Electronic Supplementary Information

Mixed-dimensional $PdSe_2$/SiNWA heterostructures based photovoltaic detectors towards self-driven, broadband photodetection, infrared imaging and humidity sensing

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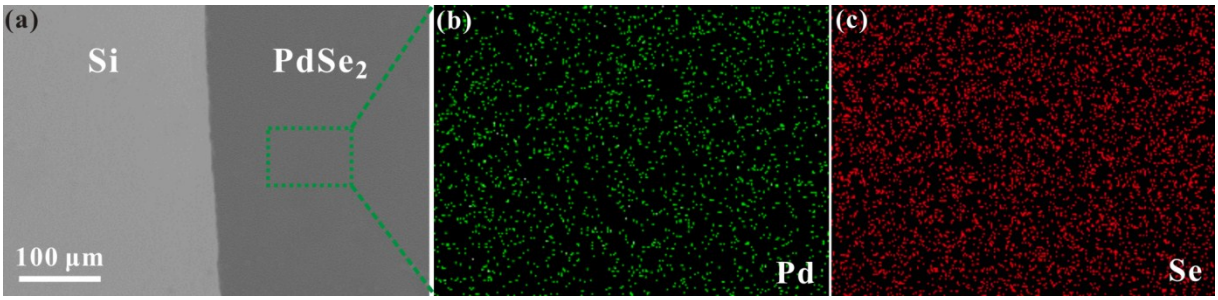

Fig. S1 (a) SEM image and the EDS mappings for (b) Pd and (c) Se elements.

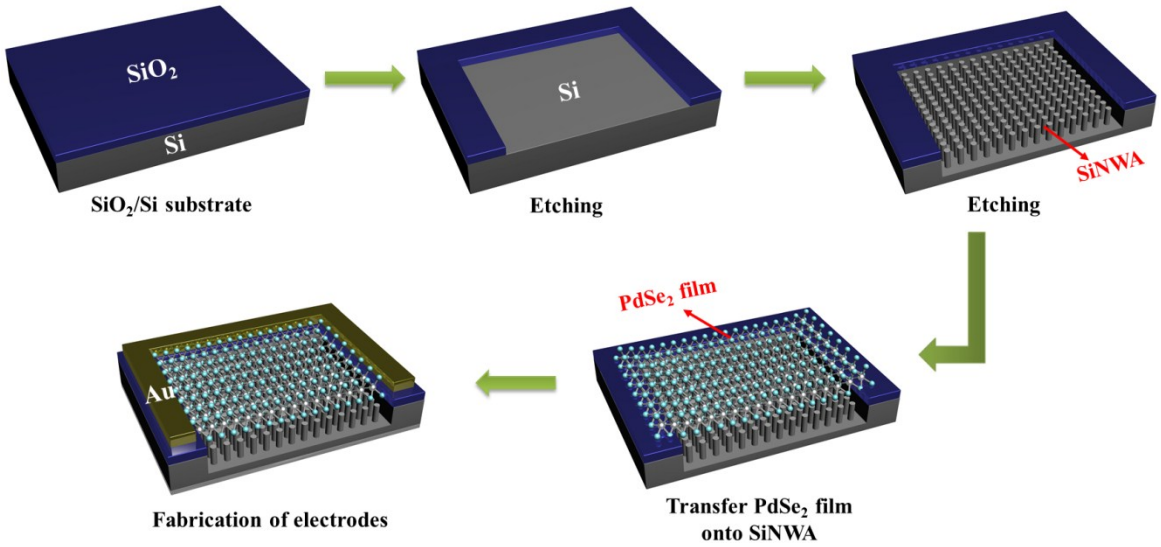

Fig. S2 Schematic diagram of fabrication process for a $PdSe_2$/SiNWA heterostructure device.

