Supplementary material for

Controllable growth of two-dimensional WSe_2 using salt as co-solvent

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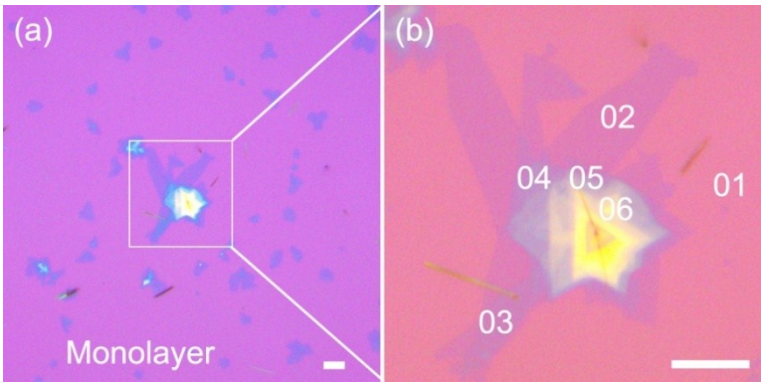

Fig. S1 OM images showing the coexistence of monolayer, bilayer and multilayers in the WSe_2 flakes. (a) overview. (b) zoom-in of (a). Scale bars, 10 μm.

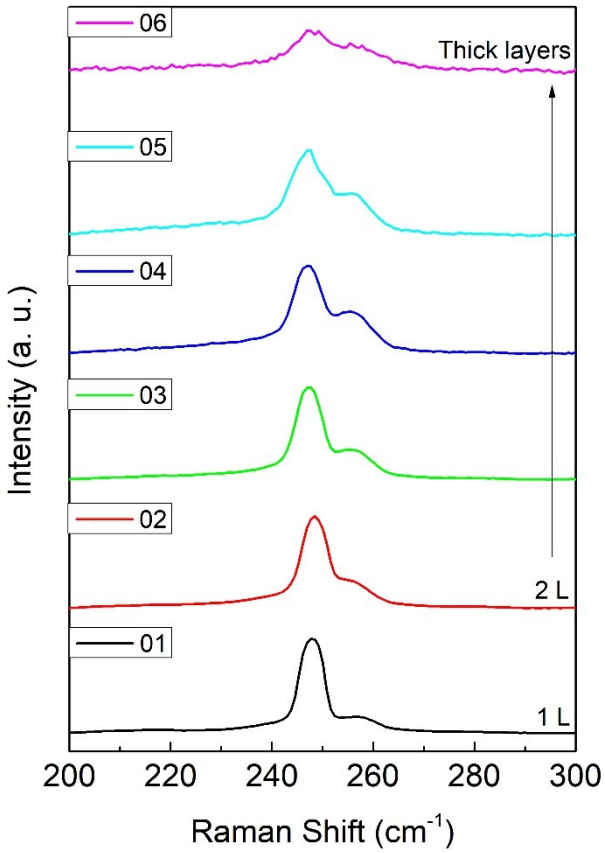

Fig. S2 Raman spectra collected from the regions of the 2D WSe_2 with different thickness shown in Fig. S1.

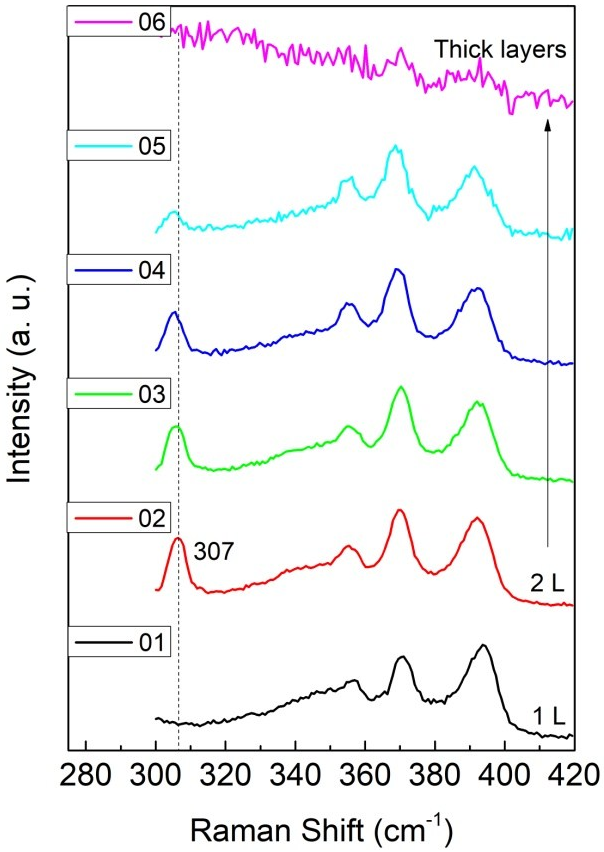

Fig. S3 Raman spectra collected from the regions of the 2D WSe_2 with different thickness shown in Fig. S1.

