Supporting Information

Patterned Growth of $AgBiS_2$ Nanostructures on Arbitrary Substrates for Broadband and Eco-Friendly Optoelectronic Sensing

Yu Miao,[a] Zhuoran Wang,*[a] Zhongming Wei[b] and Guozhen Shen*[a]

[a.] *School of Integrated Circuits and Electronics, Beijing Institute of Technology, Beijing 100081, China.*

[b.] *State Key Laboratory of Superlattices and Microstructures, Institute of Semiconductors, Chinese Academy of Sciences, Beijing 100083, China.*

E-mail: zhuoran.wang@bit.edu.cn; gzshen@bit.edu.cn

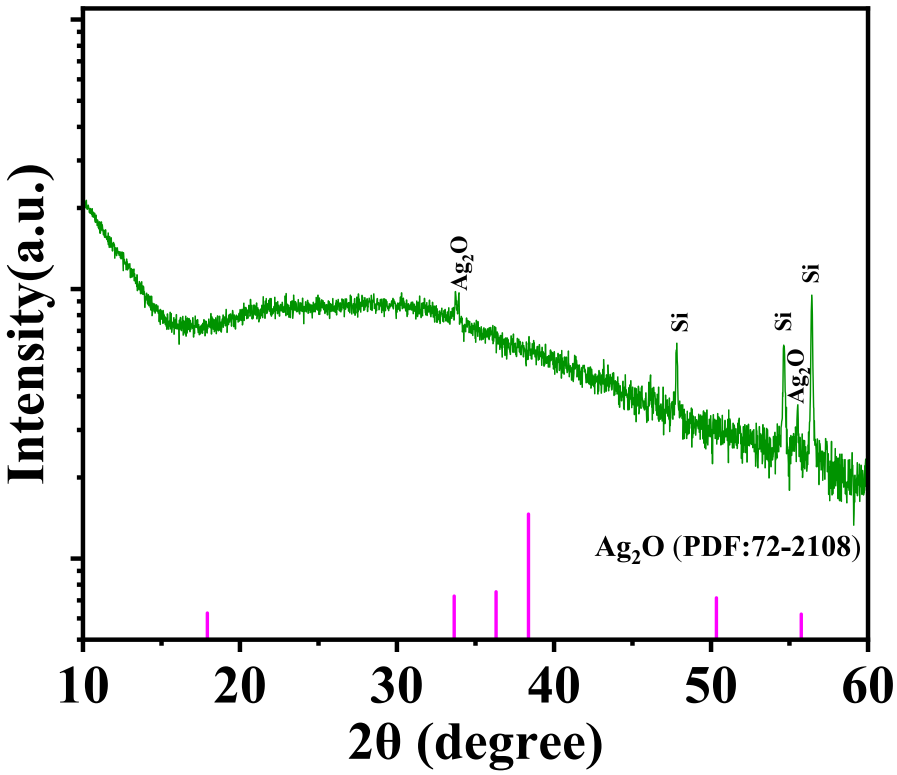

Figure S1 XRD pattern of Ag_2O on SiO_2/Si substrate.

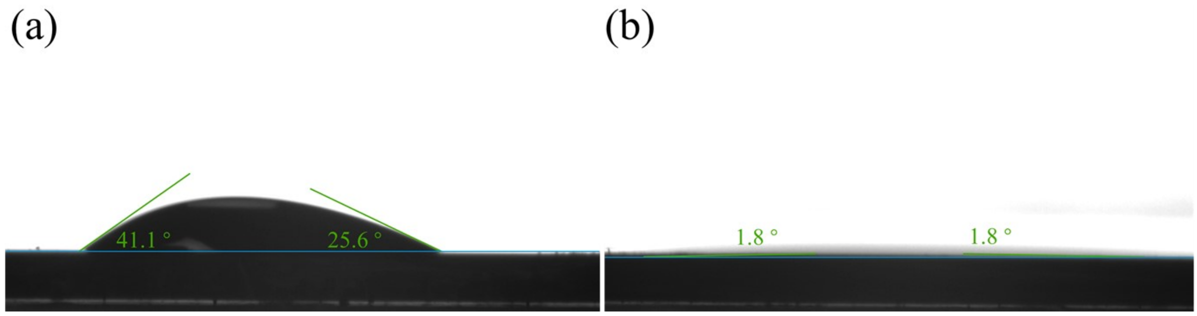

Figure S2 Contact angle test between (a) $AgBiS_2$ solution and SiO_2 substrate and (b) $AgBiS_2$ solution and Ag_2O.

Figure S3 Optical microscope picture of the original mask pattern of the university logo.