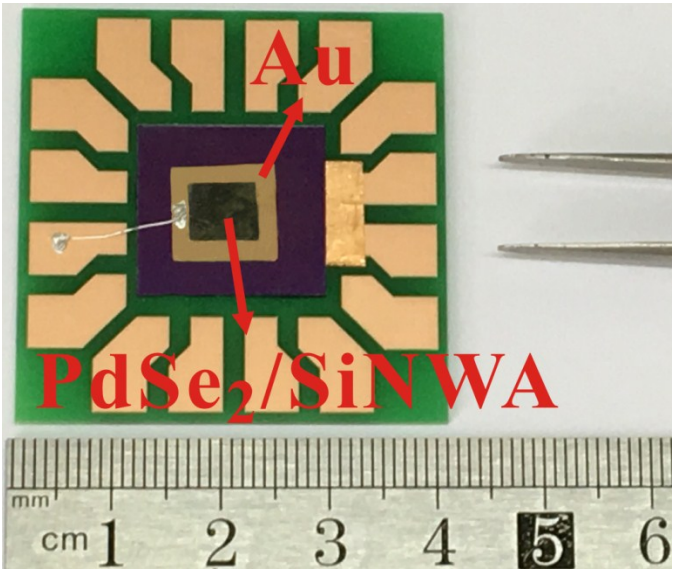

Fig. S3 Digital photograph of the as-fabricated $PdSe_2$/SiNWA heterostructure device, which is mounted a circuit board for measurements.

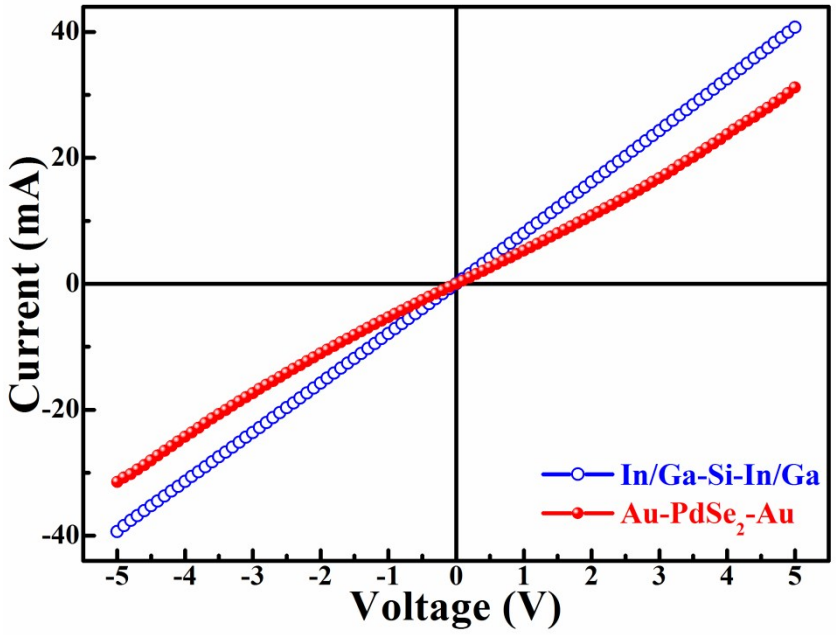

Fig. S4 *I-V* curves of Au-$PdSe_2$-Au and In/Ga-Si-In/Ga.

