Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Broadband self-powered photodetector based on $NiPS_3$

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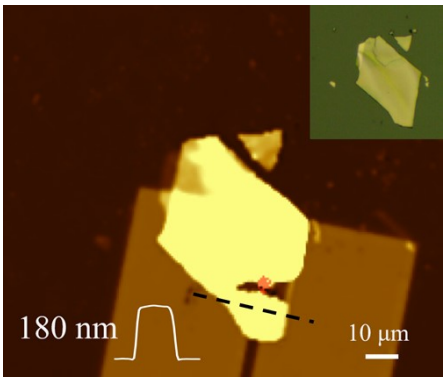

Fig. S1 White light interferometer measurement of a $NiPS_3$ flake. The inset shows the optical image of the flake before transferring onto the gold electrodes.

According to the measurement by white light interferometer, the thickness for the $NiPS_3$ thin film of the device was 180 nm.

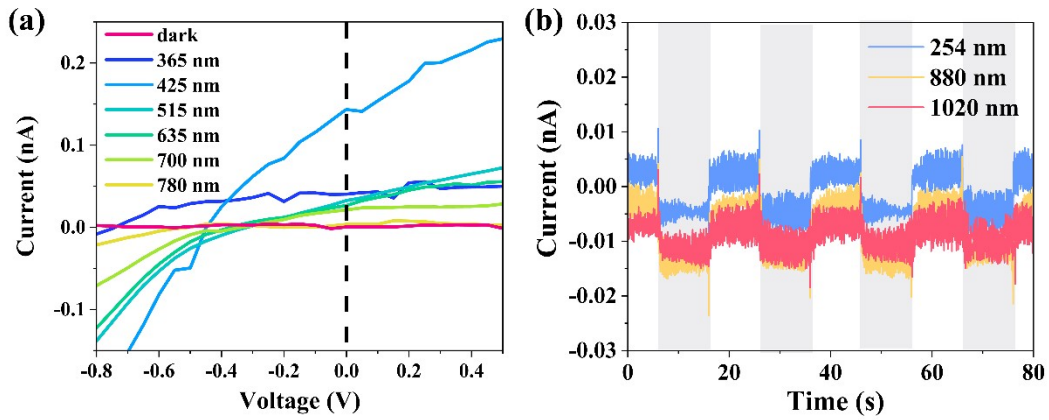

Fig. S2 (a) Zoomed-in I-V curves of Fig. 3b under 365, 425, 515, 635, 700, and 780 nm wavelength light irradiation. (b) I-t curves for 254 nm, 880 nm and 1020 nm wavelengths at -5 V bias.

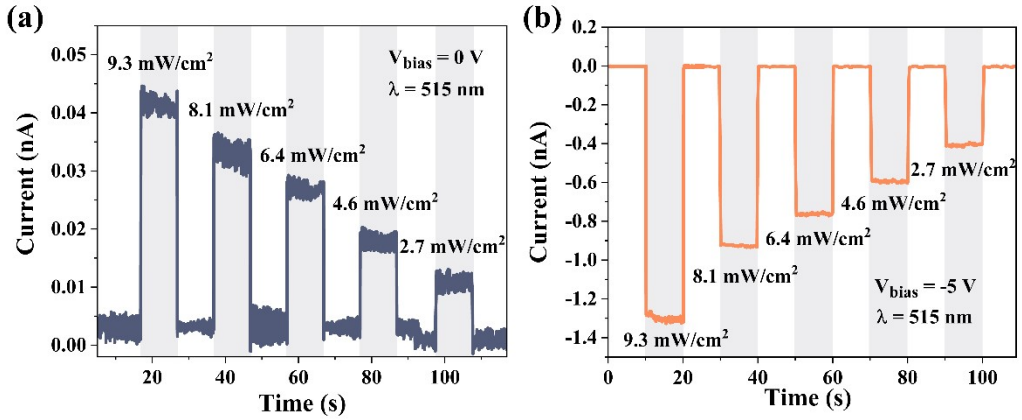

Fig. S3 The on/off photoelectric response of a $NiPS_3$-based MSM photodetector with asymmetric electrode contacts at 0 V (a) and -5 V (b) bias voltages under 515 nm illumination at different power densities.