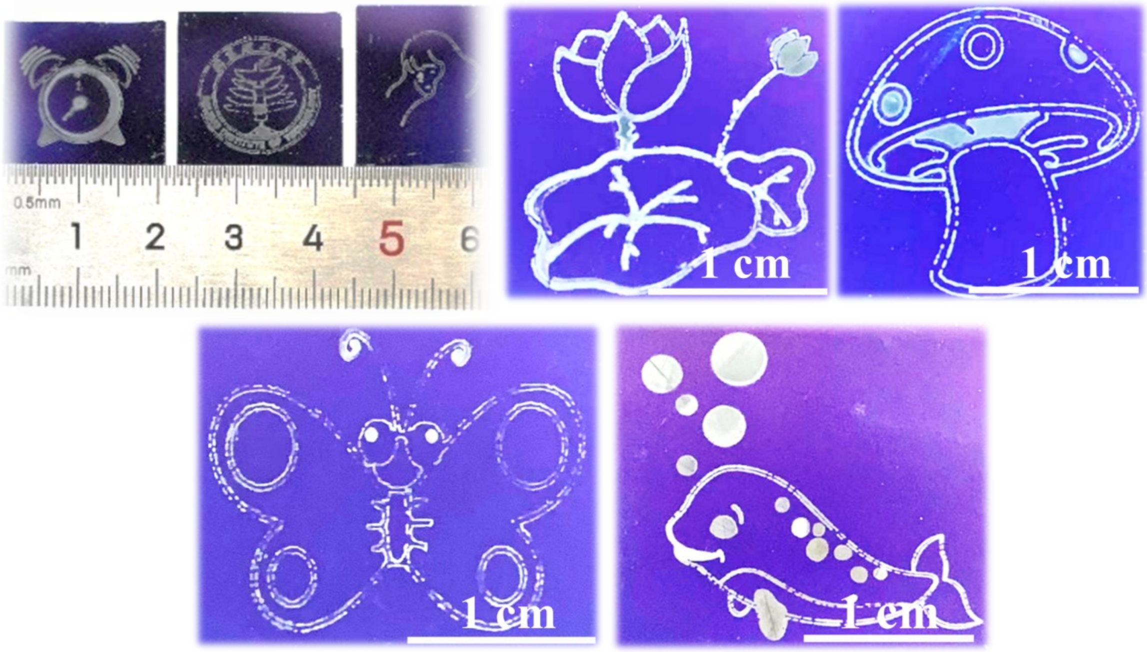

Figure S4 Photographs of centimeter-scaled patterns of Clock, University Logo, Human Face, Lotus, Mushroom, Butterfly, Peppa Pig and Shark on SiO_2/Si substrates based on the patterning process.