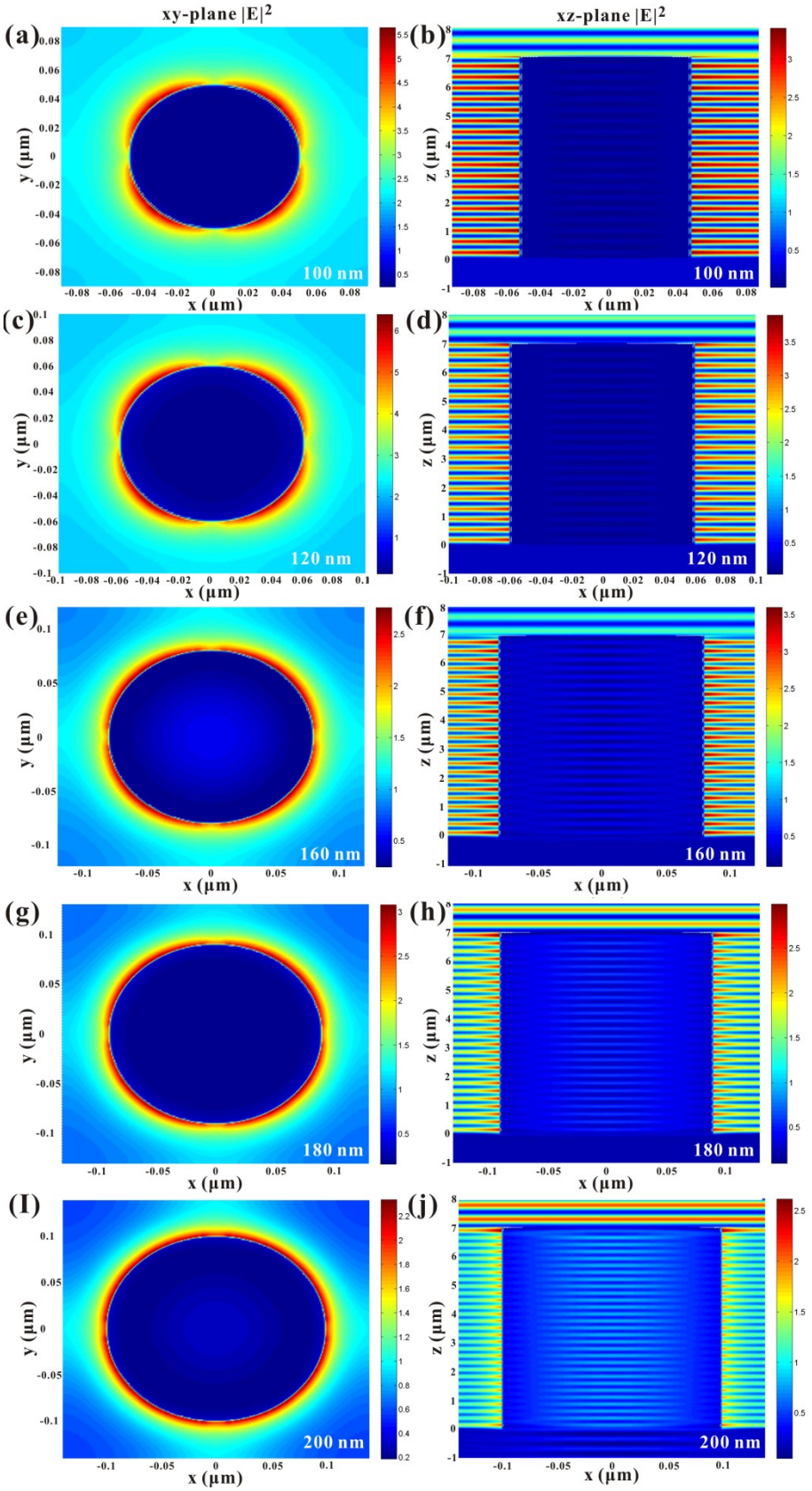

Fig. S5 Theoretical simulations of $PdSe_2$/SiNWA structure. Simulated electric field energy distribution for the $PdSe_2$/SiNWs with diameter of (a, b) 100 nm, (c, d) 120 nm, (e, f) 160 nm, (g, h) 180 nm, and (i, j) 200 nm.

