

Large-Scale MoS₂ Pixel Array for Imaging Sensor

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Materials Preparation

The monolayer MoS₂ film synthesized on a silicon substrate was growth in a two-temperature-zone CVD chamber. The adequate sulfur powder (Alfa Aesar, 99.999%) and MoO₃ powder (Alfa Aesar 99.95%), used as material sources for film fabrication, were loaded in two separate inner tubes and placed at different zones by a distance of 30 cm [1]. During the growth, the two inner tubes were flowed with Ar as carrying gases, and the growth temperature for the sulfur and MoO₃ precursors was controlled at 180 and 650 °C, respectively [2]. The continuous monolayer MoS₂ film was synthesized at room pressure with 15 min sulfuration time.

Device Fabrication

A conventional photolithography laser direct writing (MicroWriter ML③3) is performed to form the source and drain electrodes pattern and then 35 nm Au was deposited by E-beam evaporation, next lift-off the excess metal, followed by second lithography and CF₄ reactive ion etching to define the channel region. Finally, Aluminum oxide (40 nm) was deposited as the protective insulator via ALD.

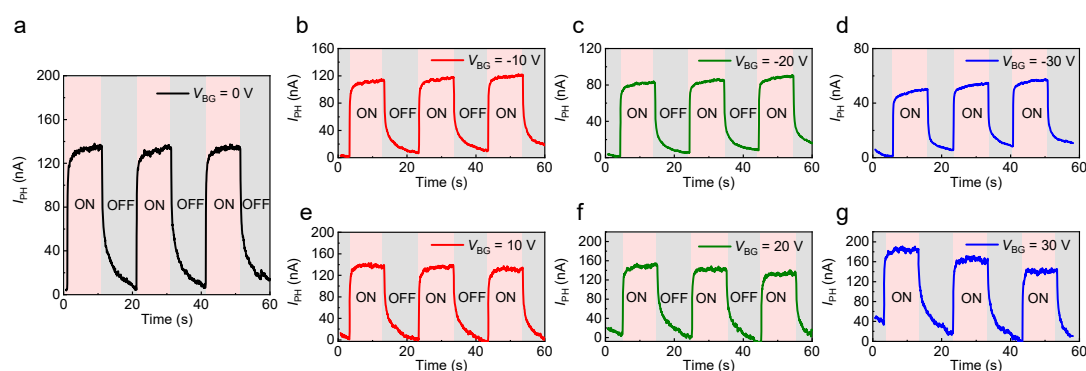


Figure S1. Photoswitching characteristics of the MoS₂ phototransistor under temporal light illumination with varying back gate voltage V_{BG} from -30 V to 30 V with a step of 10 V. All switching curves were measured at $V_{DS} = 1$ V with illumination frequency of 0.05 Hz.

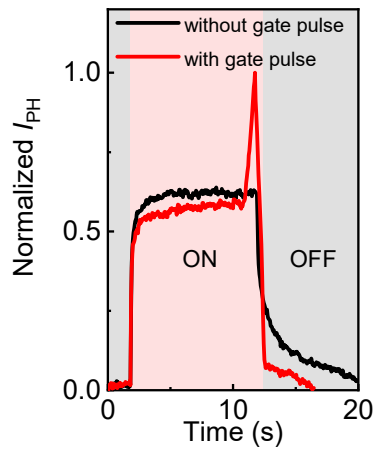


Figure S2. A Time resolved photoresponsive characteristics of the monolayer MoS₂ phototransistor under temporal light illumination with $\lambda = 550$ nm without and with gate voltage pulse. The fall time is improved from 7.59 s to 6.24 s.

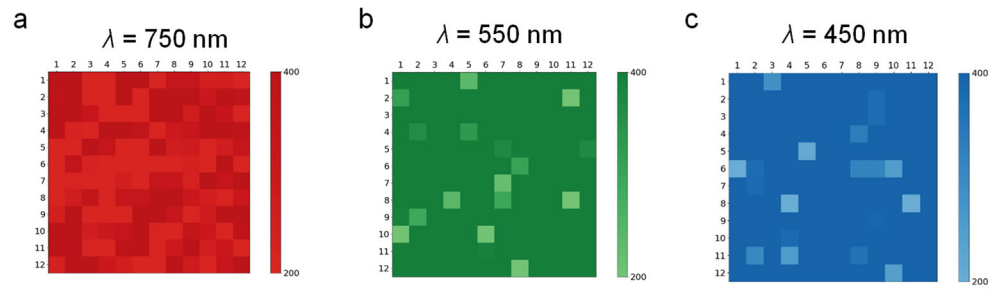


Figure S3. Photocurrent mapping of 12×12 MoS₂ phototransistors at $V_{DS} = 1$ V, $V_{BG} = -10$ V under RGB light illumination ($\lambda = 750, 550,$ and 450 nm), indicating uniform photocurrent photoresponses.

Table S1. The rise time and fall time with different case.

		Rise time (s)	fall time (s)
Wavelength	Red (750nm)	2.8	2.5
	Green (550nm)	1.8	1.6
	Blue (450nm)	2.4	2.2
Illuminance	Strong (285 $\mu\text{W}/\text{cm}^2$)	2.1	1.7
	Weak (71 $\mu\text{W}/\text{cm}^2$)	2.4	2.1
V_{DS}	1.0V	1.9	1.7
	0.5V	2.2	2.0

References

1. Xu, H.; Zhang, H.; Guo, Z.; Shan, Y.; Wu, S., Wang, J. High-performance wafer-scale MoS₂ transistors toward practical application. *Small* **2018**, *14*, 1803465.
2. Yu, H.; Liao, M.; Zhao, W.; Liu, G.; Zhou, X.J.; Wei, Z.; Xu, X.; Liu, K.; Hu, Z.; Deng, K.; et al. Wafer-Scale Growth and Transfer of Highly-Oriented Monolayer MoS₂ Continuous Films. *ACS Nano* **2017**, *11*, 12001–12007, <https://doi.org/10.1021/acsnano.7b03819>.