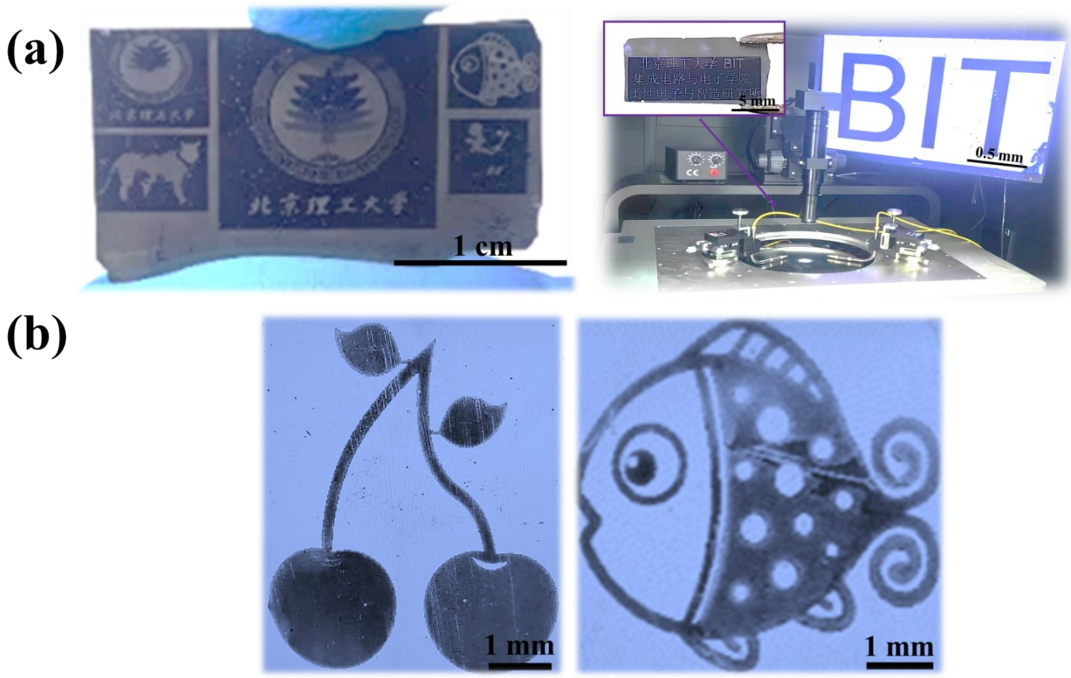

Figure S5 (a) Photographs of mini-patterns of university logo, animal schematics (left) and micro-letters of “BIT” stands for Beijing Institute of Technology (right); **(b)** Optical microscope photographs of Panda, Cherries and Goldfish on SiO_2/Si substrates based on the patterning process.

Figure S6 Optical microscope photographs of Goldfish, Tiger and Cherries on glass substrates based on the patterning process.

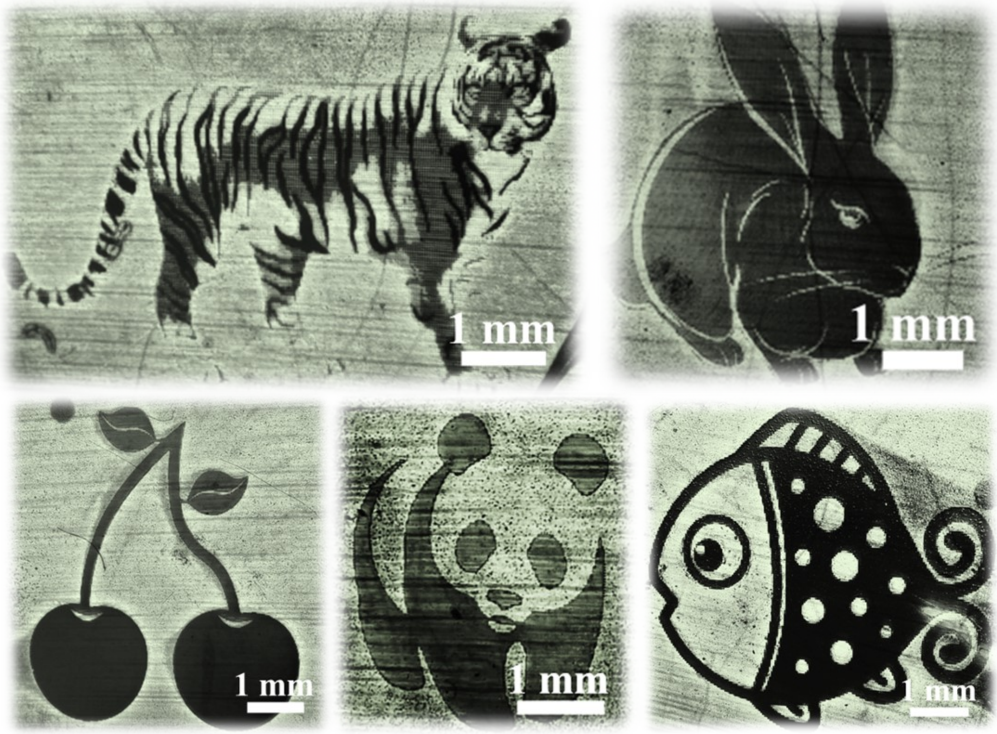

Figure S7 Optical microscope photographs of Tiger, Rabbit, Cherries, Panda and Goldfish on PET substrates based on the patterning process.