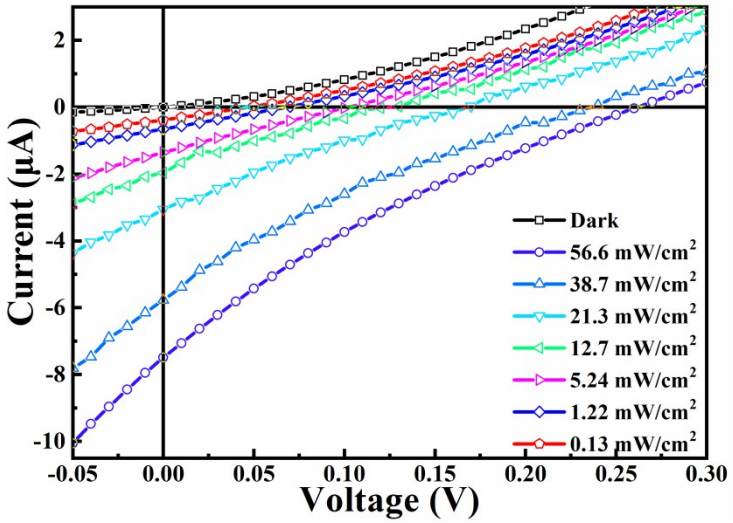

Fig. S6 Enlarged *I-V* curves of the $PdSe_2$/SiNWA heterostructure device, which show the photovoltaic behaviors of the device under 980 nm light illumination with different light intensities.

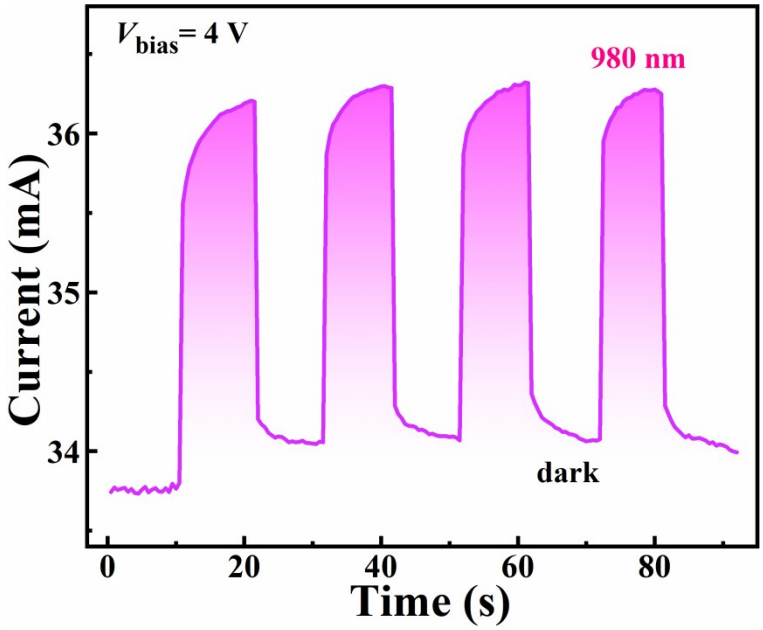

Fig. S7. The photoresponse property of the SiNWA under 980 nm light illumination.

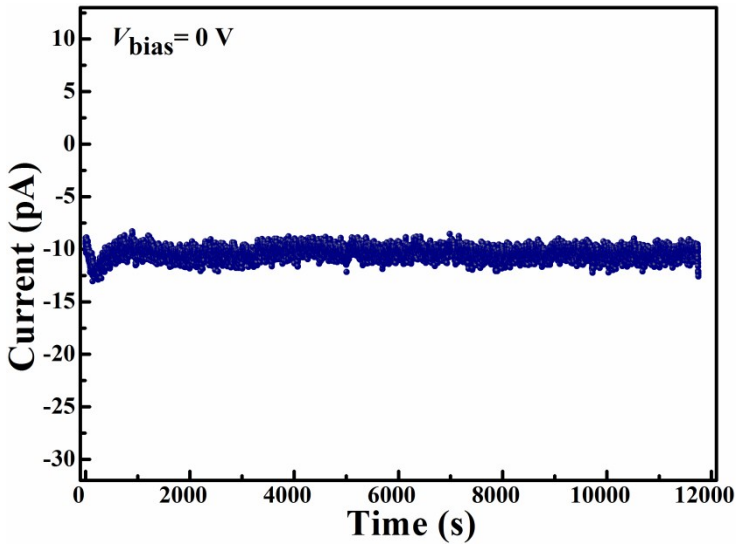

Fig. S8 Dark current of the $PdSe_2$/SiNWA heterostructure device measured at zero external bias voltage.

