

## Supplementary Information

### Phase selective CVD growth and photoinduced 1T→1H phase transition in WS<sub>2</sub> monolayer

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**Figure S1.** XRD pattern of precursor WO<sub>3</sub> used for growing WS<sub>2</sub>. Pattern is matched with JCPDS file no. 852459; a = 7.324 Å, b = 7.324 Å, c = 7.662 Å with space group of P63/mcm.

**Figure S2.** Deconvolution of Raman Spectrum resolves the E<sub>2g</sub> and 2LA modes in (a) 1T (b) 1H phases of WS<sub>2</sub>.

**Figure S3.** (a) Raman spectra of as grown 1T phase WS<sub>2</sub> obtained at different times. (b) E<sub>2g</sub>/A<sub>1g</sub> ratio calculated at three different flakes showing increasing trend. The observed increase in intensity of E<sub>2g</sub> mode with time, contributing to increased E<sub>2g</sub>/A<sub>1g</sub> ratio might be related to phase change. Raman spectra from around 20 flakes have been analysed in the form of histogram to differentiate the E<sub>2g</sub>/A<sub>1g</sub> ratios of WS<sub>2</sub> before and after conversion from 1T phase to 1H phase(c,d).

**Video 1.** In situ FM imaging shows the systematic changes in intensity across 1T-1H phase transition.

**Table S1.** Shows the calculation of XPS results for W and S peaks for 1T-WS<sub>2</sub> sample (after 24 hours of growth). Calculations indicate mixture of 1T and 1H phase in WS<sub>2</sub>.

**Table S2.** After conversion calculations of XPS results for W and S are as shown. After full transformation phase is 100% 1H.

