13, (2013) 3626
[3] M. G. Harats et al., Nano Lett 14, (2014) 5766

Figures

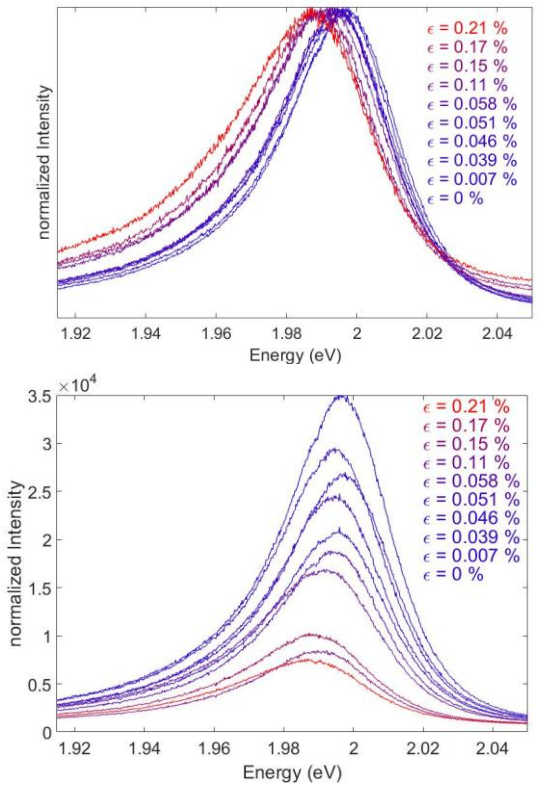

Figure 1: Normalized and non-normalized PL as a function of Energy at different strain levels.

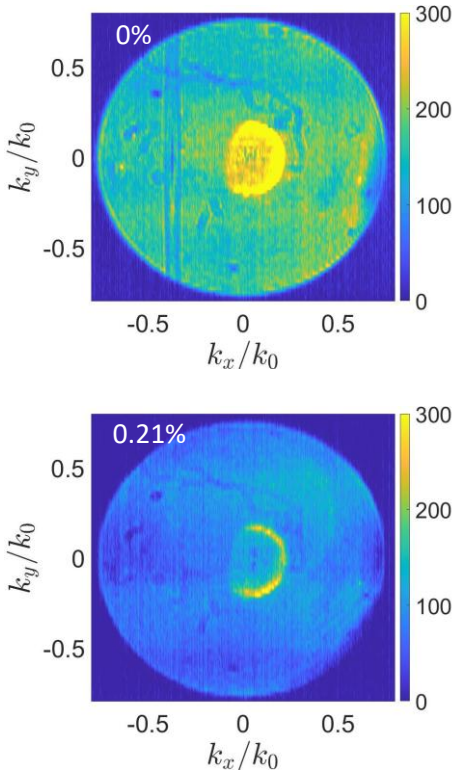

Figure 2: k-space measurements at different strain levels. The interference pattern is visible for all strain levels. Note the colorbar.