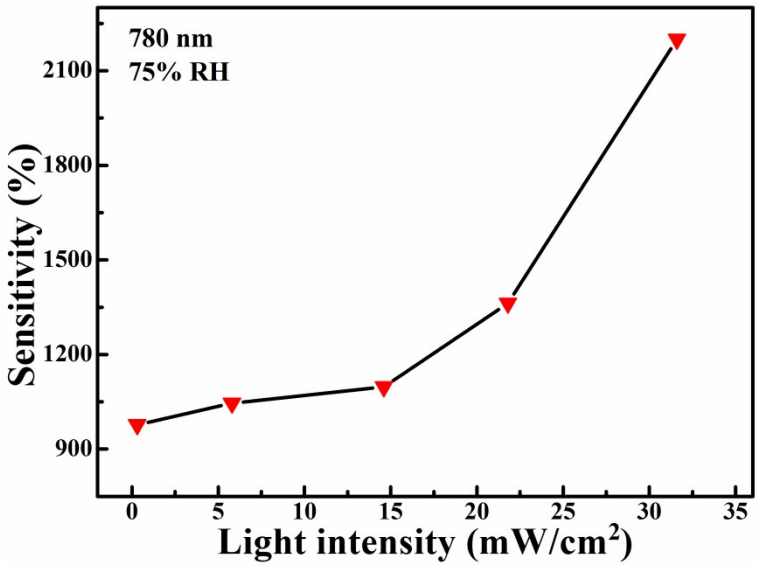

Fig. S9 Dependence relation between sensitivity and light intensity of 780 nm at 75% RH.

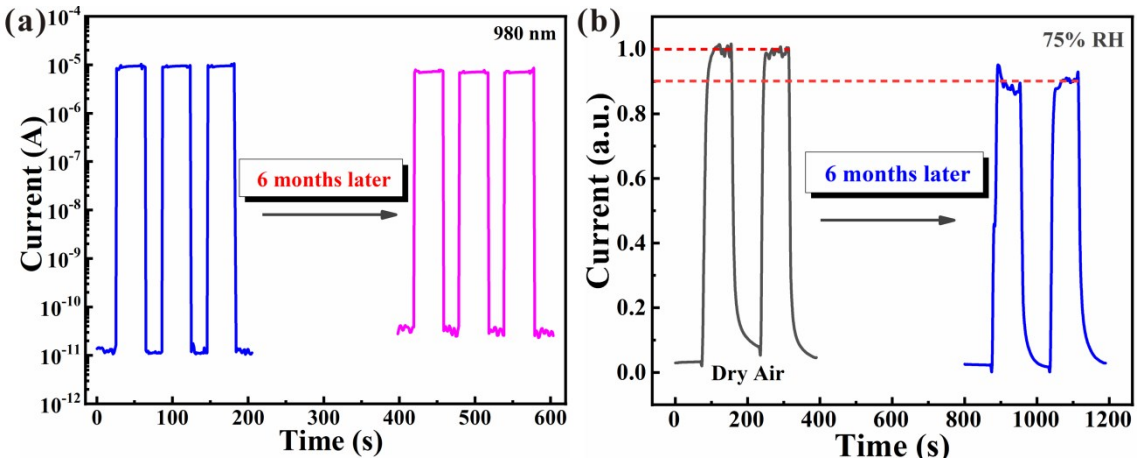

Fig. S10 The photoresponse and humidity sensing properties of $PdSe_2$/SiNWA heterostructure device after storage in the air for six months.