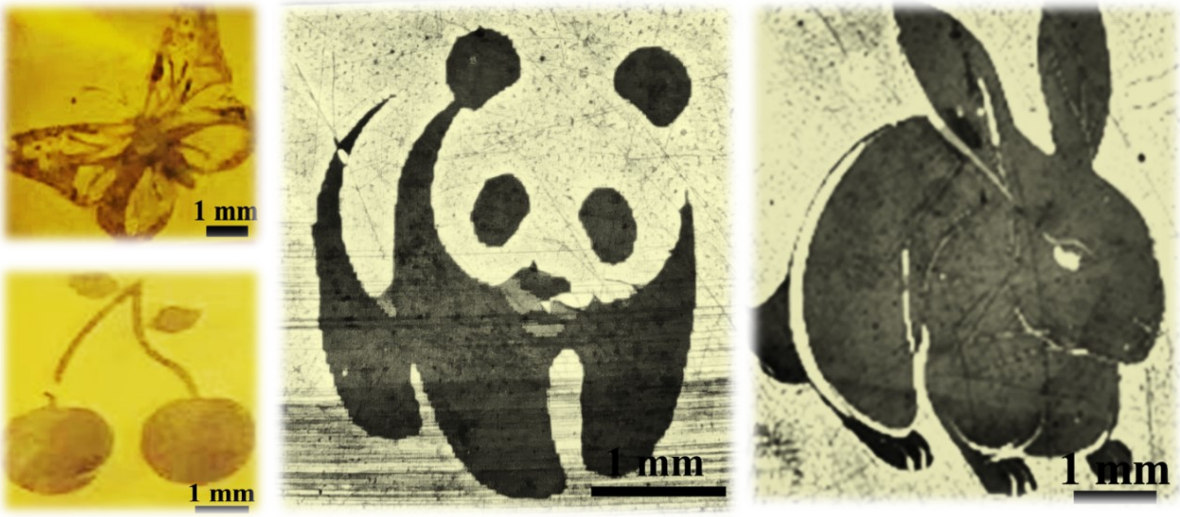

Figure S8 Photographs of Butterfly and Cherries (left) and optical microscope photographs of Panda and Rabbit (right) on PI substrates based on the patterning process.

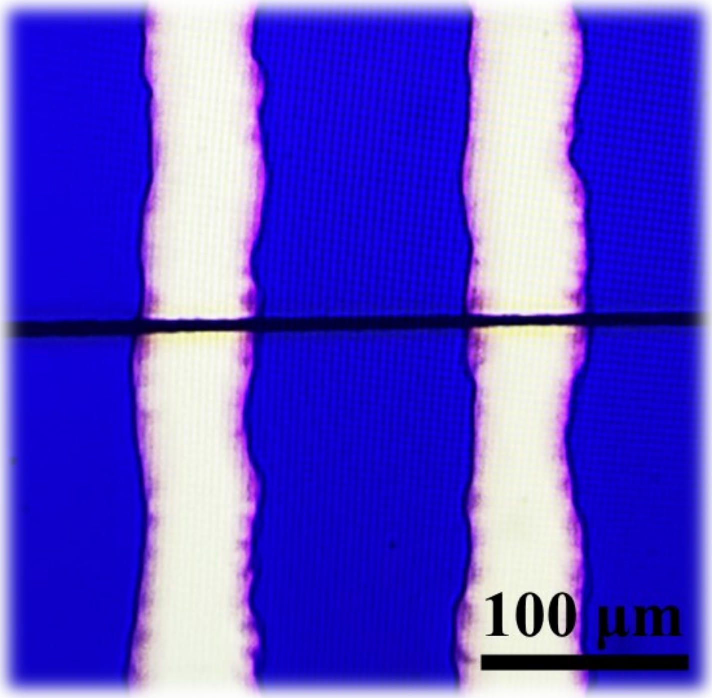

Figure S9 Optical microscope photographs of one-channel photoconductor.

