Stable and Self-Powered $SnPS_3$ Photodetector with Broadband Response from Visible to Near-Infrared

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Table S1 Optical power density of light for different wavelengths and optical power levels.

P (mW cm^{-2}) / Wavelength (nm)	I	II	III
Simulated sunlight	160	217	258
400 nm	63	86.5	114
520 nm	70.4	96	128
600 nm	60.3	83.5	110.7
700 nm	53.4	73.3	98.3
800 nm	30	41.4	53
900 nm	33.3	45.5	60

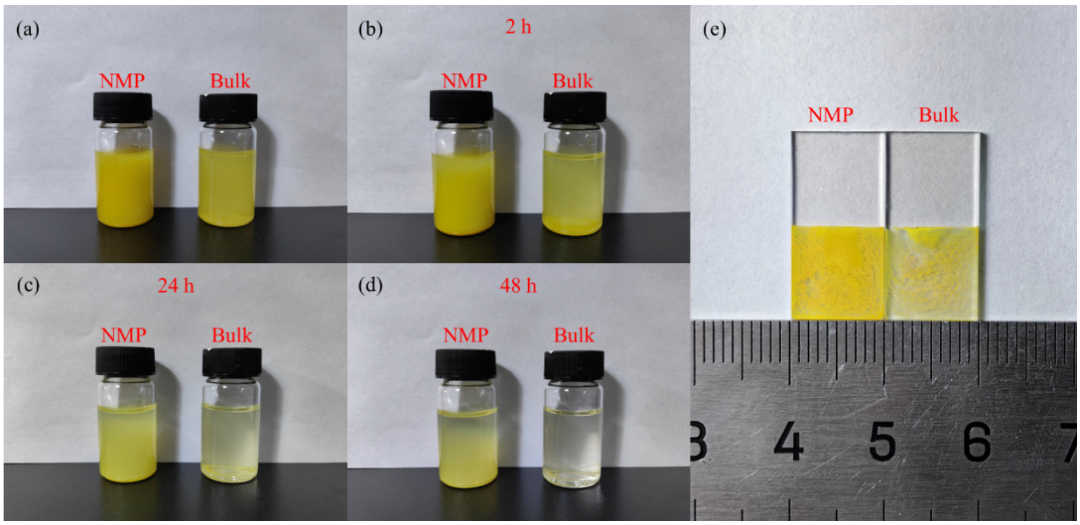

Fig.S1 The dispersibility of $SnPS_3$ sample in DMF solutioin.

Dispersion Stability Test

To demonstrate the difference in dispersion between bulk $SnPS_3$ powder and NMP liquid-phase exfoliated $SnPS_3$ powder in DMF, a dispersion stability test was designed as follows. Equal masses of bulk $SnPS_3$ powder and liquid-phase exfoliated $SnPS_3$ powder were separately weighed and placed into two clean sample vials. An equal volume of DMF solution containing PVDF was added to each vial. The two dispersions were sonicated for 40 minutes and then left to stand for 48 hours. The dispersion states in the vials were observed and recorded. The experimental results are shown in Fig. S1 below. Fig. S1(a) shows the initial state after standing. The dispersion of the NMP liquid-phase exfoliated $SnPS_3$ powder exhibited a darker and more uniform color, indicating better dispersion stability. After standing for 2 hours, as shown in Fig. S1(b), the dispersion of the bulk powder began to sediment, and the solution color started to lighten. When the standing time reached 24 hours, as shown in Fig. S1(c), significant sedimentation occurred in the bulk $SnPS_3$ dispersion, and the solution color became noticeably lighter. After 48 hours of standing, as shown in Fig. S1(d), the bulk $SnPS_3$ dispersion had almost completely settled, and the solution became nearly transparent. In contrast, the NMP liquid-phase exfoliated $SnPS_3$ dispersion still maintained significant dispersion stability. Therefore, it can be concluded that the NMP liquid-

phase exfoliated sample possesses superior dispersibility in DMF solvent. Furthermore, Fig. S1(e) shows the working electrodes fabricated from bulk $SnPS_3$ and NMP liquid-phase exfoliated $SnPS_3$. The film formed by the NMP liquid-phase exfoliated $SnPS_3$ on the conductive substrate is more uniform. In summary, liquid-phase exfoliation reduces the particle size of $SnPS_3$, leading to better dispersibility in DMF solution and consequently enabling the formation of a more uniform and dense sample film on the conductive substrate.

