

Supporting Information:

**Flexible, Self-Powered UVC Photodetectors Enabled by
Low-Temperature Solution-Processed SnO₂:PEI Nanocomposites**

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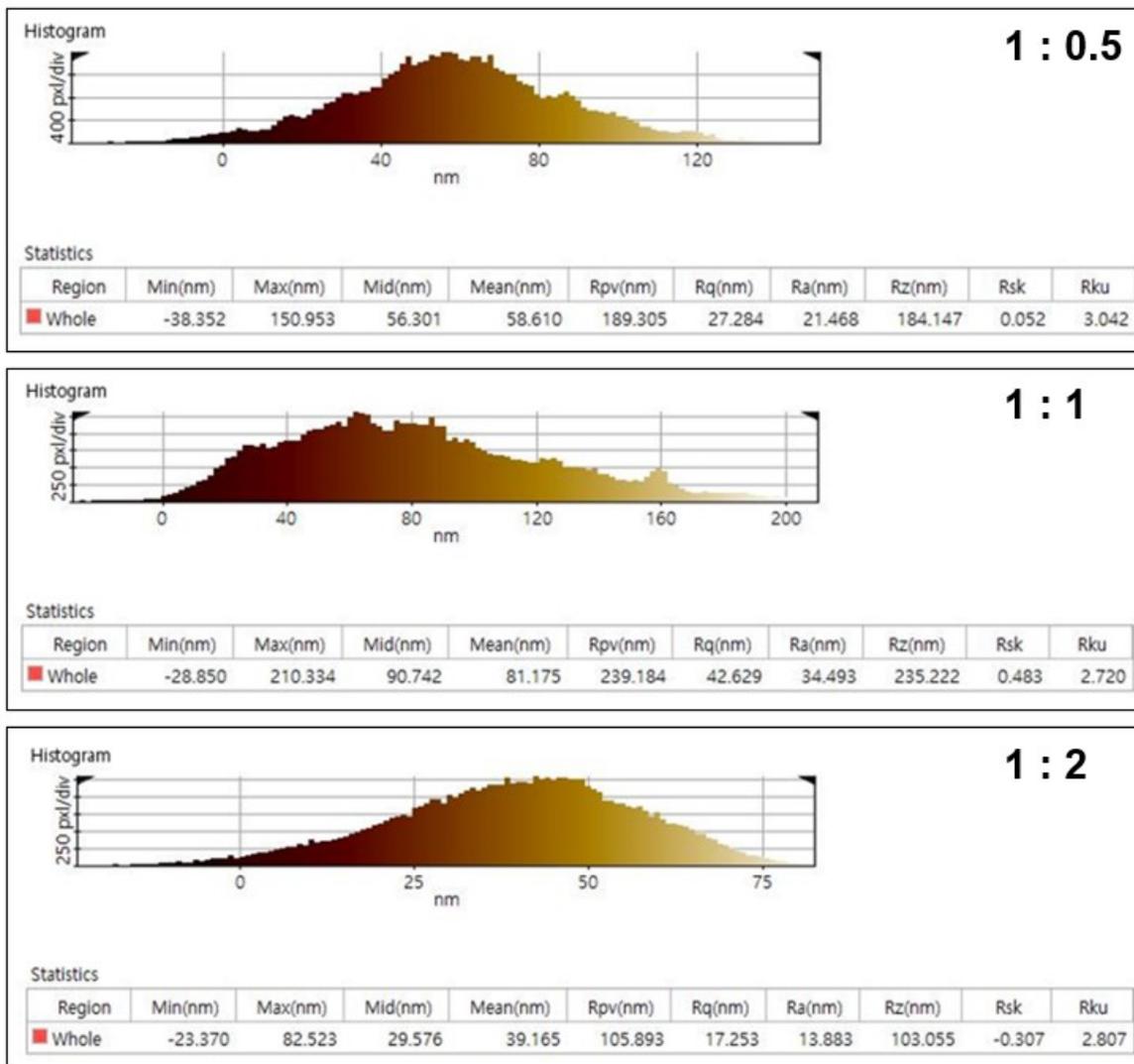


Figure S1. AFM surface roughness of SnO₂/PEI films at different SnO₂/PEI weight ratios.