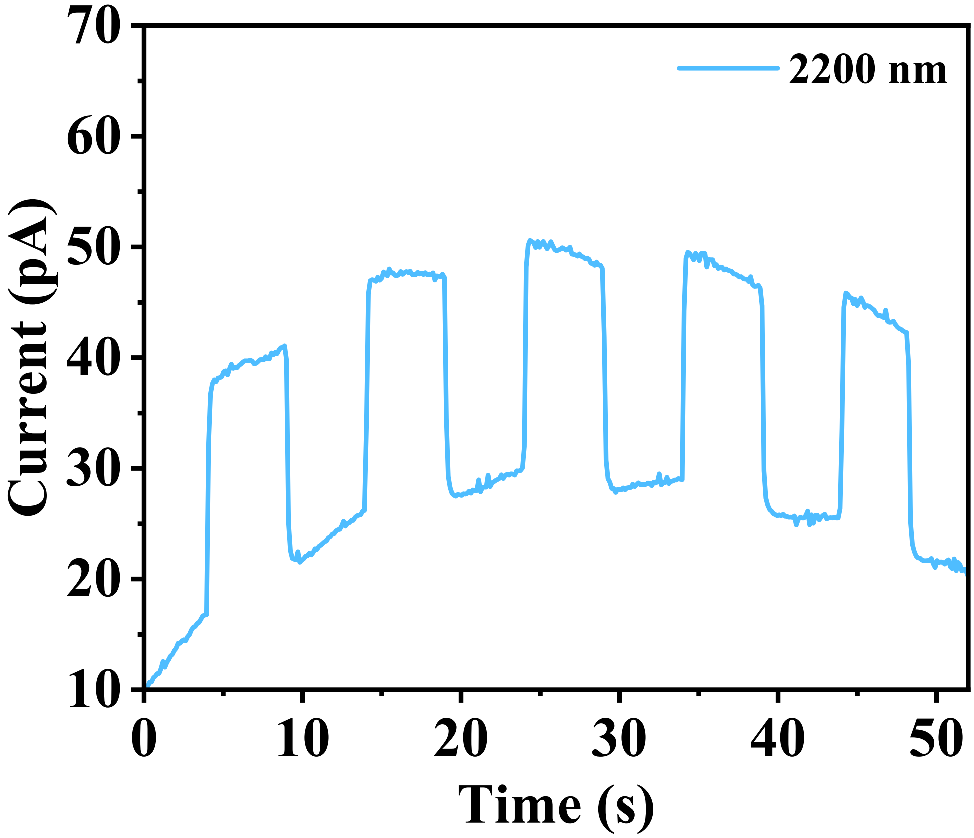

Figure S10 Photocurrent responses of one-channel photoconductor under 2200 nm illumination (2.5 W/cm^2).

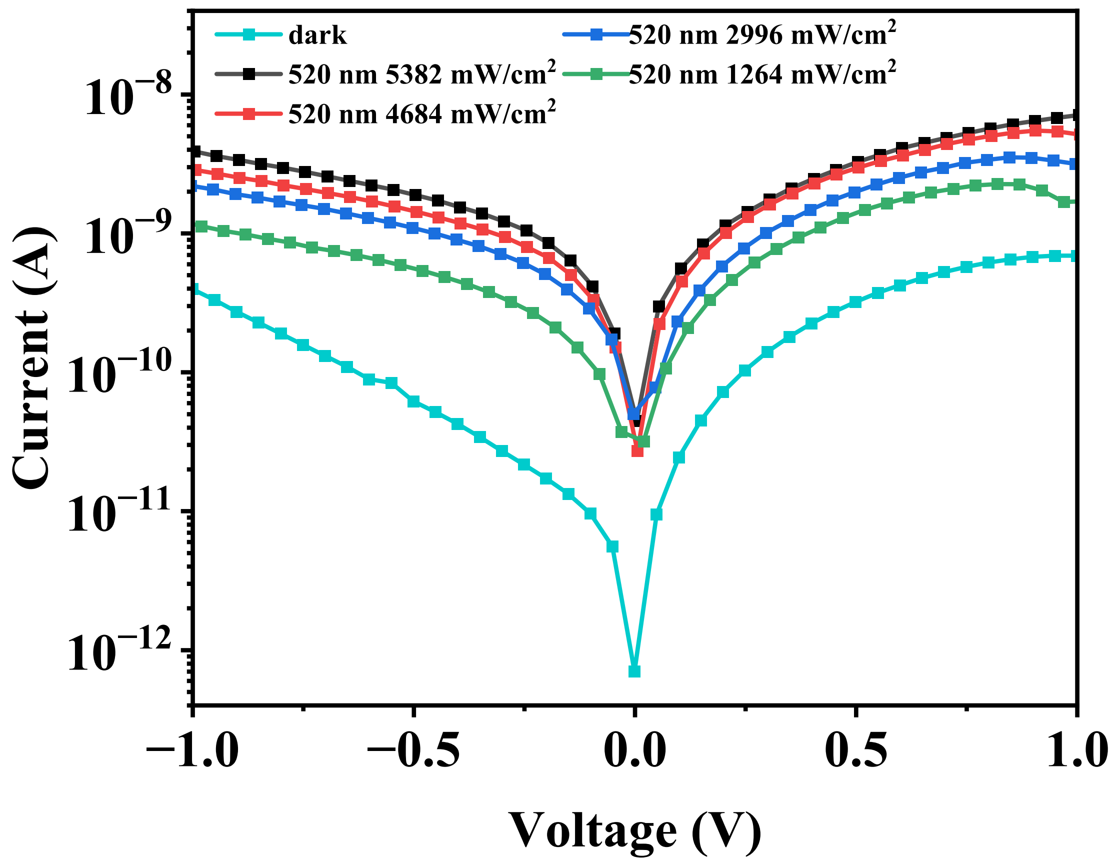

Figure S11 I-V characteristics of one-channel photoconductor under 520 nm illumination with different light intensities.

