

CVD growth of mono-layer WSe₂ flakes on silica from different solid precursors

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The growth of mono-layer and large mono-crystalline flakes of transition metal dichalcogenides (TMD) is of prime interest for fundamental research and future applications. Chief amongst TMD is the well studied MoS₂, but other compounds exist such as WSe₂ which also exhibit a direct band gap in the mono-layer form at room temperature [1] as well as the largest spin-orbit-coupling in the valence band (470meV) [2].

Apart from exfoliation from bulk crystals, the fabrication of "large" (i.e over 1 micron wide) mono-crystalline flake of WSe₂ is obtained by chemical vapor deposition (CVD) on silica or oxidized silicon substrates.

We investigate here the growth of WSe₂ flakes grown from different solid precursors. First, directly from WSe₂ powder, in the presence or absence of water (H₂O) traces in the N₂ carrier gas. Second, we investigate WO₄H₂+NaCl as the source of W[3][4], complemented by WSe₂ powder as the source of Se. An example of growth result is presented Fig.1. Advantages and drawbacks of each growth sequence will be discussed.

References

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| [3] | Reale et al., Scientific Reports (2015), 7: 14911 | 10.1038/s41598-017-14928-2 |
| [4] | Li et al., Appl. Mater. Today (2015) 1 60–66 | 10.1016/j.apmt.2015.09.0012352-9407 |

Figures

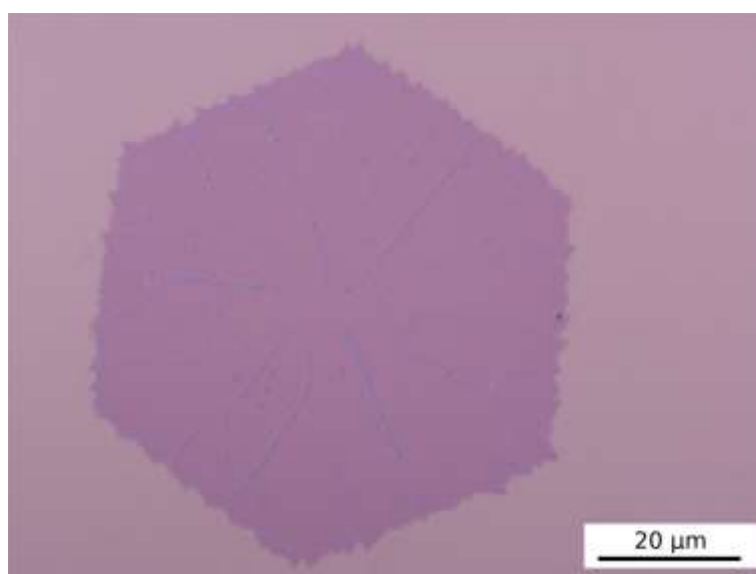


Figure 1: Optical micrograph of a WSe₂ flake of monolayer thickness grown using (WO₄H₂+NaCl) and WSe₂ using N₂ as a carrier gas.