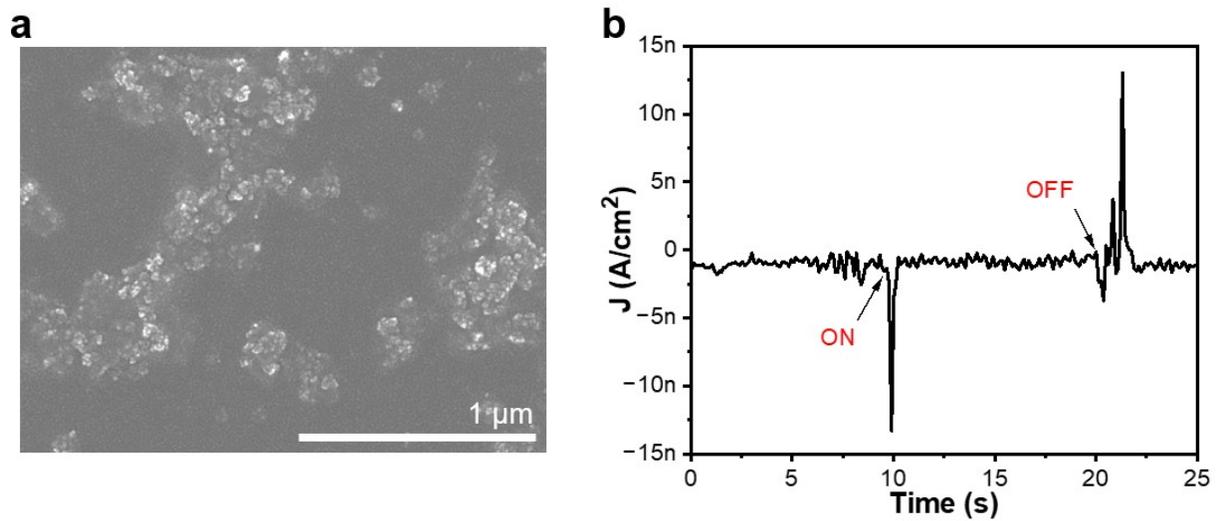


Figure S2. (a) SEM image of the pristine SnO₂ film (without a PEI binder) and (b) J - t curve at 0 V for the device based on the pristine SnO₂ film.