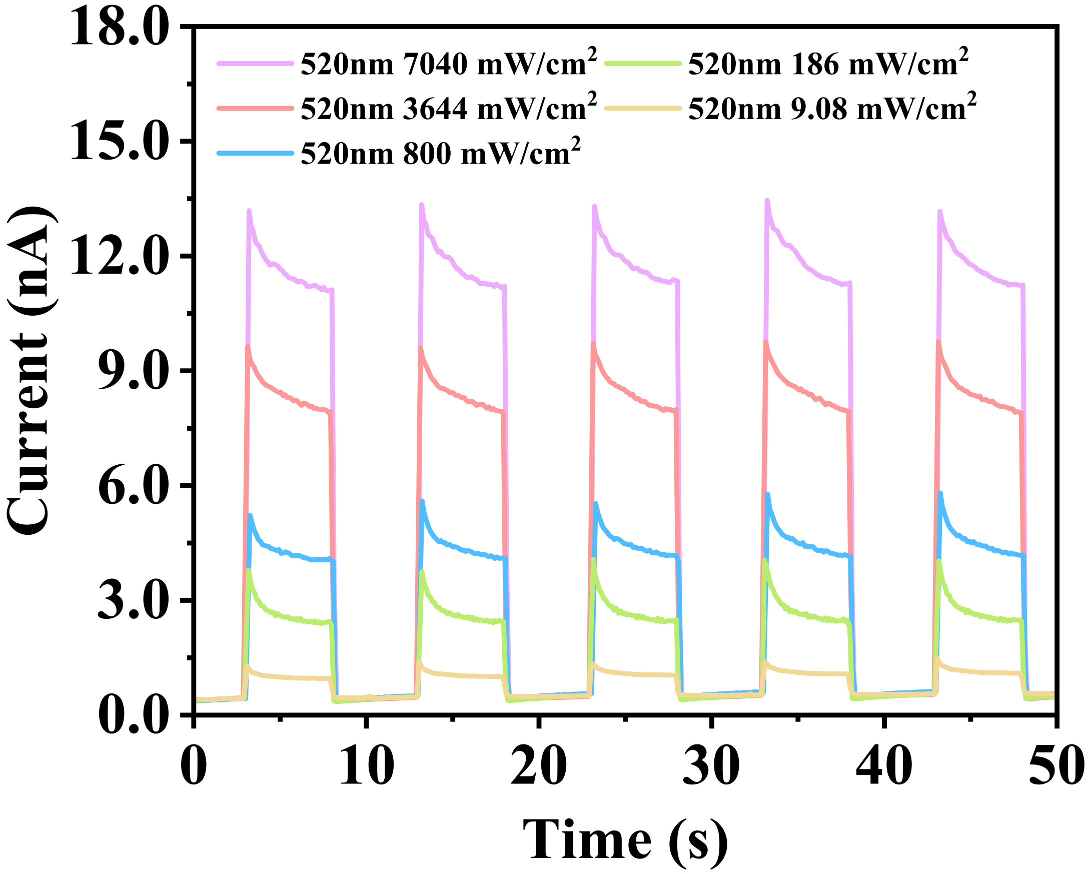

Figure S 12 Photocurrent responses of one-channel photoconductor under 520 nm illumination with different light intensities.

