

Supporting Information

Molecular Beam Epitaxy of Highly Crystalline MoSe₂ On Hexagonal Boron Nitride

Sock Mui Poh^{1,2†}, Xiaoxu Zhao^{1,2†}, Sherman Jun Rong Tan^{1,2}, Deyi Fu^{2,3}, Wenwen Fei⁴, Lei Qiang Chu^{2,3}, Jiadong Dan^{1,5}, Wu Zhou⁶, Stephen J. Pennycook^{1,5}, Antonio H. Castro Neto^{7,8} and Kian Ping Loh^{2,3,8*}

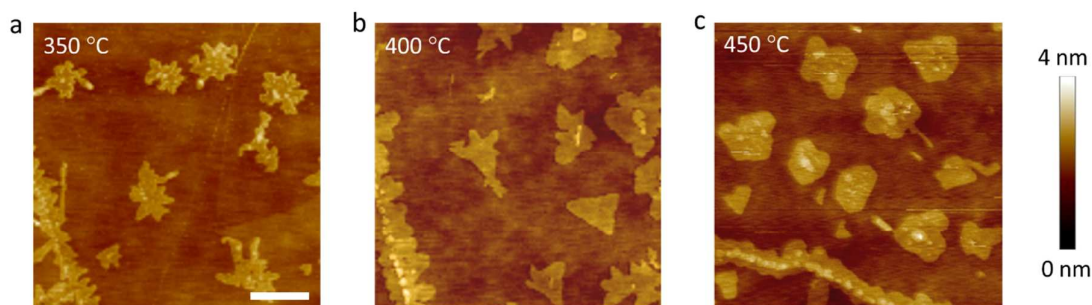


Figure S1. AFM topograph of MBE-grown MoSe₂ at (a) 350 °C, (b) 400 °C and (c) 450 °C. All the images are of the same scale bar: 200 nm.

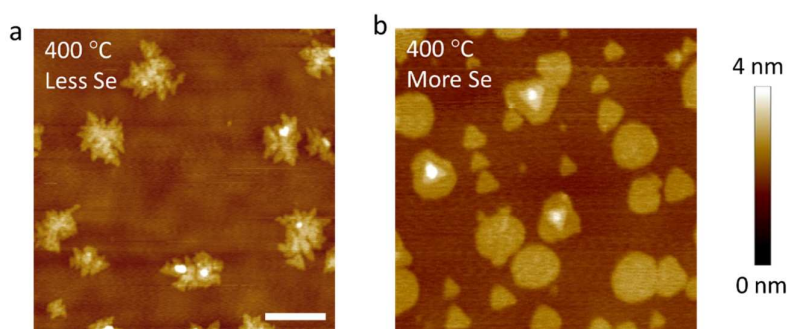


Figure S2. AFM topograph of MBE-grown MoSe₂ at 400 °C with (d) selenium deficient condition and (e) selenium excess condition. All the images are of the same scale bar: 200 nm.

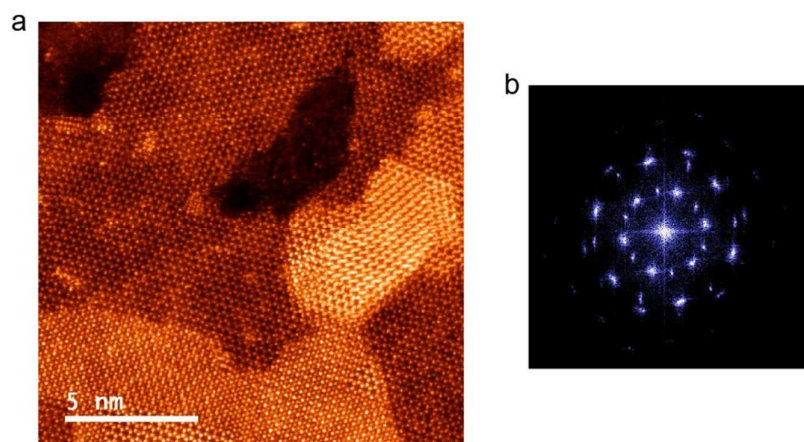


Figure S3 (a) An atomic resolution STEM-ADF image of a typical MoSe₂ film grown on SiO₂ and (b) the corresponding fast Fourier transform (FFT) pattern.

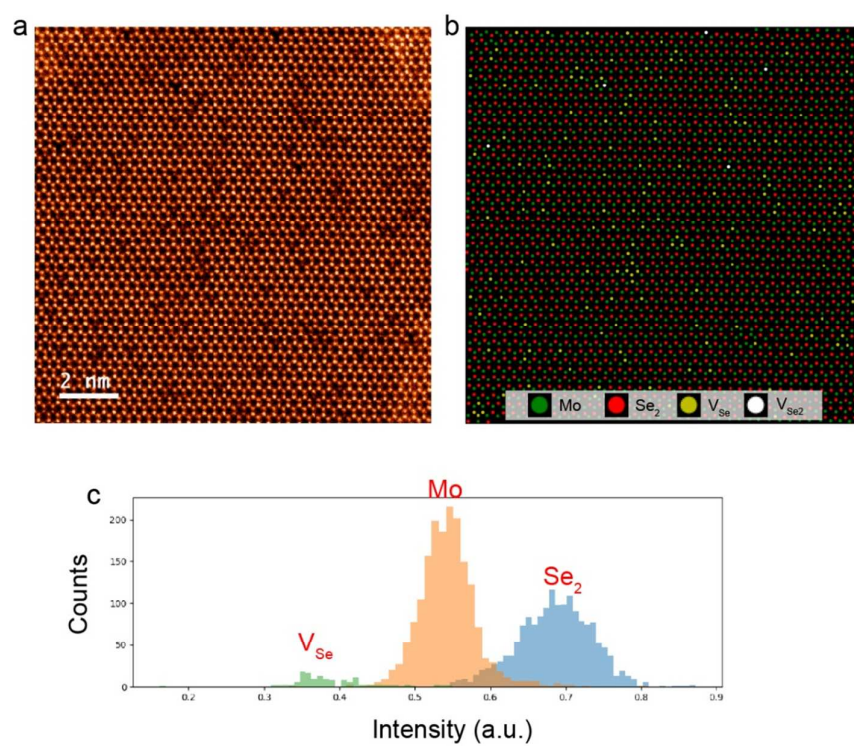


Figure S4. (a) An atomic-resolution STEM-ADF image of a CVD grown monolayer MoSe₂ film and (b) its corresponding Python script map based on the intensity. (c) The calculated histogram showing the intensity of all atom blobs in (a). The calculated defect density of CVD-MoSe₂ grown via the method from ref. [44], it is found to be $V_{Se} = 1.68 \text{ nm}^{-2}$ and $V_{Se2} = 0.08 \text{ nm}^{-2}$.