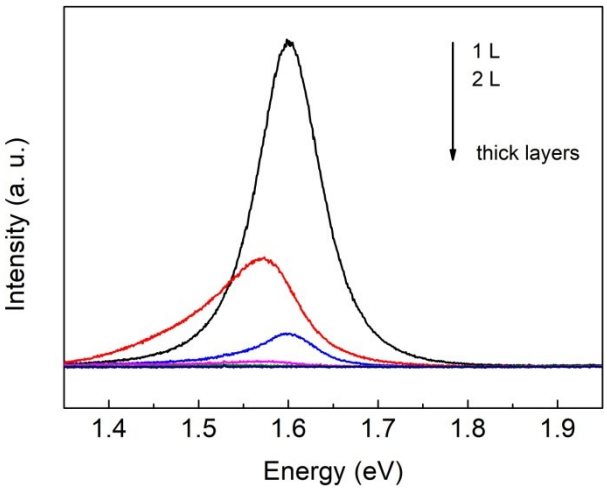

Fig. S4 PL spectra collected from the regions of the 2D WSe_2 with different thickness shown in Fig. S1.

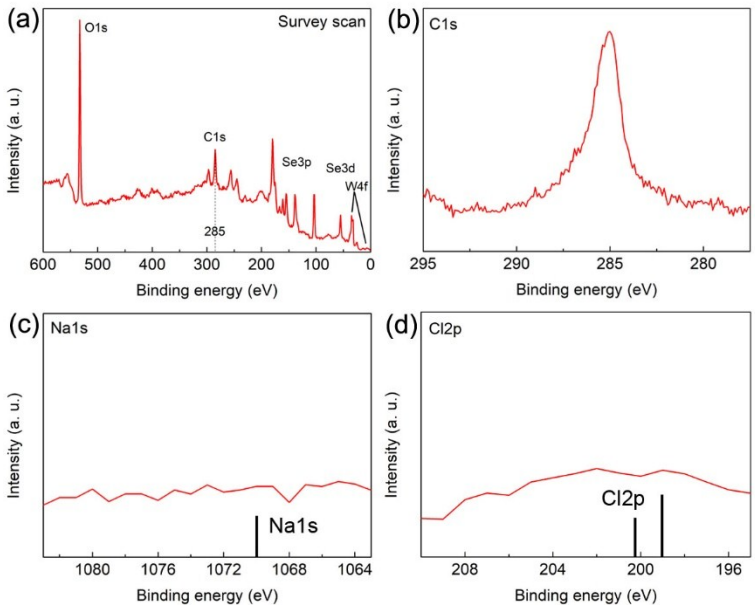

Fig. S5 XPS spectra of the as-grown 2D WSe_2. (a) survey scan, (b) C1s, (c) Na1s, and (d) Cl2p.

