Supporting Information

Synthesis of monolayer n-doped WSe_2 from solid state inorganic precursors

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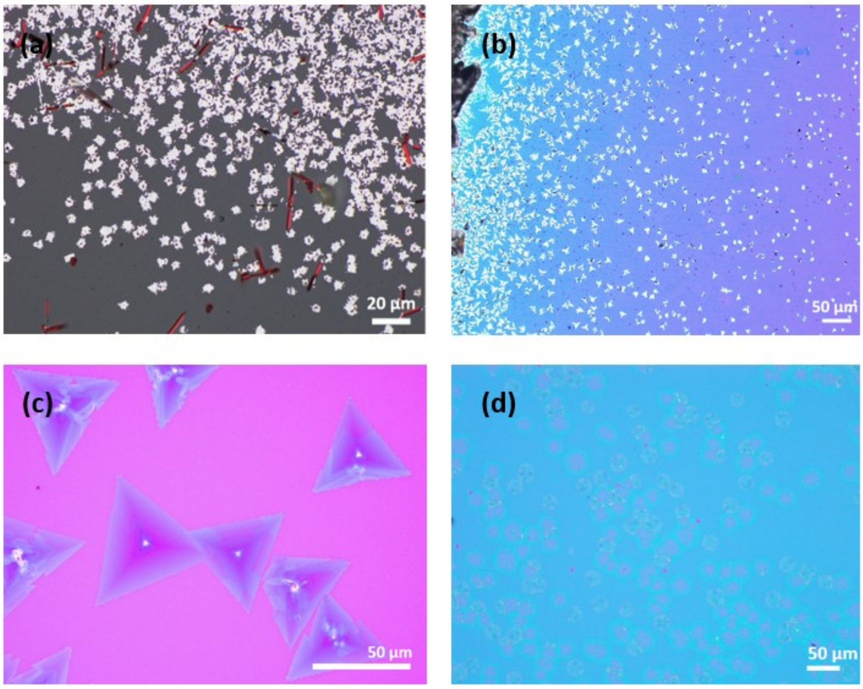


Figure SI1. (a) Multilayer WSe_2 flakes grown on c-plane sapphire. (b) Multilayer WSe_2 grown on h-BN/SiO_2 substrate. (c) WSe_2 flakes grown at 850°C on SiO_2 substrate. (d) Growth attempt result at 800°C.

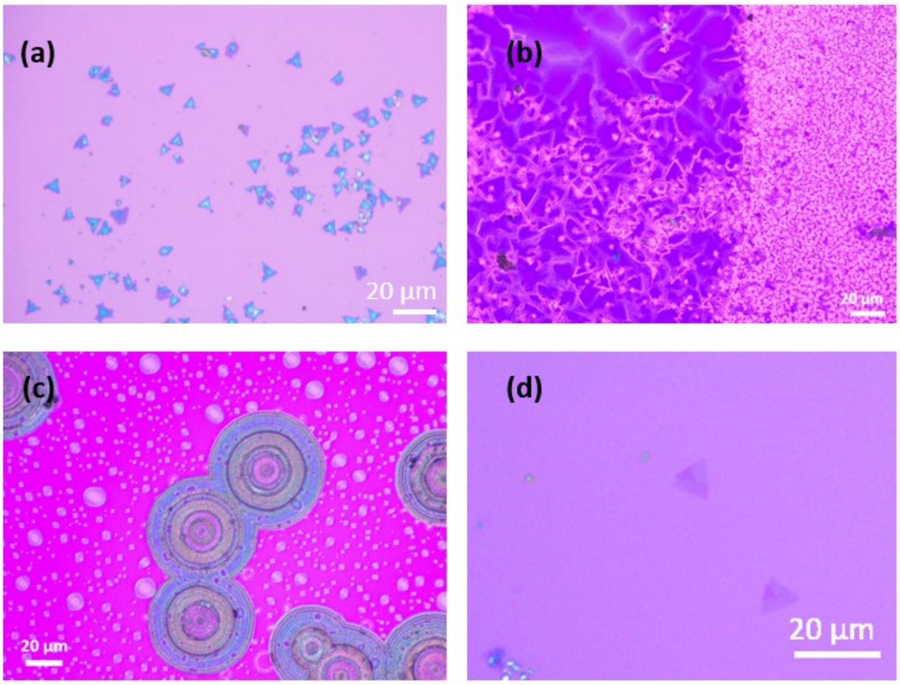


Figure SI2. (a) Thick and irregular WSe_2 flakes grown using Se powder. (b) Multilayer WSe_2 film grown using ZnSe alongside Se powder. (c) Results of growth attempt using CdSe as Se precursor. (d) The only few WSe_2 flakes grown using Na_2Se as Se precursor.

