Electronic Supplementary Information

Mixed-dimensional PdSe$_2$/SiNWA heterostructures based photovoltaic detectors towards self-driven, broadband photodetection, infrared imaging and humidity sensing

Di Wu,$^a$ Cheng Jia,$^a$ Fenghua Shi,$^b$ Longhui Zeng,*$^c$ Pei Lin,$^a$ Lin Dong,$^a$ Zhifeng Shi,$^a$ Yongtao Tian,$^a$ Xinjian Li,$^a$ and Jiansheng Jie*$_d$

$^a$School of Physics and Microelectronics, Key Laboratory of Material Physics, Ministry of Education, Zhengzhou University, Zhengzhou, Henan 450052, China
$^b$College of Physics and Electronic Information, Anhui Normal University, Wuhu, Anhui 241000, China
$^c$Department of Applied Physics and Materials Research Center, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, China
$^d$Institute of Functional Nano & Soft Materials (FUNSOM), Soochow University, Suzhou, Jiangsu 215123, China

*Corresponding author: E-mail: lhzeng.hfut@gmail.com, E-mail: jsjie@suda.edu.cn
Fig. S1 (a) SEM image and the EDS mappings for (b) Pd and (c) Se elements.

Fig. S2 Schematic diagram of fabrication process for a PdSe$_2$/SiNWA heterostructure device.
Fig. S3 Digital photograph of the as-fabricated PdSe₂/SiNWA heterostructure device, which is mounted on a circuit board for measurements.

Fig. S4 $I-V$ curves of Au-PdSe₂-Au and In/Ga-Si-In/Ga.
Fig. S5 Theoretical simulations of PdSe$_2$/SiNW structure. Simulated electric field energy distribution for the PdSe$_2$/SiNWs with diameter of (a, b) 100 nm, (c, d) 120 nm, (e, f) 160 nm, (g, h) 180 nm, and (i, j) 200 nm.
Fig. S6 Enlarged $I$-$V$ curves of the PdSe$_2$/SiNWA heterostructure device, which show the photovoltaic behaviors of the device under 980 nm light illumination with different light intensities.

Fig. S7. The photoresponse property of the SiNWA under 980 nm light illumination.
Fig. S8 Dark current of the PdSe$_2$/SiNWA heterostructure device measured at zero external bias voltage.

Fig. S9 Dependence relation between sensitivity and light intensity of 780 nm at 75% RH.

Fig. S10 The photoresponse and humidity sensing properties of PdSe$_2$/SiNWA heterostructure device after storage in the air for six months.