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

Supporting Information

A Novel Post-processed Surface Modified Double-network Polymer Layer for Triboelectric Nanogenerator

Yaqian Liu, [a,b] Xiumei Wang, [a,b] Yujie Yan, [a,b] Zhichao Rao, [a,b] Huipeng Chen, [a,b] * Tailiang Guo [a,b]

[a]*Institute of Optoelectronic Display,*

National & Local United Engineering Lab of Flat Panel Display Technology,

Fuzhou University, Fuzhou 350002, China

[b]*Fujian Science & Technology Innovation Laboratory for Optoelectronic Information of China, Fuzhou 350100, China*

Email: hpchen@fzu.edu.cn

* Corresponding authors.

Email: **hpchen@fzu.edu.cn(Huipeng Chen)**

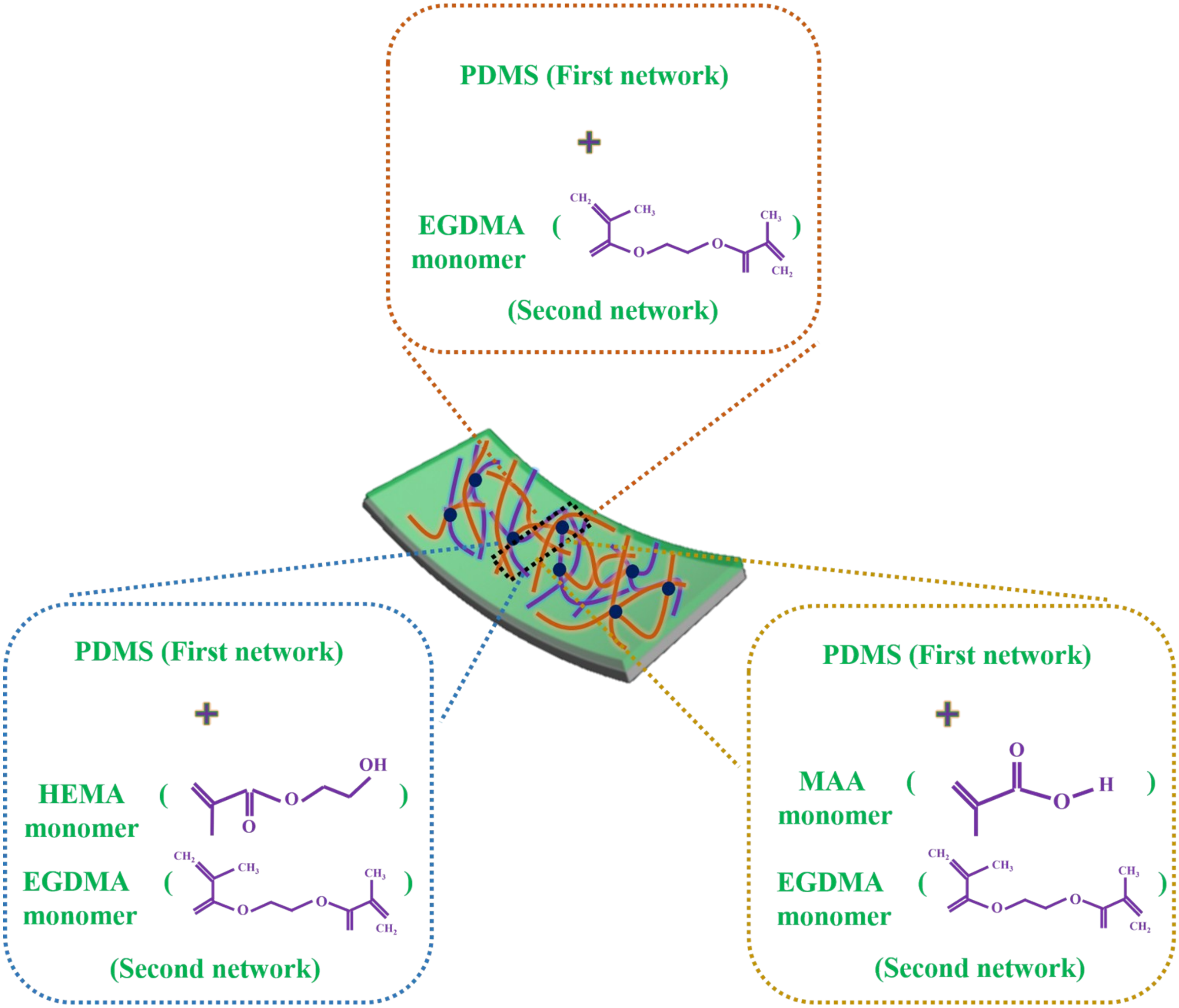

Fig. S1 Schematic illustration for DN-PDMS film with different monomer solvents.

EGDMA HEMA MAA

Fig. S2 Photograph with three prepared monomer solvents.

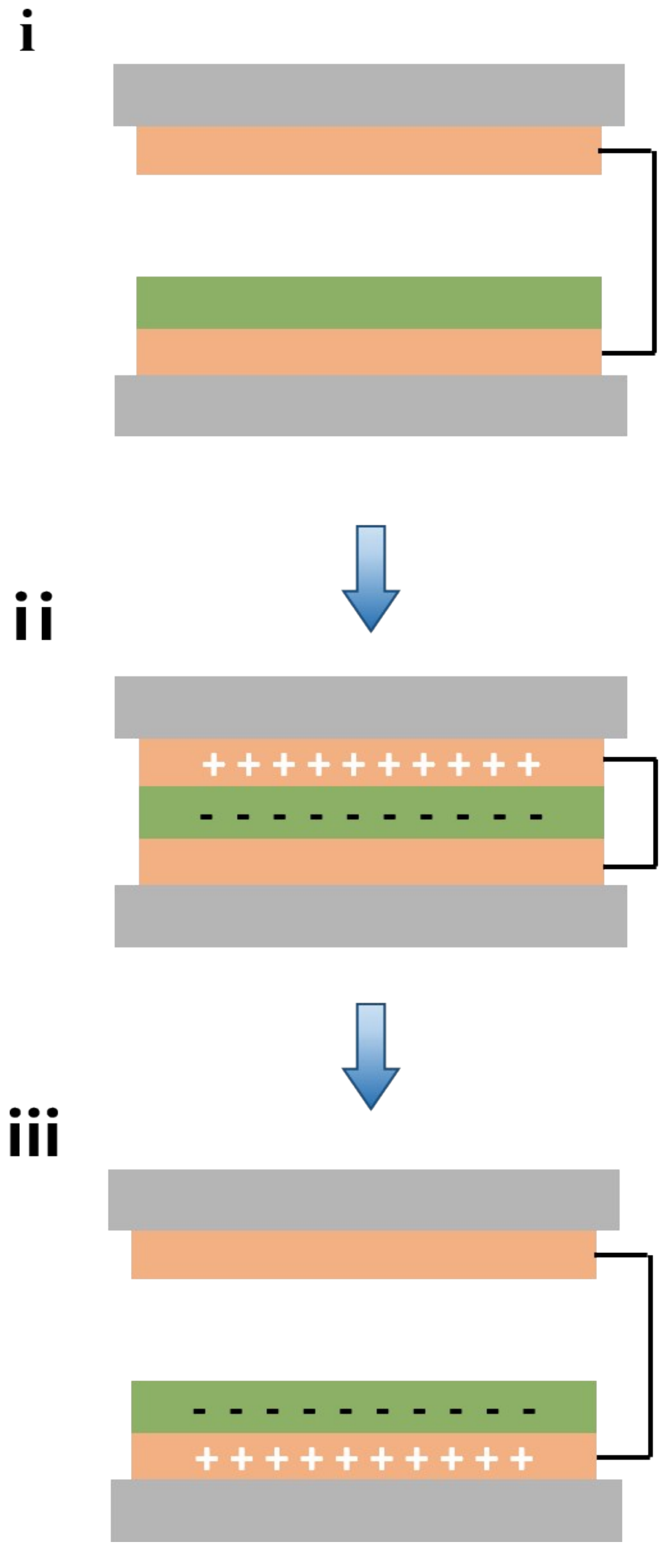

Fig. S3 Working mechanism of original state TENG.