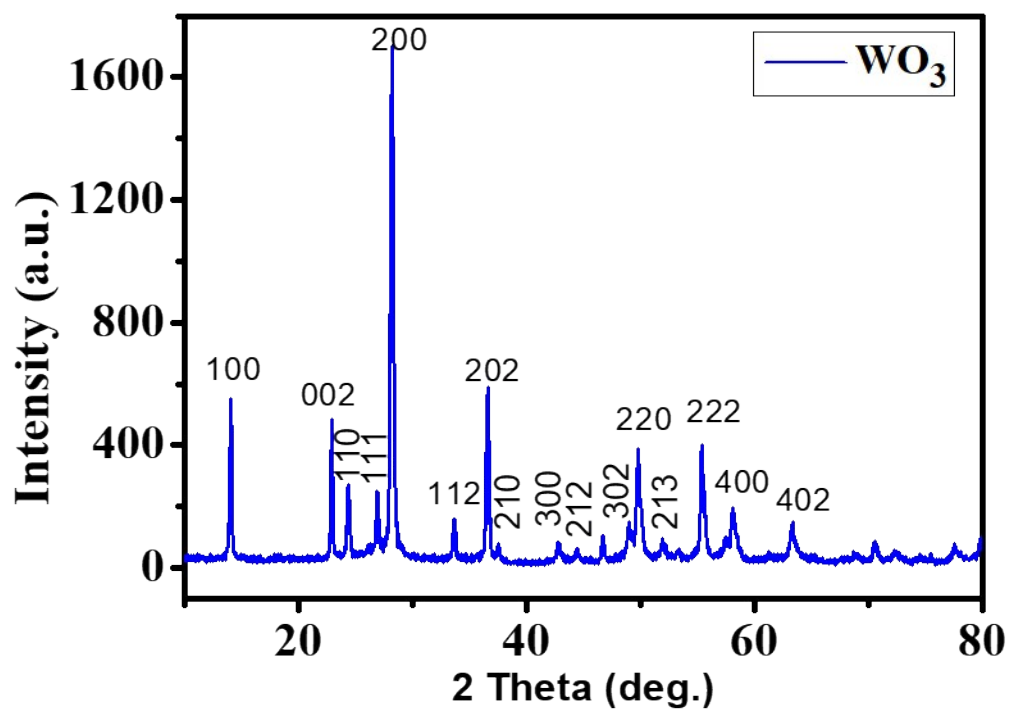
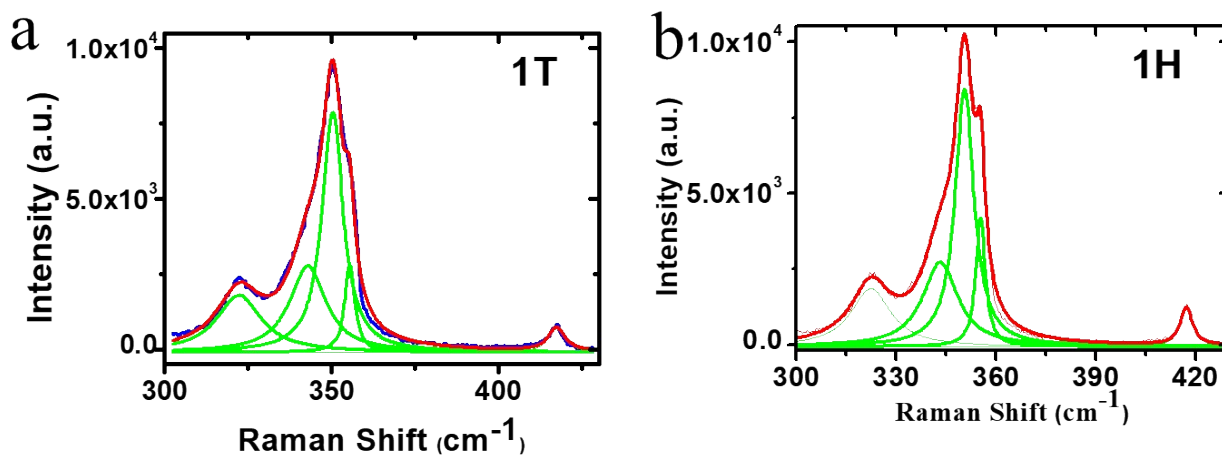
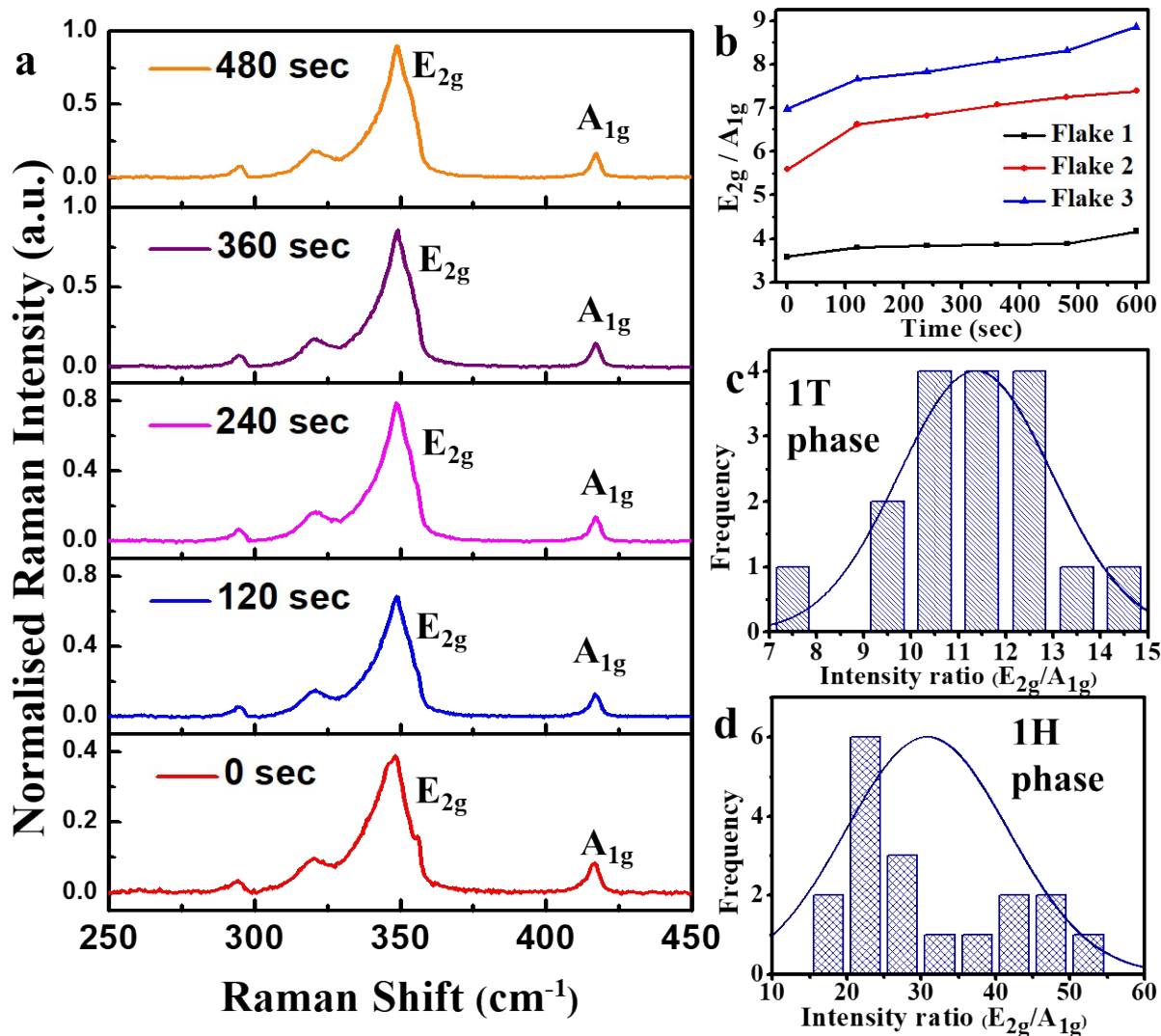


