Supporting Information for ***ACS Nano***

Reversible Semiconducting-to-Metallic Phase Transition in Chemical Vapor Deposition Grown Monolayer WSe_2 and Applications for Devices

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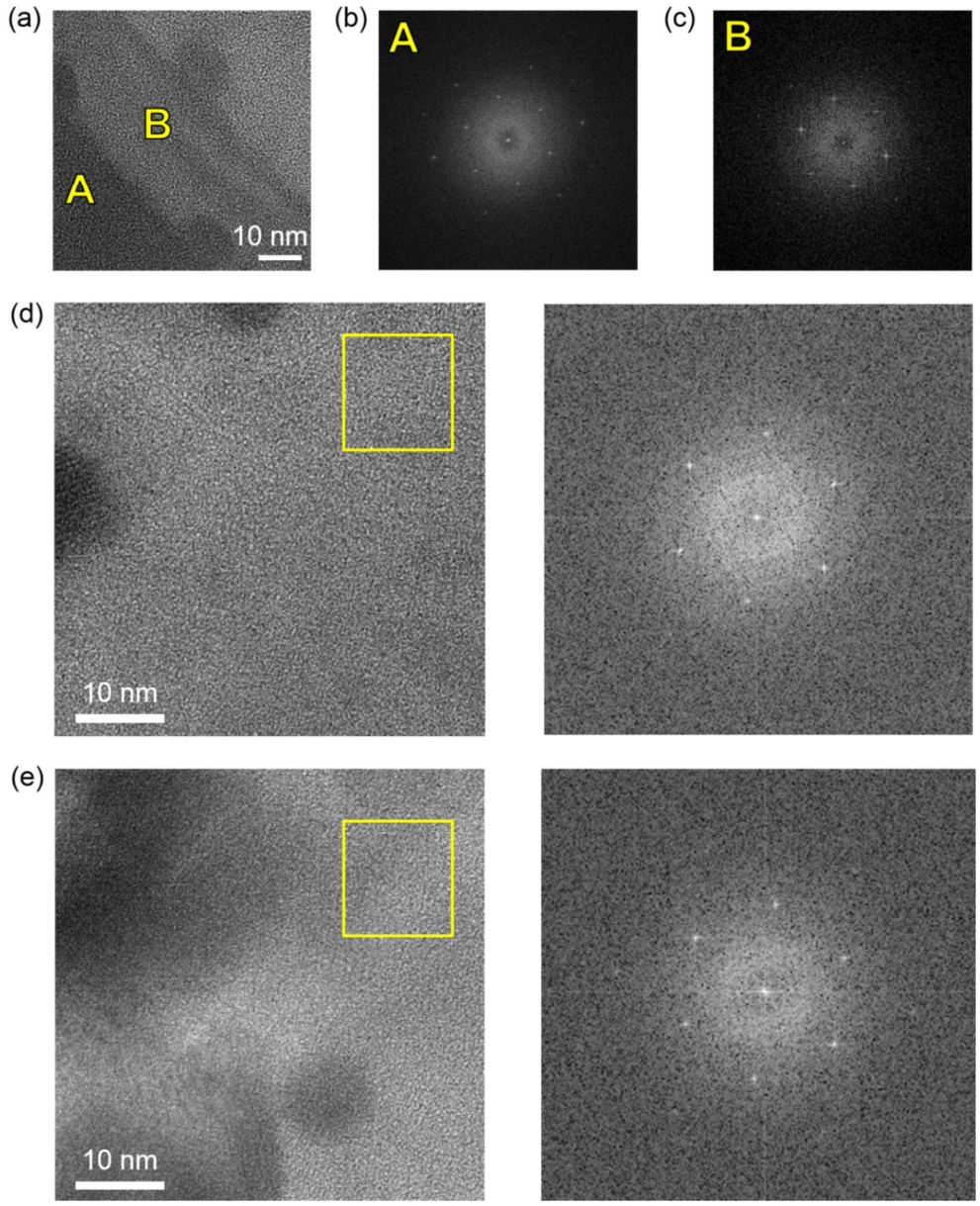

Figure S1. Transmission electron microscope (TEM) images and Fast Fourier Transform (FFT) patterns of 2H and 1T WSe_2 samples. (a) TEM image of a WSe_2 flake. Clear contrast difference can be observed between position A (2H phase) and B (1T phase). (b) FFT taken at position A shown in (a), which shows a typical 2H pattern. (c) FFT taken at position B shown in (a). (d) TEM image of a 2H-WSe_2 flake with its FFT pattern shown on the right. The region of FFT is highlighted by the yellow box. (e) TEM image of a 1T-WSe_2 flake with its FFT pattern shown on the right. The region of FFT is highlighted by the yellow box.