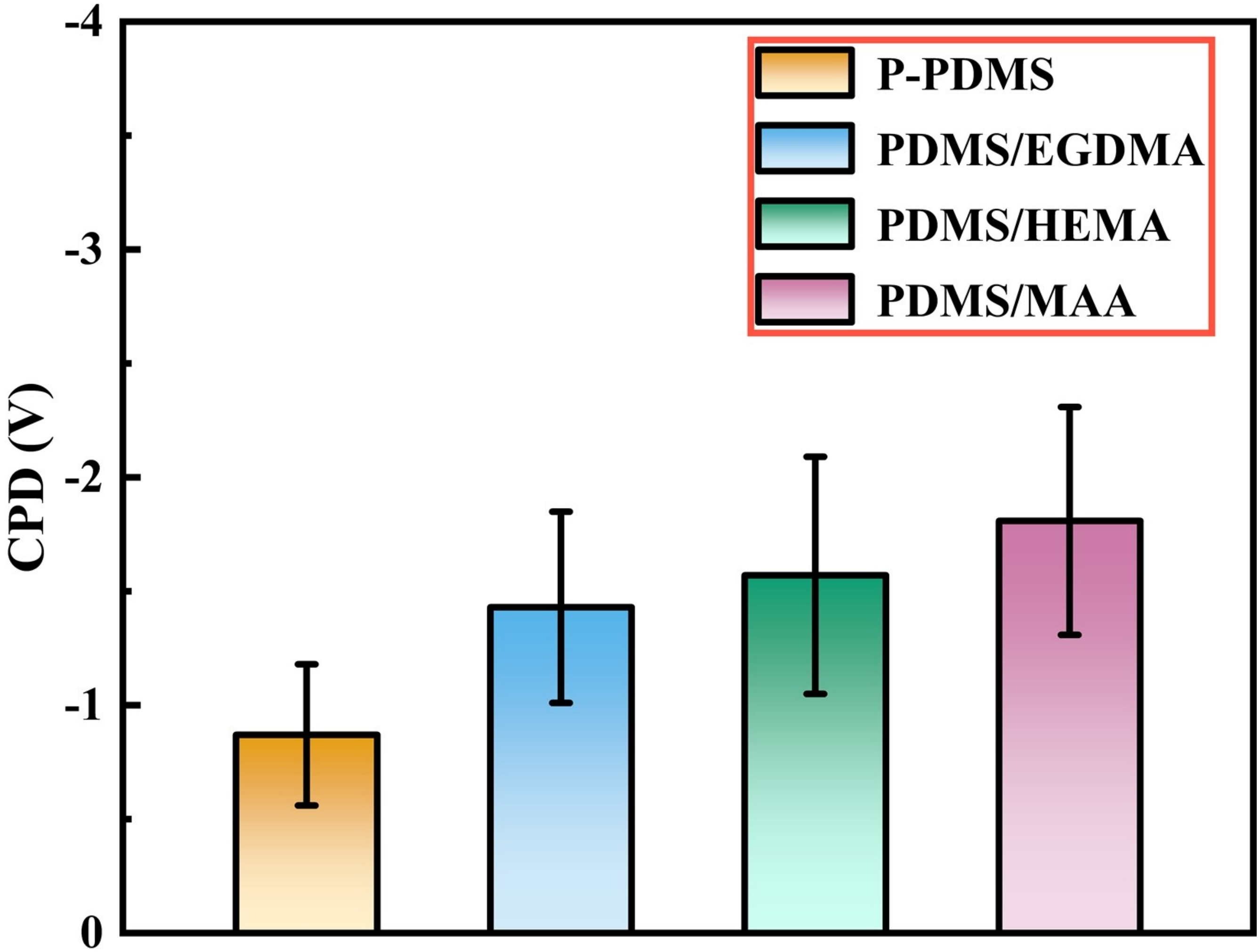

Fig. S4 Summarized CPD results presented that the DN-PDMS was apt to attract an even greater amount of charge than P-PDMS.

