

## Supplementary Information

### Doping-free bandgap tuning in one-dimensional Magnéli-phase nanorods of $\text{Mo}_4\text{O}_{11}$

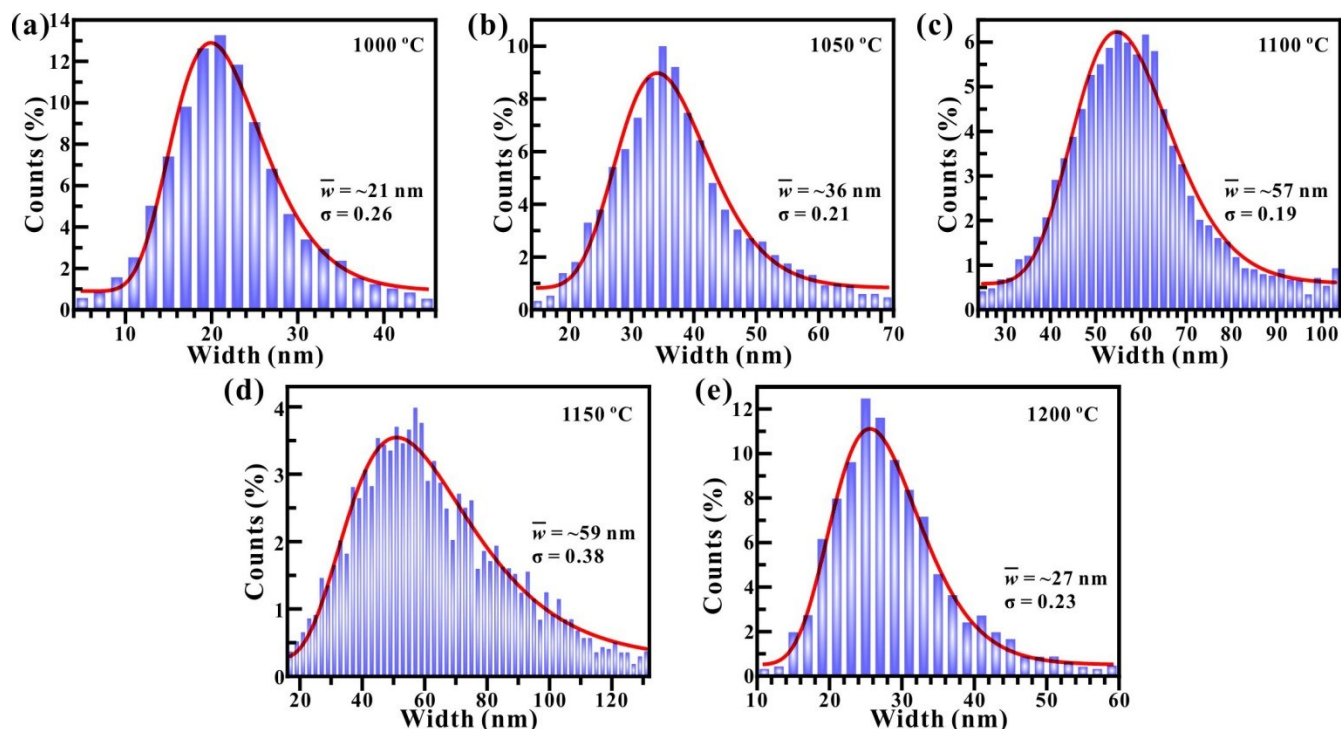
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**Figure S1.** Statistical histograms of the width distributions of 1D Magnéli-phase  $\text{Mo}_4\text{O}_{11}$  nanorods synthesized at various temperatures of (a) 1000 °C, (b) 1050 °C, (c) 1100 °C, (d) 1150 °C, and (e) 1200 °C. All the data are fitted by a log-normal distribution function.