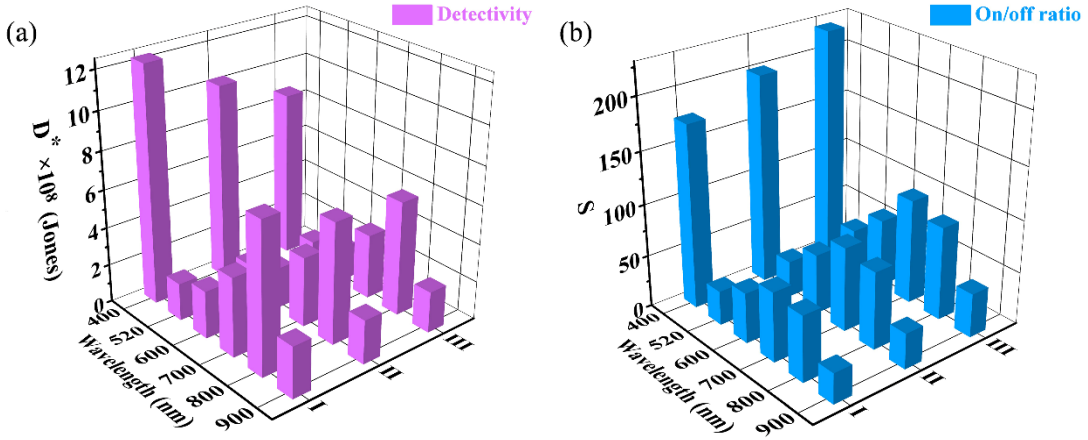

Figure S2: (a) Detectivity of the device under 0 V bias at various incident light wavelengths and power levels; (b) On/off ratio of the device under 0 V bias at various incident light wavelengths and power levels.

The formulas used are as follows:

$$D^* = \frac{R \cdot \sqrt{A}}{\sqrt{2e \cdot I_{\text{dark}}}}$$

where R is the responsivity (A/W), A is the effective illumination area (cm^2), e is the elementary charge (1.602×10^{-19} C), and I_{dark} is the dark current (A).

$$S = \frac{I_{\text{light}}}{I_{\text{dark}}}$$

where I_{light} is the photocurrent under illumination and I_{dark} is the dark current.

Table S2: Performance comparison of MPX_3 ($FePS_3$, $FePSe_3$, $NiPS_3$, $MnPS_3$, $MnPSe_3$, $SnPS_3$)-based PEC-type photodetectors.

Material	Electrolyte	Response spectrum (nm)	Bias (V)	Light intensity (mW cm^{-2})	J_{ph} (μA cm^{-2})	τ_r/τ_d (ms)	References
$FePS_3$	Na_2SO_4 (0.5 M)	365~730	0	150	0.542 (simulated sunlight)	256/279	[1]
$FePSe_3$	Na_2SO_4 (0.1 M)	400~800	0	114.0	0.19 (400 nm)	30/50	[2]
$NiPS_3$	KOH (0.1 M)	simulated sunlight	0	100.00	0.724 (simulated sunlight)	~5800	[3]
$MnPS_3$	Na_2SO_4 (0.3 M)	350~700	0	19.80	0.26 (350 nm)	400/2100	[4]
$MnPSe_3$	Na_2SO_4 (0.1 M)	400~800	0	114.0	0.77 (400 nm)	10/15	[5]
$SnPS_3$	HCl (0.1 M)	400~900	0	114.0	14.12 (400 nm)	75/91	This work

References

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