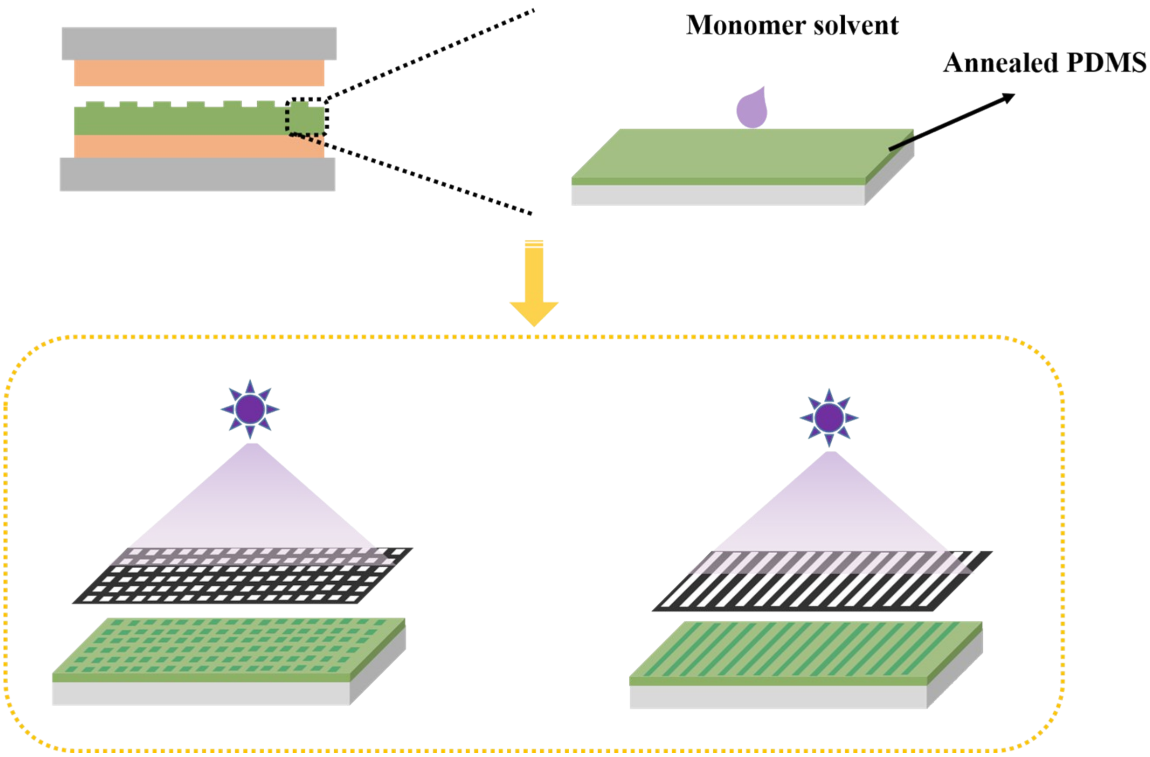

Fig. S5 Schematic illustration of fabrication micro-patterned DN-PDMS layers.