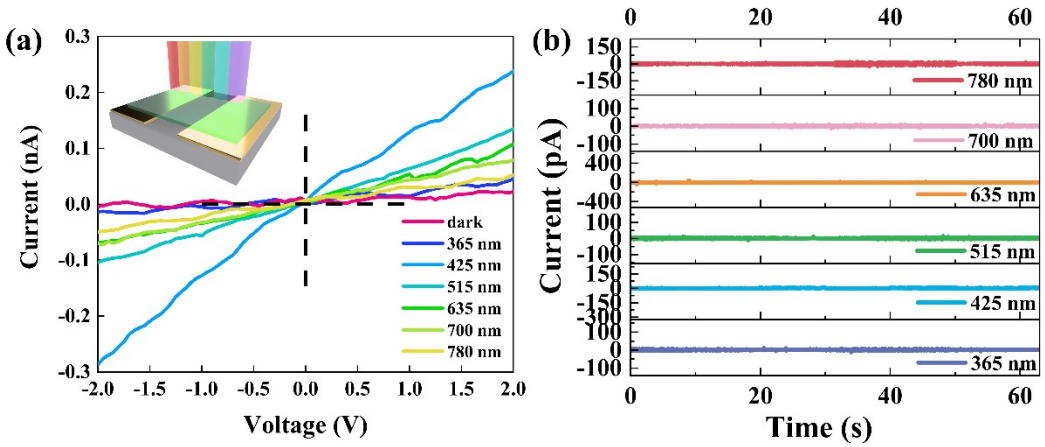

Fig. S4 (a) I-V curves of a symmetrical device under illumination of different light wavelengths. The inset shows a schematic device structure. (b) Zero-bias I-t curves of the symmetric device at different wavelengths.

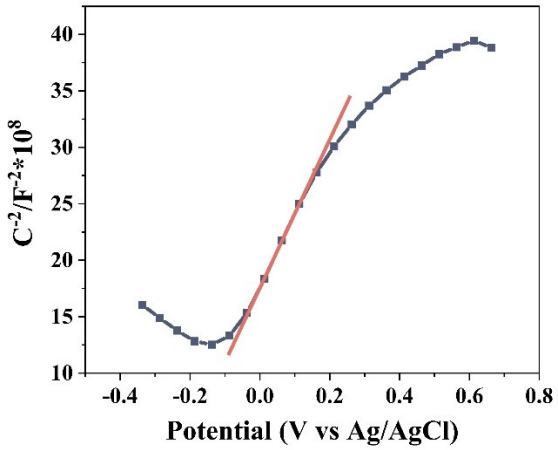

Fig. S5 Measured Mott-Schottky curve of $NiPS_3$.

The positive slope of the Mott-Schottky curve for $NiPS_3$ indicates an n-type semiconductor behavior.

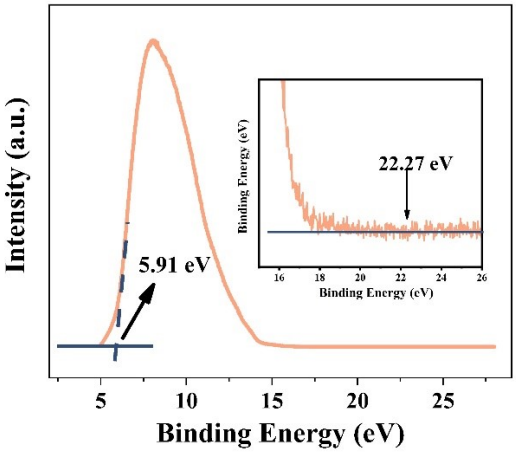

Fig. S6 UPS measurement of $NiPS_3$.

