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).
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.