Examining the Presence of Oxygen Substitutions in Monolayer WS2 Prepared via Chemical Vapor Deposition and Molecular Beam Epitaxy

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In the last decade, 2D Transition Metal Dichalcogenides (TMD's), such as WS2, and their heterostructures have emerged as a platform to study novel physics. A common epitaxial technique for producing high quality WS2 is Chemical Vapor Deposition with metal-oxide precursors. However, the oxygen present in the precursor results in a final product containing a high concentration of oxygen substitutions at the sulfur sites, which can be identified by Scanning Tunneling Microscopy (STM). A potential solution to this issue is to use an all-UHV synthesis technique such as Molecular Beam Epitaxy (MBE), which does not require oxide precursors. In this work, we use STM to compare the density of oxygen defects in CVD and MBE-prepared WS2 on HOPG substrates, and provide evidence that the MBE samples contain a lower oxygen defect density than those prepared via metal-oxide CVD.

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