Figure S1. XRD pattern of WO<sub>3</sub> nanorods used for growing WS<sub>2</sub>. Pattern is matched with JCPDS file no. 852459; crystal system is hexagonal,  $a = 7.324 \text{ \AA}$ ,  $b = 7.324 \text{ \AA}$ ,  $c = 7.662 \text{ \AA}$  with space group of P63/mcm.

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**Figure S2.** Deconvolution of Raman Spectrum resolves the E<sub>2g</sub> and 2LA modes in (a) 1T (b) 1H phases of WS<sub>2</sub>.



**Figure S3.** (a) Raman spectra of as grown 1T phase  $\text{WS}_2$  obtained at different times. (b)  $E_{2g}/A_{1g}$  ratio calculated at three different flakes showing increasing trend. The observed increase in intensity of  $E_{2g}$  mode with time, contributing to increased  $E_{2g}/A_{1g}$  ratio might be related to phase change. Raman spectra from around 20 flakes have been analysed in the form of histogram to differentiate the  $E_{2g}/A_{1g}$  ratios of  $\text{WS}_2$  before and after conversion from 1T phase to 1H phase(c,d).

Peak	Area	Intensity (Counts / Sec)	FWHM	Position (eV)	Areal Phase fraction ( $A_{\text{phase}}/A_{1\text{T}} + A_{1\text{H}}$ )	Peak Shift (eV)
1T-W 4f <sub>7/2</sub>	13039.81	7998.44	0.81	32.57	0.248	0.53
1H-W 4f <sub>7/2</sub>	39567.59	37597.42	0.83	33.10	0.752	
1T-W 4f <sub>5/2</sub>	9826.611	5475.86	0.63	34.69	0.235	0.57
1H-W 4f <sub>5/2</sub>	31955.80	28593.17	0.84	35.26	0.765	
W 5p <sub>3/2</sub>	8633.89	2064.32	1.15	38.61		
1H-S 2p <sub>3/2</sub>	18903.68	18771.79	0.94	163.00	0.837	0.43
1T-S 2p <sub>3/2</sub>	3694.48	2299.26	1.52	162.57	0.163	
1H-S 2p <sub>1/2</sub>	9351.58	9274.50	0.94	164.19	0.846	0.35
1T-S 2p <sub>1/2</sub>	1698.72	1133.65	1.40	163.84	0.154	

**Table S1: Shows the calculation of XPS results for W and S peaks for 1T-WS<sub>2</sub> sample (after 24 hours of growth). Calculations indicates mixture of 1T and 1H phase.**

Peak	Area	Intensity (Counts / Sec)	FWHM	Position (eV)
1H-S 2p <sub>3/2</sub>	15634.20	17454.66	86.43	162.60
1H-S 2p <sub>1/2</sub>	7311.04	8580.39	86.69	163.78
1H-W 4f <sub>7/2</sub>	35475.57	39991.81	20.31	32.97
1H-W 4f <sub>5/2</sub>	26284.46	28893.39	22.17	35.10
W 5p <sub>3/2</sub>	3576.89	2105.53	21.19	38.68

**Table S2: After conversion calculations of XPS results for W and S are as shown. After full transformation phase is 100% 1H.**