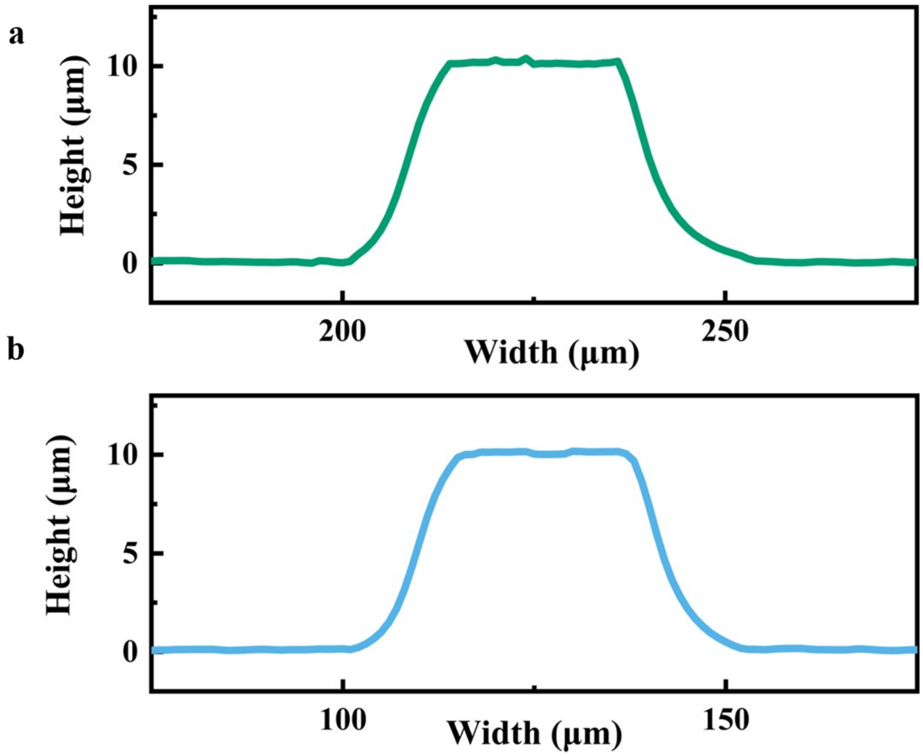

Fig. S6 Surface profilometry depth profile for a section of a micro-patterned DN-PDMA with (a) lines and (b) cubes.

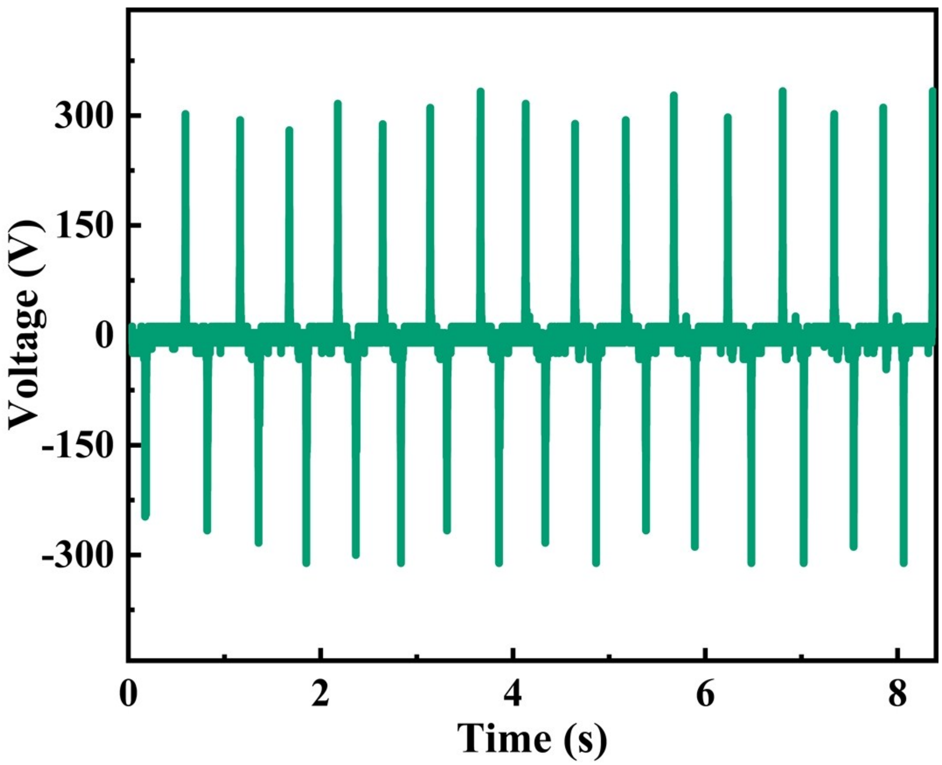

Fig. S7 V_{oc} of cube DN-PDMS TENG with the size of 2 cm × 2 cm.