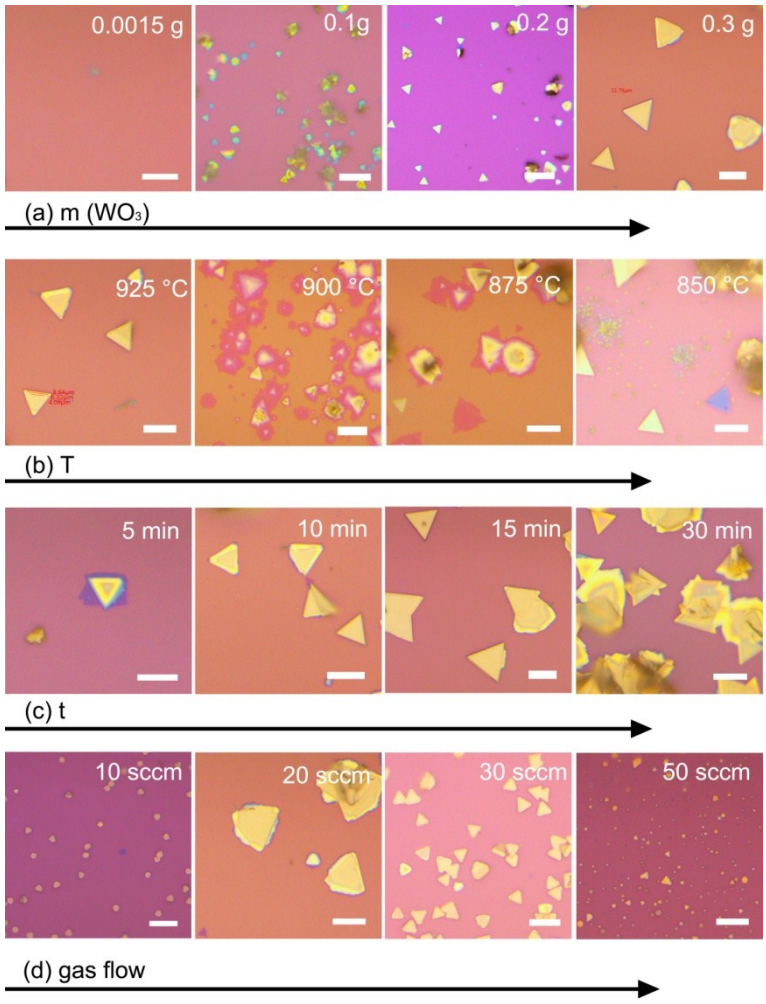

Fig. S6 OM image of 2D WSe_2 flakes grown by CVD without NaCl. Optimized parameters: (a) mass (WO_3); (b) reaction temperature T; (c) reaction time t; and (d) gas flow. Scale bars, 10 μm.

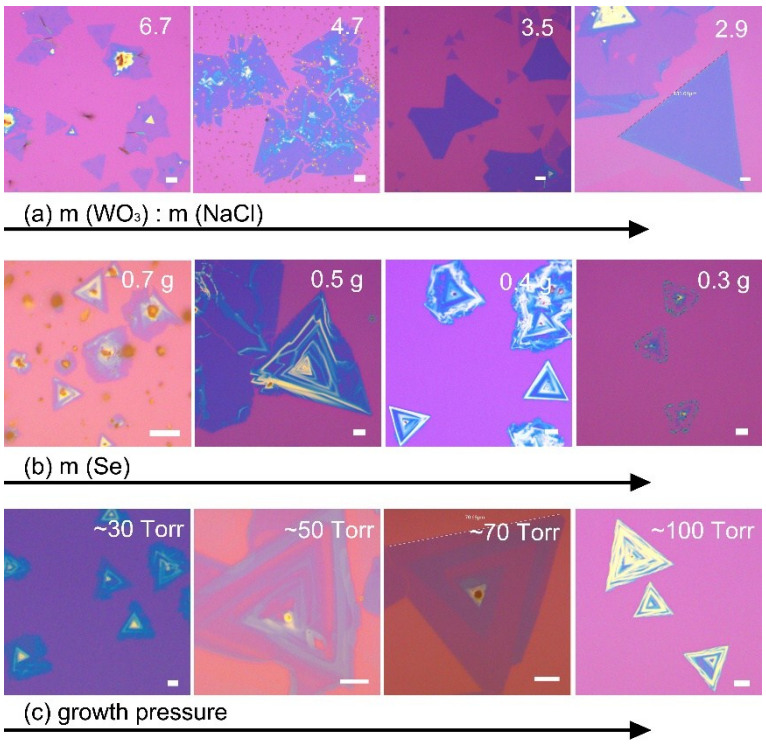

Fig. S7 OM image of 2D WSe_2 flakes grown by CVD with NaCl. Optimized parameters: (a) mass (WO_3) : mass (NaCl); (b) mass (Se); (c) growth pressure. Scale bars, 10 μm.