Temperature	Average length of the 1D nanorods	Thickness of the buffer layer
1000 °C	249.7 nm	165.9 nm
1050 °C	422.7 nm	145.1 nm
1100 °C	845.4 nm	140.2 nm
1150 °C	830.3 nm	133.4 nm
1200 °C	1053.8 nm	55.4 nm

**Table S1.** Average lengths of the 1D Mo<sub>4</sub>O<sub>11</sub> nanorods and thicknesses of the MoO<sub>x</sub> buffer layers synthesized on ITO/glass substrates at 1000, 1050, 1100, 1150, and (e) 1200 °C.

Temperature	Percentage of orthorhombic ( $\alpha$ ) phase	Percentage of monoclinic ( $\beta$ ) phase
1000 °C	~10 %	~90 %
1050 °C	~98 %	~2 %
1100 °C	~95 %	~5 %
1150 °C	~93 %	~7 %
1200 °C	~53 %	~47 %

**Table S2.** Various composition percentages of the two orthorhombic ( $\alpha$ ) and monoclinic ( $\eta$ ) phases at 1000, 1050, 1100, 1150, and (e) 1200 °C, for the 1D Magnéli-phase Mo<sub>4</sub>O<sub>11</sub> nanorods.

Temperature	Raman band (cm <sup>-1</sup> )
1000 °C	202, 253, 323, 358, 412, 812, 894, 934, 992
1050 °C	118, 157, 189, 322, 412, 442, 799, 890, 936
1100 °C	120, 171, 275, 333, 373, 422, 442, 720, 785, 820, 900, 993
1150 °C	120, 145, 191, 234, 280, 335, 374, 444, 662, 818, 897, 992
1200 °C	121, 148, 197, 225, 284, 339, 356, 455, 491, 564, 661, 734, 821, 995

**Table S3.** Various Raman bands of the 1D Mo<sub>4</sub>O<sub>11</sub> nanorods synthesized at 1000, 1050, 1100, 1150, and (e) 1200 °C.

Raman band	Active mode	Vibration characteristics
89 cm <sup>-1</sup>	A <sub>g</sub>	translational rigid MoO <sub>4</sub> chain mode
100 cm <sup>-1</sup>	B <sub>3g</sub>	translational rigid MoO <sub>4</sub> chain mode
116 cm <sup>-1</sup>	B <sub>2g</sub>	translational rigid MoO <sub>4</sub> chain mode
129 cm <sup>-1</sup>	B <sub>3g</sub>	translational rigid MoO <sub>4</sub> chain mode
159 cm <sup>-1</sup>	A <sub>g</sub> /B <sub>1g</sub>	translational rigid MoO <sub>4</sub> chain mode
197 cm <sup>-1</sup>	B <sub>2g</sub>	O=Mo=O twist
216 cm <sup>-1</sup>	A <sub>g</sub>	rotational rigid MoO <sub>4</sub> chain mode
247 cm <sup>-1</sup>	B <sub>3g</sub>	O=Mo=O twist
285 cm <sup>-1</sup>	B <sub>2g</sub>	O=M=O wagging
293 cm <sup>-1</sup>	B <sub>3g</sub>	O=M=O wagging
334 cm <sup>-1</sup>	A <sub>g</sub> , B <sub>1g</sub>	O–M–O bend
366 cm <sup>-1</sup>	A <sub>1g</sub>	O–M–O scissor
376 cm <sup>-1</sup>	B <sub>1g</sub> ,	O–M–O scissor
380 cm <sup>-1</sup>	B <sub>1g</sub>	O–M–O scissor
473 cm <sup>-1</sup>	A <sub>g</sub>	O–M–O stretch and bend
667 cm <sup>-1</sup>	B <sub>2g</sub> , B <sub>3g</sub>	O–M–O stretch
823 cm <sup>-1</sup>	A <sub>g</sub>	M=O stretch
996 cm <sup>-1</sup>	A <sub>g</sub>	M=O stretch

**Table S4.** Varying Raman bands, corresponding active modes, and vibration characteristics of MoO<sub>1-x</sub> [34].