Control of Dielectric Properties in Single-Layer WS_2 via Defect Density Engineering

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Despite tungsten disulfide's (WS_2) appealing optical and electronic properties[1], the presence of defects of various nature, concentration, and distribution can profoundly affect the crystal's electronic characteristics[2][3]. In this work, we focus on the control of dielectric properties of WS_2 via defects density engineering. Specifically, we investigate the defects in WS_2, grown via liquid phase chemical vapor deposition (LiP-CVD)[4]. Controlling the growth conditions, allows us to obtain WS_2 in different shapes (Figure. 1), thereby influencing the crystal defects distributions. We used a range of techniques including optical spectroscopy, photoelectron spectroscopy, and Kelvin probe force microscopy. Our findings reveal the chemical nature of defects in WS_2 and their significant impact on the crystal's optical properties. By gaining a deeper understanding of the microscopic nature of defects in WS_2, our work offers a crucial contribution towards the development of defect-controlled technologies for controlling the dielectric environment in 2D crystals.

References and Acknowledgments

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Figures

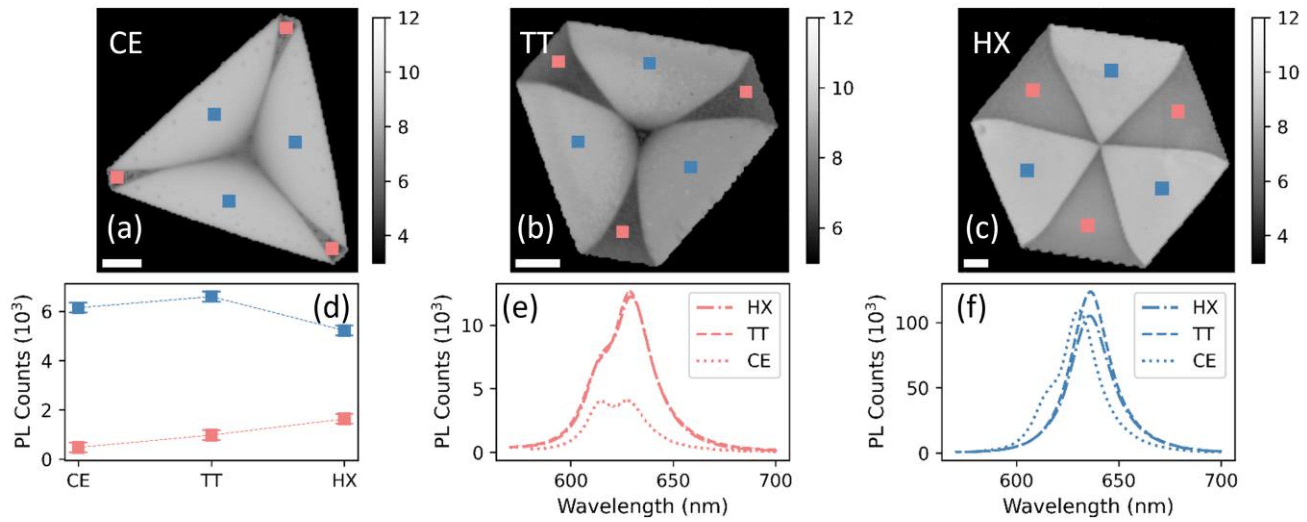

Figure 1: 2D PL intensity maps of cut-edged (CE) (a), truncated (TT) (b), hexagonal (HX) (c) monolayer WS_2. (d) PL intensity for dark (red) and bright (blue) regions for the three different shapes. (e-f) PL spectra for dark and bright regions respectively, for the three structures. Scalebar 15 μm.