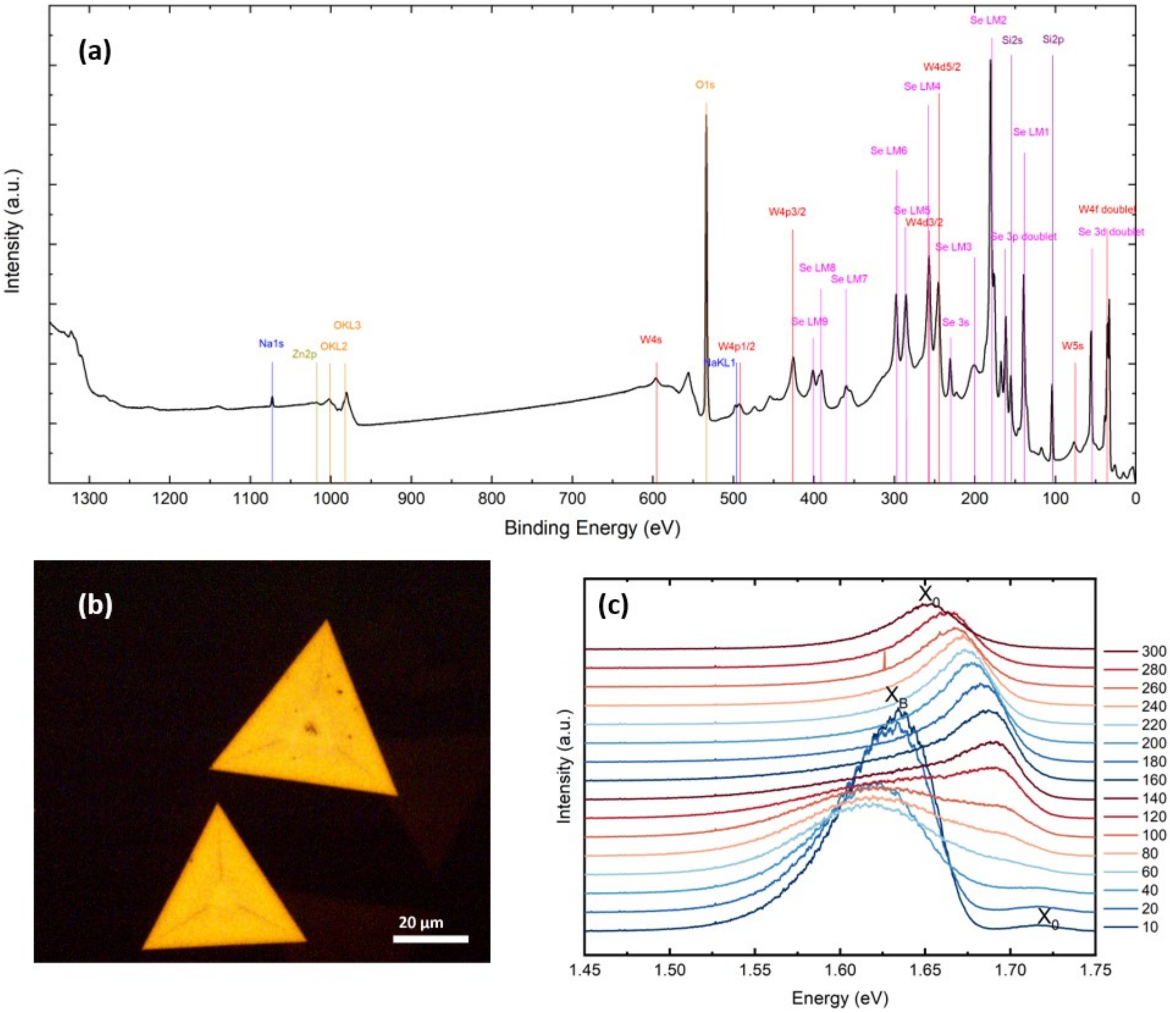


Figure SI3. (a) XPS survey spectrum of WSe_2 grown with ZnSe. Peaks are assigned to core levels and Auger lines. (b) PL image of WSe_2 flakes presenting a strain-induced pattern. (c) PL evolution from room temperature to 10 K.