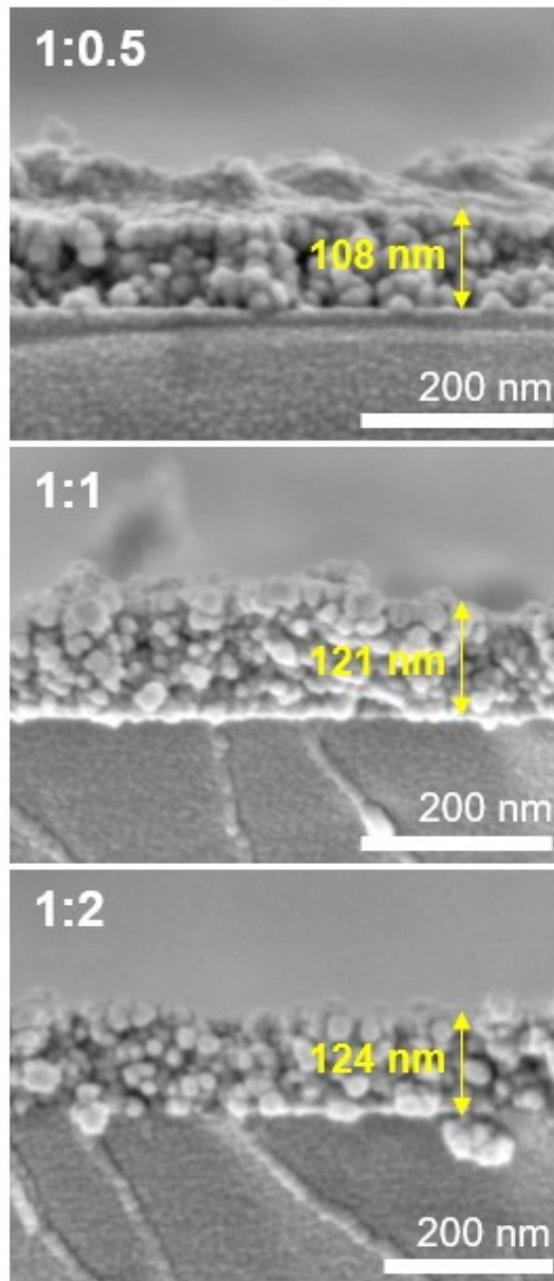


Figure S3. Cross-sectional SEM images of SnO₂/PEI films at different SnO₂/PEI weight ratios.

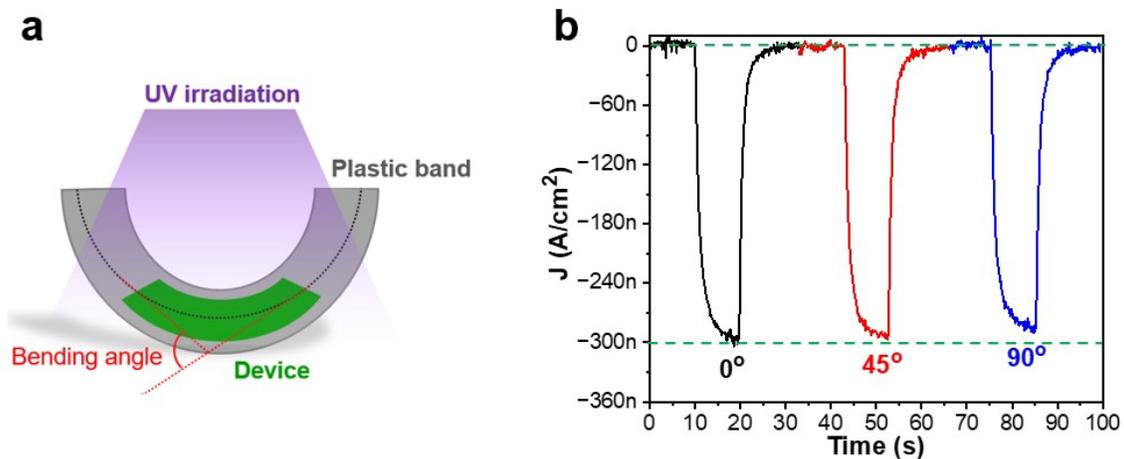


Figure S4. (a) Schematic illustration of performance testing under bending deformation and (b) corresponding J - t curves of the MSM device based on SnO₂:PEI (1:1, w/w) at various bending angles.

Table S1. Exponential fitting parameters of the transient J - t response under light on/off switching for devices based on SnO₂:PEI at different SnO₂/PEI weight ratios.

SnO ₂ :PEI ratio	ON stage			OFF stage		
	$J_{0(\text{rise})}$ [nA/cm ²]	A_{rise}	T_{rise} [s]	$J_{0(\text{fall})}$ [nA/cm ²]	A_{fall}	T_{fall} [s]
1 : 0.5	-107	9.91×10^{-6}	0.70	-2.10	-0.344	0.76
1 : 1	-311	1.20×10^{-5}	0.89	-9.24	-0.794	0.76
1 : 2	-162	2.56×10^{-6}	0.98	-12.14	-0.063	0.85

Table S2. Performance comparison of recent wide-bandgap photoabsorber-based UVC PDs.