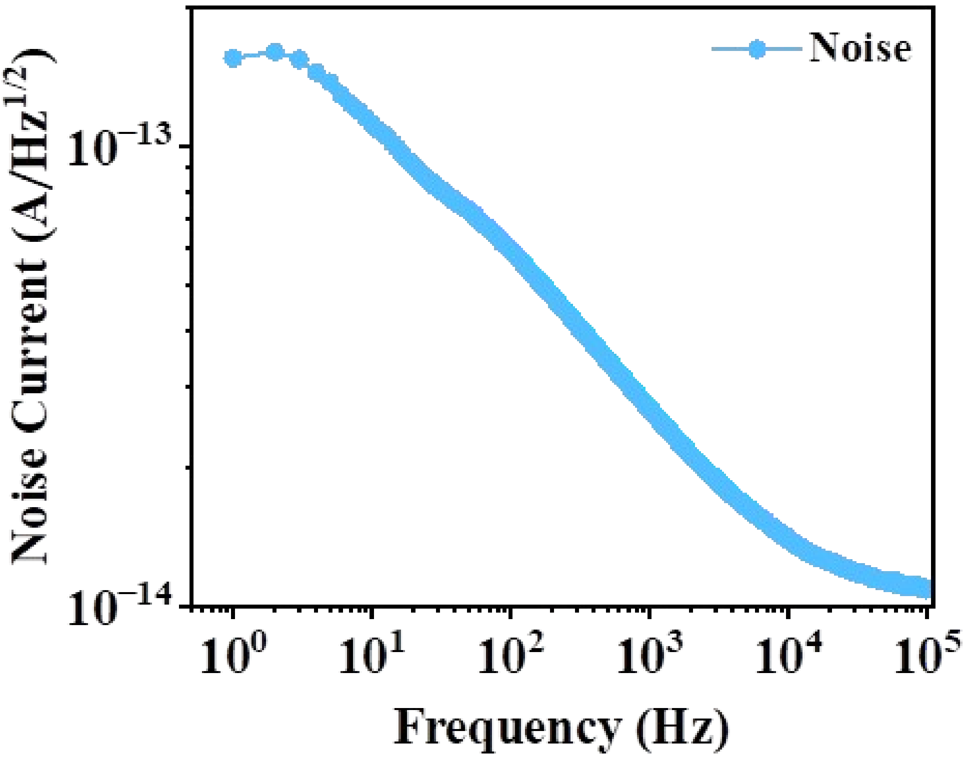

Figure S13 Photodetector noise testing.

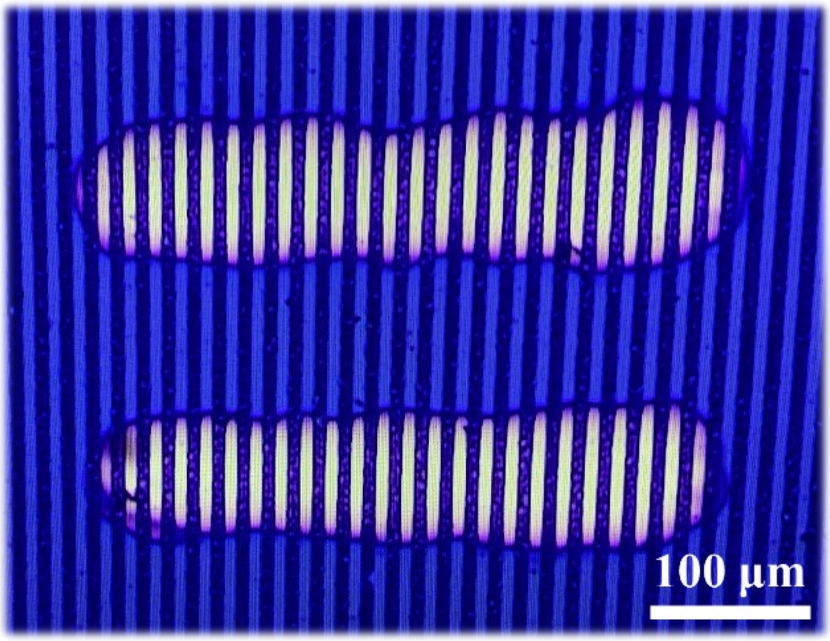

Figure S 14 Optical microscope photographs of a device of multiple “microroads”.

