

Supporting Information for

## MoS<sub>2</sub>-Based Photodetectors Powered by Asymmetric Contact

### Structure with Large Work Function Difference

Zhe Kang<sup>1</sup>, Yongfa Cheng<sup>1</sup>, Zhi Zheng<sup>1</sup>, Feng Cheng<sup>1</sup>, Ziyu Chen<sup>1</sup>, Luying Li<sup>1</sup>,  
Xinyu Tan<sup>2,\*</sup>, Lun Xiong<sup>3</sup>, Tianyou Zhai<sup>1</sup>, Yihua Gao<sup>1,3,\*</sup>

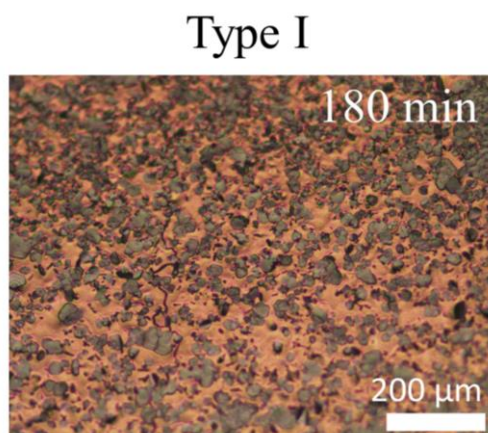
<sup>1</sup>Center for Nanoscale Characterization & Devices (CNCD), Wuhan National Laboratory for Optoelectronics (WNLO) & School of Physics & School of Materials Science and Engineering, Huazhong University of Science and Technology (HUST), LuoyuRoad 1037, Wuhan 430074, People's Republic of China

<sup>2</sup>College of Materials and Chemical Engineering, China Three Gorges University, Daxue Road 8, Yichang 443002, People's Republic of China

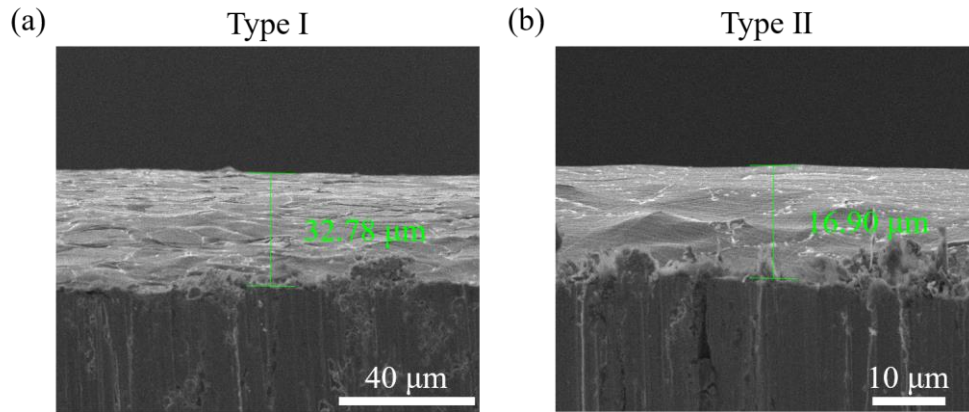
<sup>3</sup>Hubei Key Laboratory of Optical Information and Pattern Recognition, School of Optical Information and Energy Engineering, School of Mathematics and Physics, Wuhan Institute of Technology, Guanggu 1st Road 206, Wuhan 430205, People's Republic of China

\*Corresponding authors. E-mail: gaoyihua@hust.edu.cn (Yihua Gao), tanxin@ctgu.edu.cn (Xinyu Tan)