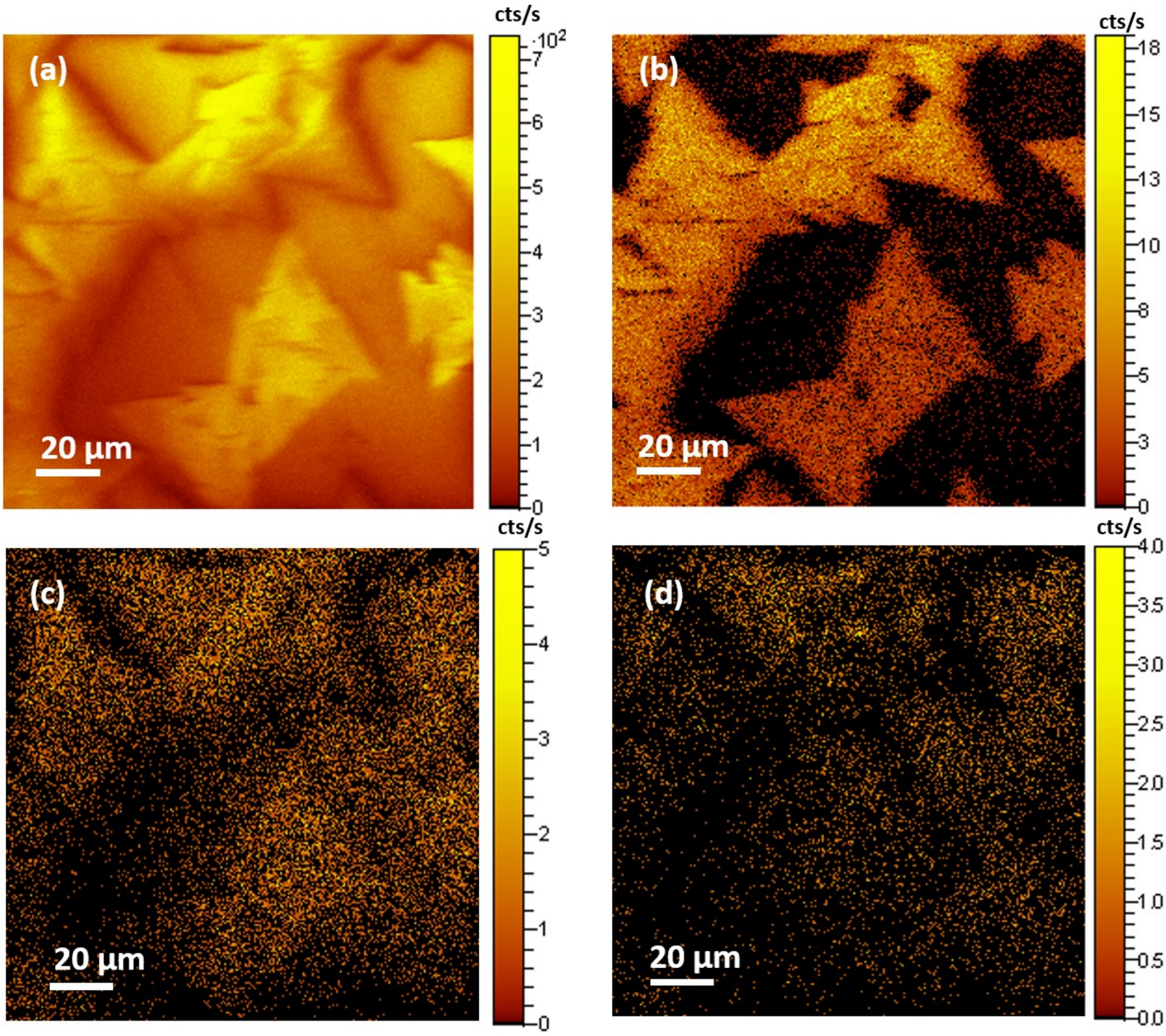
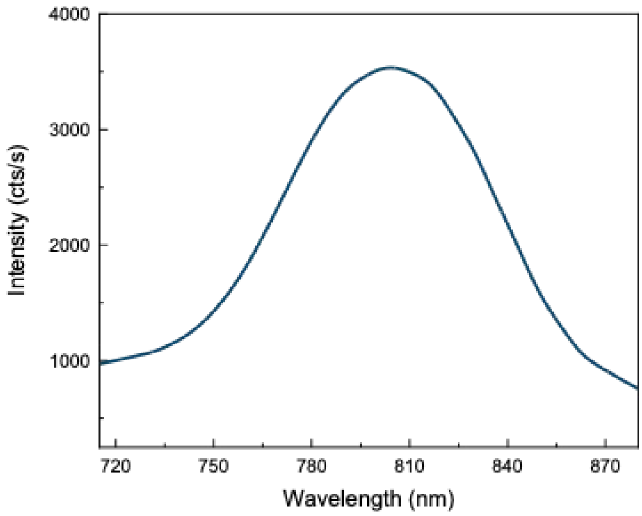


