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RESEARCH ARTICLE

Defect control during CVD-growth for high performance MoS_2-based self-powered photodetector

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Supporting information

1. Raman spectrum of the sample when the temperature of S source is 150 ℃

Figure S1 shows the Raman spectra of the sample grown at 150 ℃ in the low temperature zone. We can observe two weak vibration peaks belonging to MoS_2, corresponding to the in-plane vibration mode E^1_{2g} and the out-of-plane vibration mode A_{1g}, respectively [1]. Meanwhile, two vibration peaks associated with MoO_{3-x} appeared. The Raman peak at 451.5 cm^{-1} was the tensile vibration mode of OMo_3 (i.e., one O atom connected to three Mo atoms), and the Raman peak at 691 cm^{-1} was assigned to scissoring vibration of the O-Mo-O bond [2]. This proves that at the S source environment of 150 ℃, MoO_3 was partly sulfurized to MoS_2.

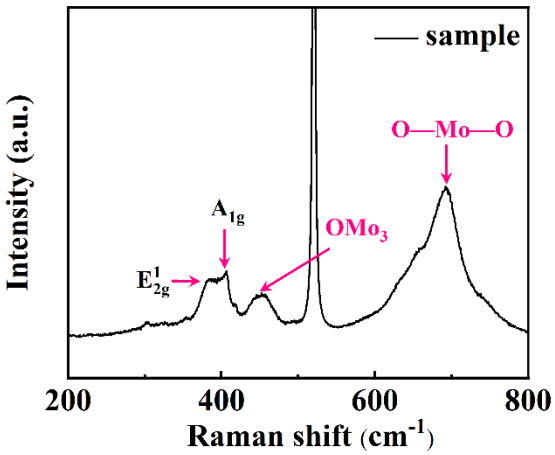

Fig. S1 Raman spectrum of sample when the temperature of S source is 150 ℃.

2. Characterization of MoS_2 nanosheets grown at different S source temperatures

Figure S2(a) shows the optical images of MoS_2 nanosheets grown at the temperature of S source ranging from 160 ℃ to 170 ℃. We can clearly see that the MoS_2 nanosheets grown at three temperatures are triangular. As the temperature of S source increases, the majority size of the MoS_2 nanosheets is doubly enlarged. The Raman spectra of MoS_2 nanosheets grown at different temperatures are shown in Fig. S2(b). The wave difference between the A_{1g} and E^1_{2g} Raman peak can effectively describe the number of layers of MoS_2 nanosheets. When the temperature of S source is 160 ℃, 165 ℃, and 170 ℃, the wave difference between the A_{1g} and E^1_{2g} Raman peaks are 21.91 cm^{-1}, 21.14 cm^{-1}, and 20.36 cm^{-1}, respectively. This indicates that the MoS_2 is bilayer [3].

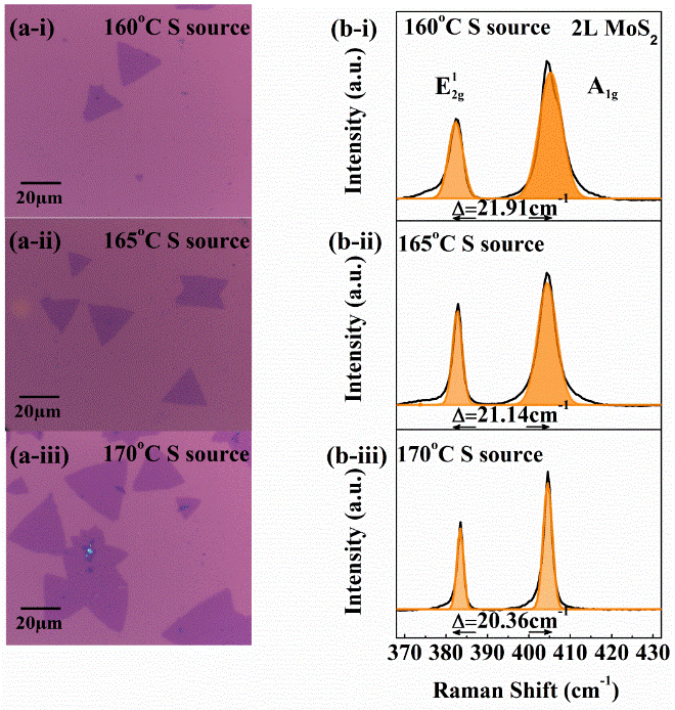

Fig. S2 (a) Optical images and **(b)** Raman spectra for MoS_2 nanosheets grown at the temperature of S source ranging from 160 ℃ to 170 ℃.

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