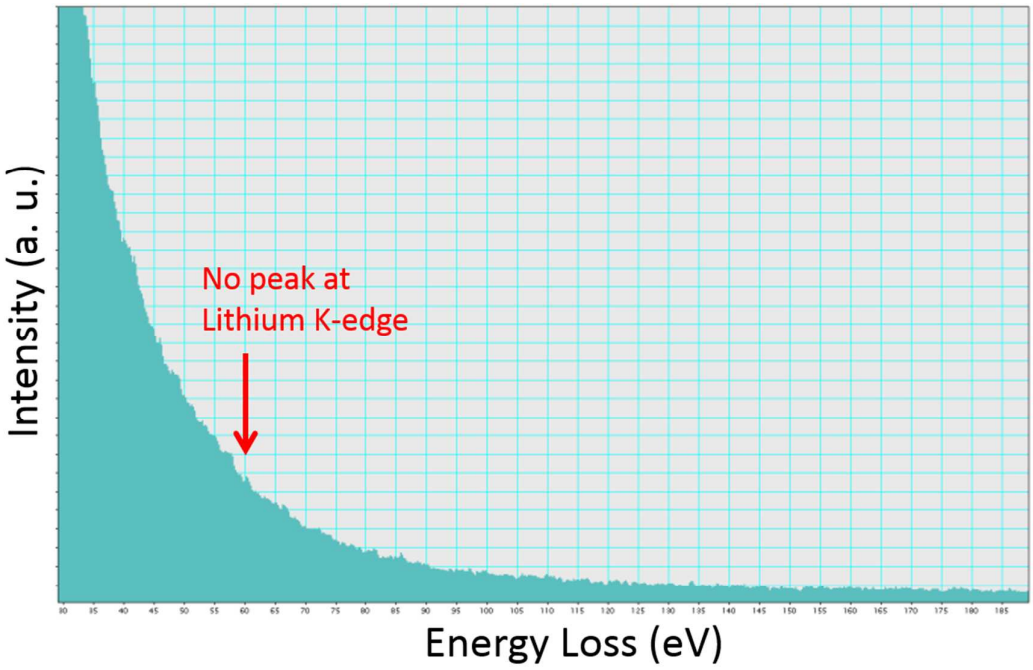

Figure S2. Electron energy loss spectroscopy (EELS) characterization of 1T-WSe_2. EELS measurements were performed to detect any lithium remaining in the 1T-WSe_2 samples since this technique is sensitive to light elements. As can be seen, no signals from lithium K-edge were detected (~60 eV). We have measured several flakes and all of them show similar spectra. For EELS sample preparation, CVD-grown 2H-WSe_2 flakes were first transferred onto a TEM grid using PMMA-mediated transfer method.[1] Then the PMMA film was dissolved by dipping into acetone. After that, the TEM grid with WSe_2 flakes was immersed into n-BuLi solution. The samples were rinsed with hexane before loaded into TEM for EELS experiments.

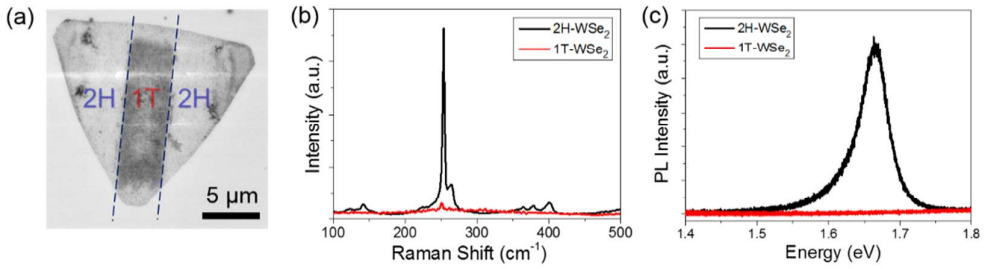

Figure S3. Characterization of another 2H-1T-2H laterally-structured WSe_2 flake. (a) Scanning electron microscopy (SEM) image of the WSe_2 sample with 1T phase in the middle region. The substrate is Si/SiO_2 wafer. (b) Raman spectra collected at 2H (black curve) and 1T (red curve) regimes of the flake in image (a). (c) PL spectra collected at 2H (black curve) and 1T (red curve) regimes of the flake in image (a).

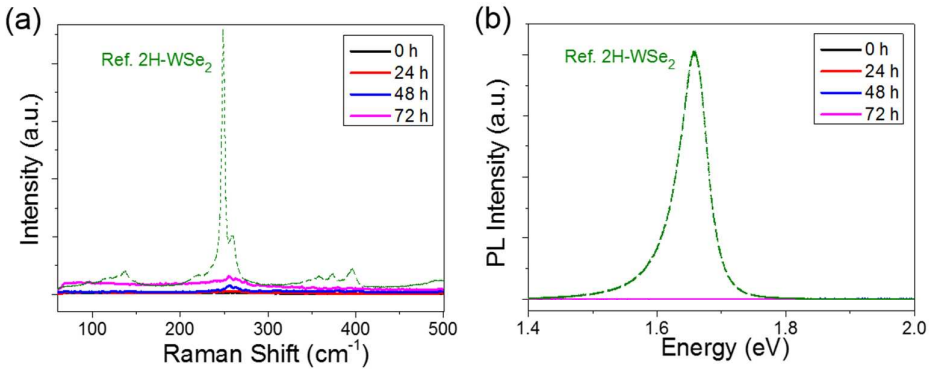

Figure S4. Stability of 1T-WSe_2 in argon atmosphere without annealing. (a) Raman spectra evolution for this sample at different time. Green dash line shows Raman spectrum of a typical 2H-WSe_2 for comparison. (b) PL spectra evolution for this sample at different time. Green dash line shows PL spectrum of a typical 2H-WSe_2 for comparison. These results show that the 1T-WSe_2 is pretty stable in argon atmosphere at room temperature.

References and Notes

1. Liu, B. L.; Ren, W. C.; Gao, L. B.; Li, S. S.; Pei, S. F.; Liu, C.; Jiang, C. B.; Cheng, H. M., Metal-Catalyst-Free Growth of Single-Walled Carbon Nanotubes. *J. Am. Chem. Soc.* **2009**, *131*, 2082-2083.