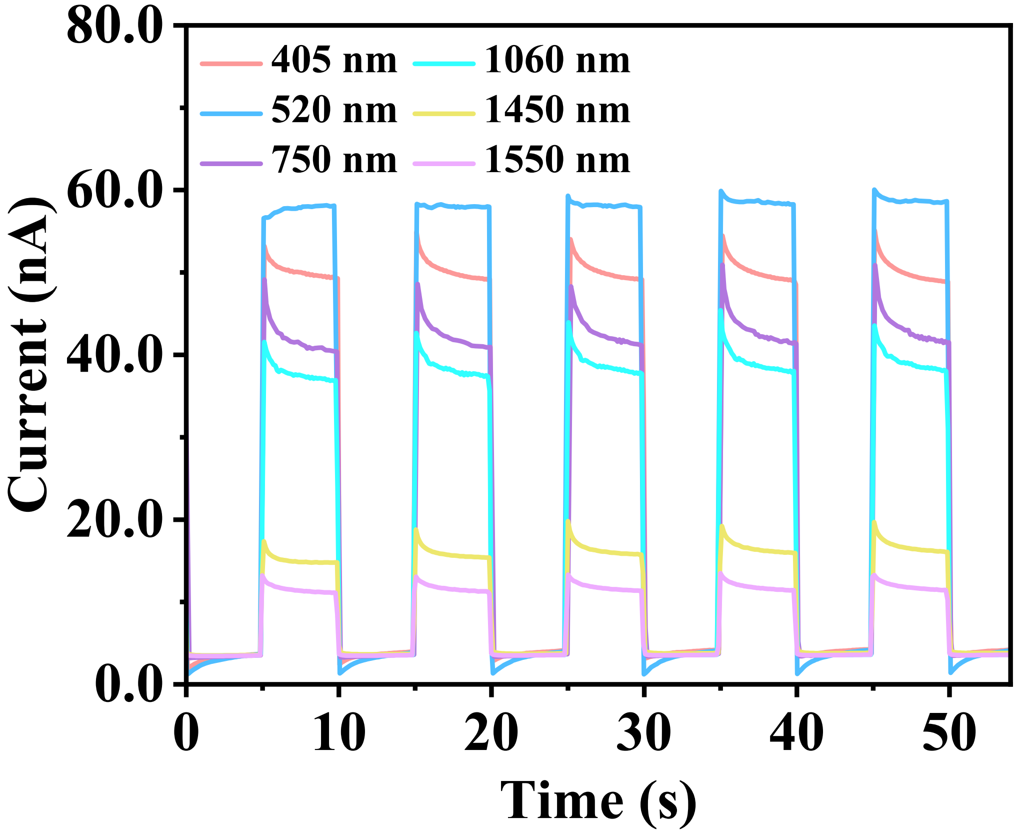

Figure S 15 R_λ and EQE of multiple-channels photodetector with different wavelengths under 0.5 W/cm^2 light intensity illumination.

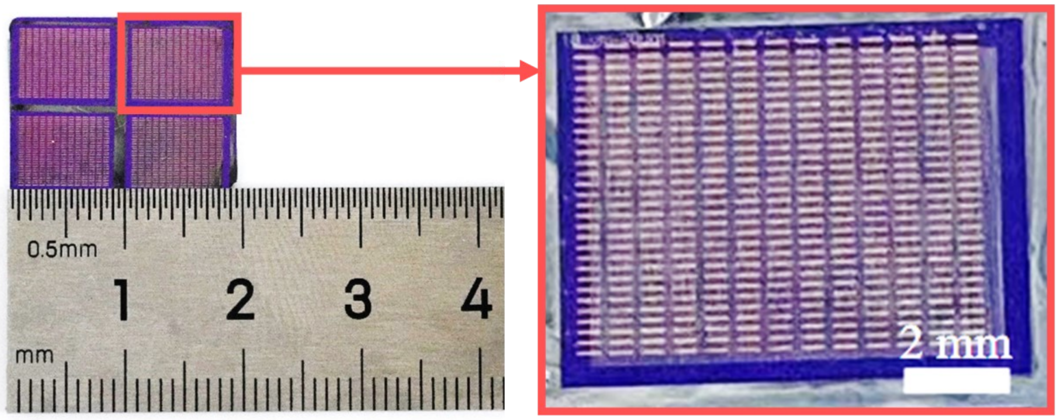

Figure S16 Photographs of a 28 × 12 pixel photodetector arrays.

Calculation Formula

Responsivity[1] (R_λ), external quantum efficiency[1] (EQE) and specific detectivity[2] (D*) can be calculated by the following equations:

$$R_\lambda = \frac{I_{ph} - I_{dark}}{P \cdot A}$$

$$EQE = \frac{Rhc}{q\lambda}$$

$$D^* = \frac{R_\lambda \sqrt{A\Delta f}}{i_n}$$

where I_{ph} is the photocurrent, I_{dark} is the dark current, P is the incident light intensity, A is the effective area of the photodetector, h is Planck's constant, c is the speed of light, q is the electron charge, i_n is the noise current spectral density, Δf is the noise bandwidth, here being 1 Hz and λ is the wavelength of the incident light.

The time required for the I_{ph} to rise from 10% to 90% and decay from 90% to 10% of its maximum value are defined as rise time (τ_r) and decay time (τ_d), respectively.

The 3dB bandwidth is an essential parameter to characterize the response speed of the system and is calculated as:[3-5]

$$f_{3dB} = \frac{0.443}{\tau_r}$$

References

1 L. Li, P. Wu, X. Fang, T. Zhai, L. Dai, M. Liao, Y. Koide, H. Wang, Y. Bando and D. Golberg, *Adv. Mater.*, 2010, **22**, 3161-3165.

2 X. Gong, M. Tong, Y. Xia, W. Cai, J. S. Moon, Y. Cao, G. Yu, C. L. Shieh, B. Nilsson and A. J. Heeger, *Science*, 2009, **325**, 1665-1667.

3 L. Dou, Y. M. Yang, J. You, Z. Hong, W. H. Chang, G. Li and Y. Yang, *Nat. Commun.*, 2014, **5**, 5404.

4 F. P. García de Arquer, A. Armin, P. Meredith and E. H. Sargent, *Nat. Rev. Mater.*, 2017, **2**.

5 C. Bao, Z. Chen, Y. Fang, H. Wei, Y. Deng, X. Xiao, L. Li and J. Huang, *Adv. Mater.*, 2017, **29**.