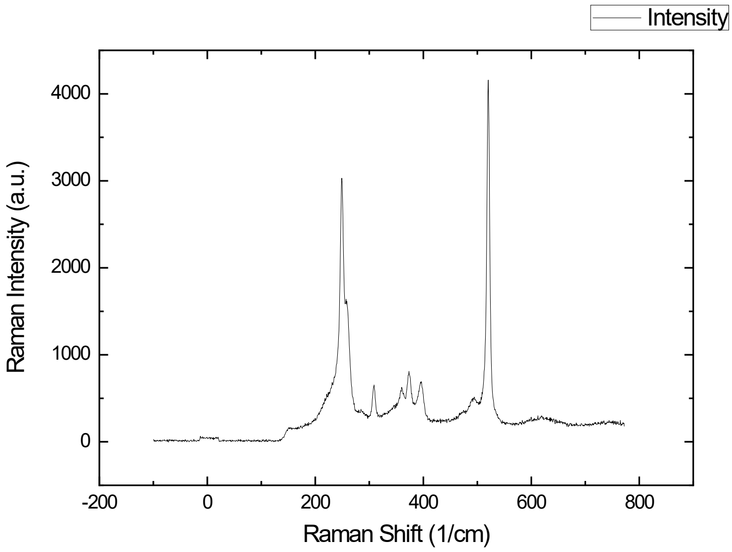
Figure SI4. (a) Total ToF-SIMS signal in the positive channel. Maps of W (b), Se (c) and Zn (d) common isotopes collected in the positive channel.

Table SI1. Carrier mobilities of reported WSe_2

Materials	Transporting types	Electron mobilities ($cm^2 \cdot V^{-1} \cdot s^{-1}$)	Hole mobilities ($cm^2 \cdot V^{-1} \cdot s^{-1}$)	Ref
4-BND and DETA doped WSe_2 by CVD growth	p and n	25	82	1
Mechanically exfoliated WSe_2	p and n	12.6	74.4	2
Mechanically exfoliated WSe_2	p and n	11.35	0.13	3
WSe_2 by CVD growth	p and n	7	90	4
Mechanically exfoliated WSe_2	p and n	0~17.9	0.05~5.64	5
Zn-doped WSe_2	p and n	10	50	This work

Representative PL and Raman spectra of bilayer flakes used to fabricate FET.
The bilayer nature can be seen by the PL at 1.60 eV and the Raman peak B^1_{2g} peak at ~310 cm^{-1}. As in several flakes used for FETs we have observed optical contrasts nearly undistinguishable to the one of the ascertain bilayer nature, we can infer that several of the flakes used in devices were indeed bilayered flakes.





References

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