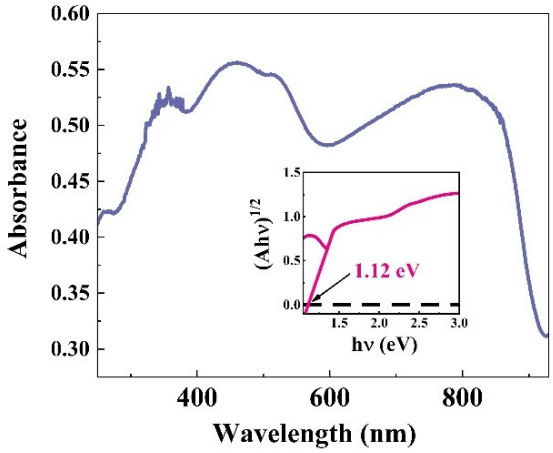

Fig. S7 the UV-vis DRS of $NiPS_3$. The inset shows the tauc plot of the spectrum.

The energy band gap (E_g) can be estimated using the conventional Tauc equation:

$$\alpha h\nu = A(h\nu - E_g)^{\frac{n}{2}} \quad (1)$$

where α is the absorption coefficient, $h\nu$ is the photon energy, A is the constant, and n = 4 for an indirectly allowed transition. According to Fig. S7, the optical band gap of $NiPS_3$ is 1.12 eV.

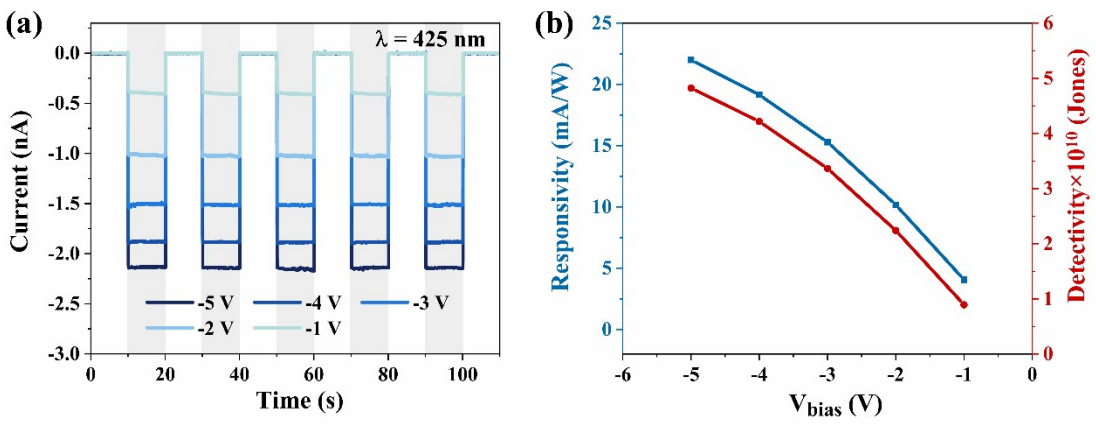

Fig. S8 I-t curves (a) and the corresponding calculated responsivity and detectivity (b) for a $NiPS_3$-based MSM photodetector with asymmetric electrode contacts at different bias voltages under 425 nm wavelength illumination.

Table S1 Photoelectric response comparison of self-powered photodetectors

Photodetector	λ (nm)	Bias (V)	R (mA/W)	D* (Jones)	I_{photo}/I_{dark}	rise/decay time (ms)	Ref.
$Ba_2Bi_{1.5}Nb_{0.5}O_6$	365~760	0	0.078	1.13×10^8	-	-	1
Ga_2O_3	254	0	0.149	3.1×10^9	-	75.9/45.1	2
$CsPbBr_3$	355,500	0	0.24	-	-	6.8×10^{-4}/0.43	3
Cs_2SnI_6	white light	0	1.07	6.03×10^{10}	-	-	4
PEDOT:PSS/α-Ga_2O_3	245,540	0	1.43	-	-	-/537	5
ZnO NRs/PbS/RGO	350~700	0	250	8.3×10^4	-	65/74	6
$AgIn_5Se_8/FePSe_3$	365~1020	0	3.8×10^{-3}	5.7×10^8	350	20/20	7
NiO/Ga_2O_3	254	0	5.7×10^{-2}	5.45×10^9	122	$340/3.7\times10^3$	8
$NiPS_3$	365~780	0	2.3	6.2×10^9	40	<40/<40	This work

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