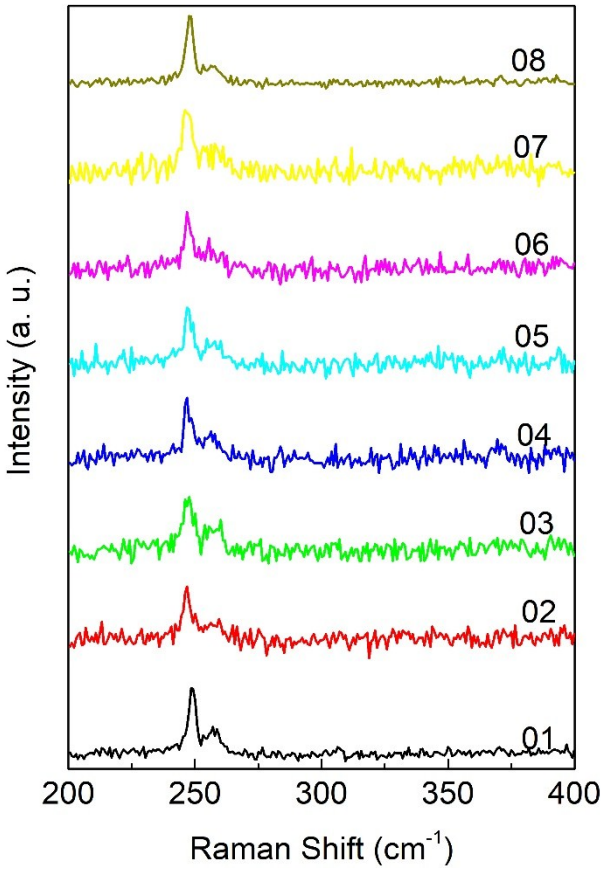

Fig. S8 Raman spectra collected from the regions of a WSe_2 flake with a spiral dislocation shown in Fig. 4(c).

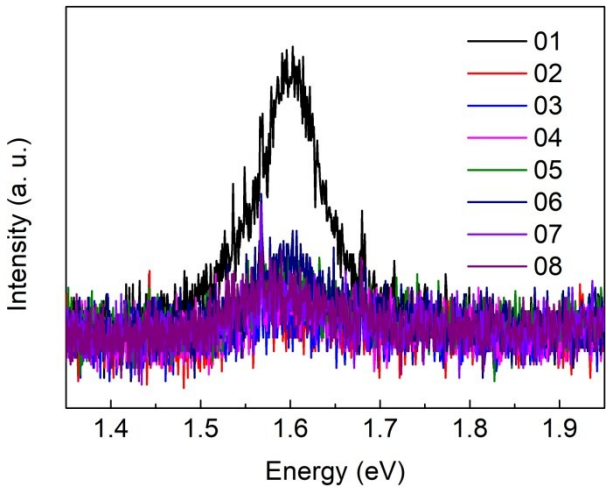

Fig. S9 PL spectra collected from the regions of a WSe_2 flake with a spiral dislocation shown in Fig. 4(c).

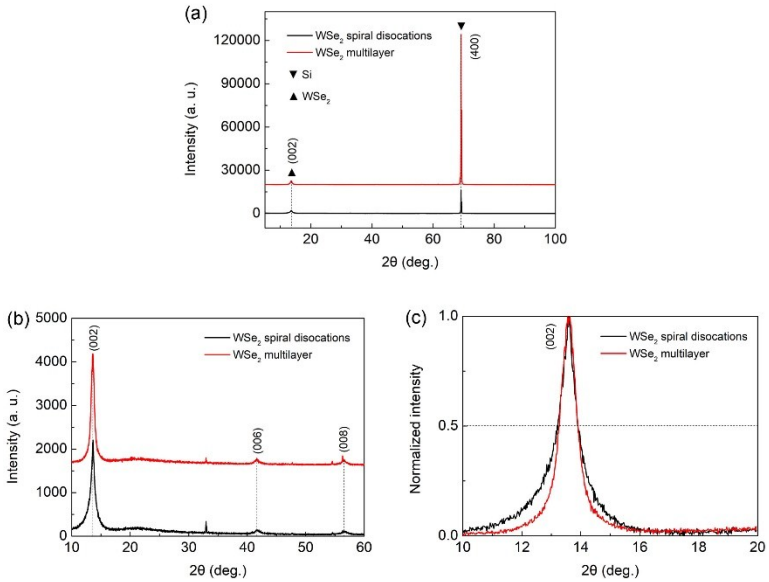

Fig. S10 XRD patterns from the WSe_2 spiral dislocation and WSe_2 multilayer. (a) XRD patterns of WSe_2 and Si substrate. (b) XRD patterns of WSe_2. (c) Normalized intensities of the (002) diffraction peaks, respectively.

The crystal structures of samples were characterized using X-ray diffraction as shown in Fig S10. Fig. S10(a) shows two major diffraction peaks of (002) and (400) appearing in both WSe_2 and Si, which is consistent with the standard values of WSe_2 (JCPDS card 38-1388) and Si substrate (JCPDS card 27-1402). For the 2D WSe_2 with spiral dislocations, the diffraction peaks of (002), (004) and (008) show no significant change with respect to WSe_2 multilayer, indicating that the crystal phase of WSe_2 is not destroyed with spiral dislocation, as shown in Fig. S10(b). Fig. S10(c) shows the half-width of (002) direction. The slight broadening of the diffraction peaks is caused by the spiral dislocation structure.