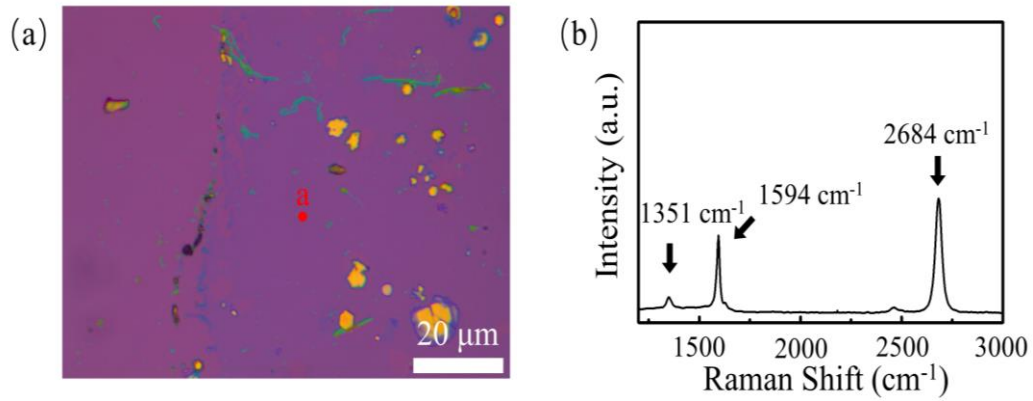
### Supplementary Figures



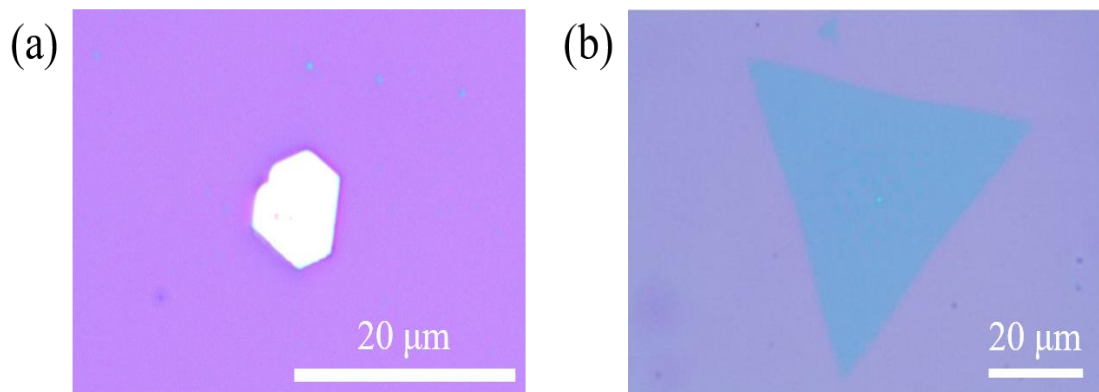
**Fig. S1** The optical image of Mo<sub>2</sub>C prepared by Type I method with the growth time of 180 min



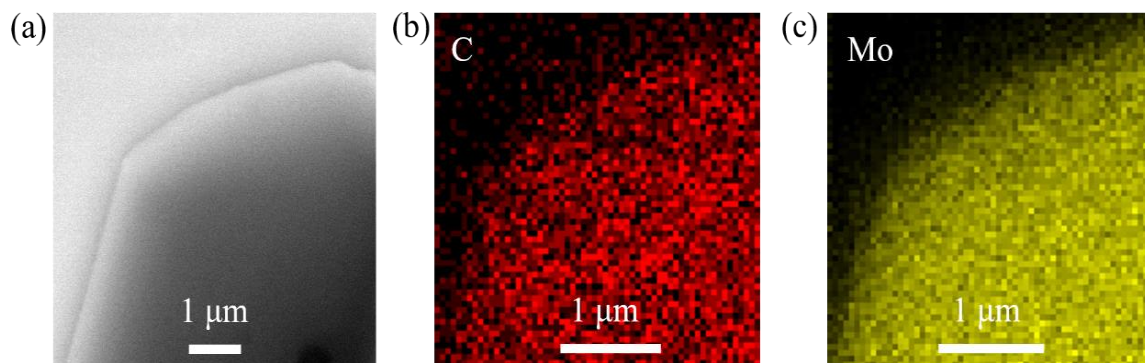
**Fig. S2** Thickness of Cu in the Cu/Mo substrate after 180 min of growth of Mo<sub>2</sub>C by **a** Type I and **b** Type II method



**Fig. S3 a** The optical image of Mo<sub>2</sub>C with Graphene on SiO<sub>2</sub> substrate. **b** The Raman spectra of graphene obtained by testing the point a of **a**

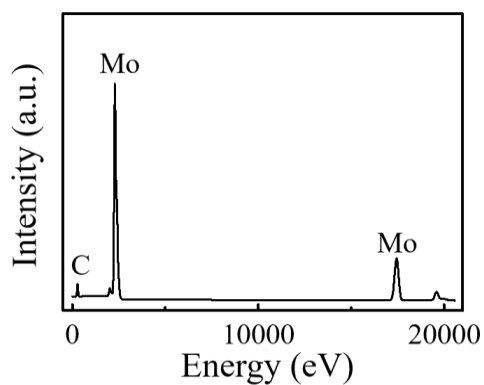


**Fig. S4** The optical image of **a** Mo<sub>2</sub>C on SiO<sub>2</sub>. **b** MoS<sub>2</sub> on SiO<sub>2</sub>

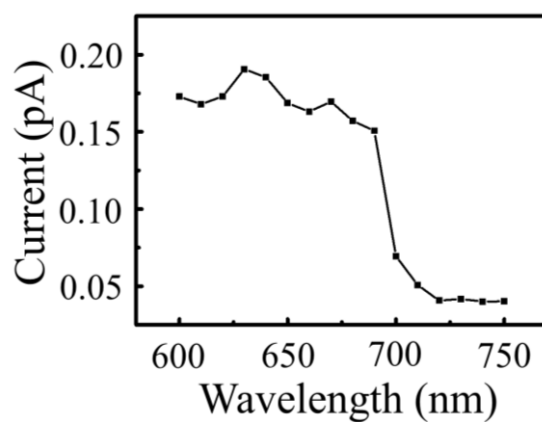


**Fig. S5** The elemental distribution of  $\text{Mo}_2\text{C}$ . **a** STEM image, **b** C distribution, and **c** Mo distribution of  $\text{Mo}_2\text{C}$

Element	Weight %	Atomic %	Uncert. %	Correction	k-Factor
C(K)	5.99	33.74	0.91	0.28	3.685
Mo(K)	94.00	66.25	2.62	0.98	4.047



**Fig. S6** The EDS of  $\text{Mo}_2\text{C}$



**Fig. S7** The current responses of  $\text{Mo}_2\text{C}/\text{MoS}_2/\text{Au}$  photodetector to light with various wavelength