Photo-absorber	Structure	λ [nm]	Bias [V]	D^* [Jones]	Flexibility	Ref.
CaSnO ₃	TFB/CaSnO ₃ /SnO ₂	254	0	1.56×10^{10}		[1]
SnO ₂ QDs	SnO ₂ QDs/PVK	254	0	2.16×10^{10}		[2]
Si-doped Ga ₂ O ₃	TiO ₂ /Ga ₂ O ₃ /TFB	254	0	6.5×10^{10}		[3]
Diamond/ Ga ₂ O ₃	Au/Diamond/ Ga ₂ O ₃ /Ti/Au	244	0	6.9×10^9		[4]
Ga ₂ O ₃	Au/Ti/TAPC/Ga ₂ O ₃ / Ti/Au	254	0	1.02×10^{13}		[5]
GaO _x	Graphene/GaO _x / Graphene	254	0	6.73×10^{12}		[6]
ZnS NPs	ITO/ZnS/TFB/ PEDOT:PSS	254	0	8.2×10^{10}	yes	[7]
MgZnO	In/MgZnO/PANI/In	250	1	1.5×10^{11}		[8]
ZrBDC	TFB/ZrBDC/SnO ₂	254	0	7.85×10^{10}	yes	[9]
Eu-MOF	ITO/ Eu-MOF/PEDOT:PSS	254	0	1.02×10^{10}		[10]
SnO ₂ :PEI	ITO/SnO ₂ :PEI/ PEDOT:PSS	254	0	9.71×10^{10}	yes	This work

Reference

- [1] M.H. Tran, T. Park, J. Hur, Wide-bandgap CaSnO_3 perovskite as an efficient and selective deep-UV absorber for a self-powered and high-performance p–i–n photodetector, *ACS Appl. Mater. Interfaces* 13 (2021) 13372–13382.
- [2] E. Park, T. Park, H. Yoo, J. Hur, Self-powered high-performance ultraviolet C photodetector based on poly(9-vinyl carbazole)/ SnO_2 quantum dot heterojunction, *J. Alloys Compd.* 918 (2022) 165502.
- [3] T.M.H. Nguyen, M.H. Tran, C.W. Bark, Growth of low-defect Si-doped Ga_2O_3 film on fluorine-doped tin oxide substrate for self-powered and high-performance ultraviolet photodetector, *ACS Appl. Electron. Mater.* 5(11) (2023) 6459–6468.
- [4] Y.C. Chen, Y.J. Lu, C.N. Lin, Y.Z. Tian, C.J. Gao, L. Dong, C.X. Shan, Self-powered diamond/ β - Ga_2O_3 photodetectors for solar-blind imaging, *J. Mater. Chem. C* 6 (2018) 5727–5732.
- [5] C. Wu, F. Wu, H. Hu, C. Ma, J. Ye, S. Wang, H. Wu, J. Wang, A. Liu, D. Guo, Work-function-tunable laser-induced graphene electrodes for Schottky-type solar-blind photodetectors, *Appl. Phys. Lett.* 120 (2022) 101102.
- [6] C. Wu, F. Wu, C. Ma, S. Li, A. Liu, X. Yang, Y. Chen, J. Wang, D. Gao, A general strategy to ultrasensitive Ga_2O_3 -based self-powered solar-blind photodetectors, *Mater. Today Phys.* 23 (2022) 100643.
- [7] M.H. Tran, J. Hur, Direct, simple, rapid, and real-time monitoring of ultraviolet B level in sunlight using a self-powered and flexible photodetector, *EcoMat* 5(3) (2023) e12301.
- [8] H. Chen, P. Yu, Z. Zhang, F. Teng, L. Zheng, K. Hu, X. Fang, Ultrasensitive self-powered solar-blind deep-ultraviolet photodetector based on all-solid-state polyaniline/MgZnO bilayer, *Small* 12 (2016) 5809–5816.
- [9] M.H. Tran, J. Hur, Ultrahigh stability of a wearable photodetector using a zirconium metal–organic framework enabling in situ and continuous monitoring of ultraviolet radiation risk, *Adv. Opt. Mater.* 10 (2022) 2101404.
- [10] T.M.H. Nguyen, C.W. Bark, Self-powered UVC photodetector based on europium metal–organic framework for facile monitoring invisible fire, *ACS Appl. Mater. Interfaces* 14(40) (2022) 45573–45581.