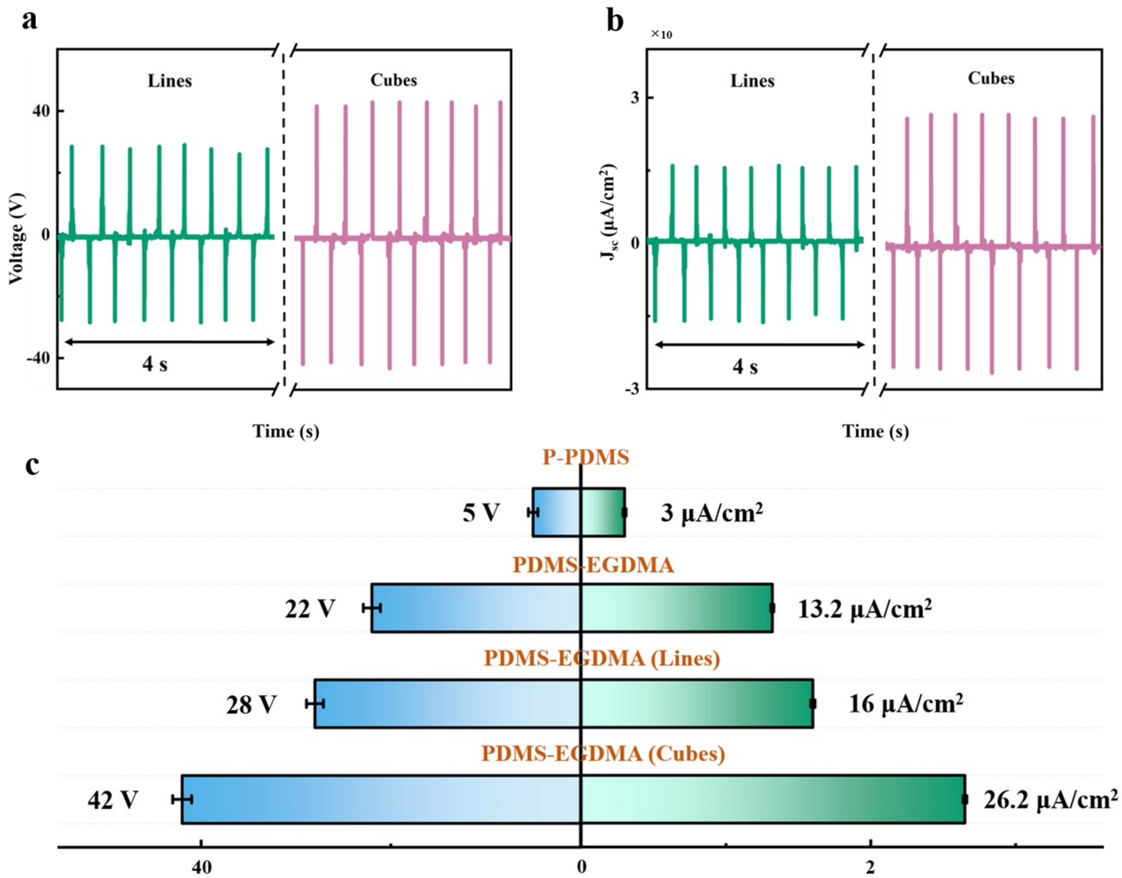

Fig. S8 (a) *Voc* and (b) *Jsc* of TENG with different patterned EGDMA DN-PDMS film. (c) Summarized performances enhancement by monomer treatment and micro-structures.

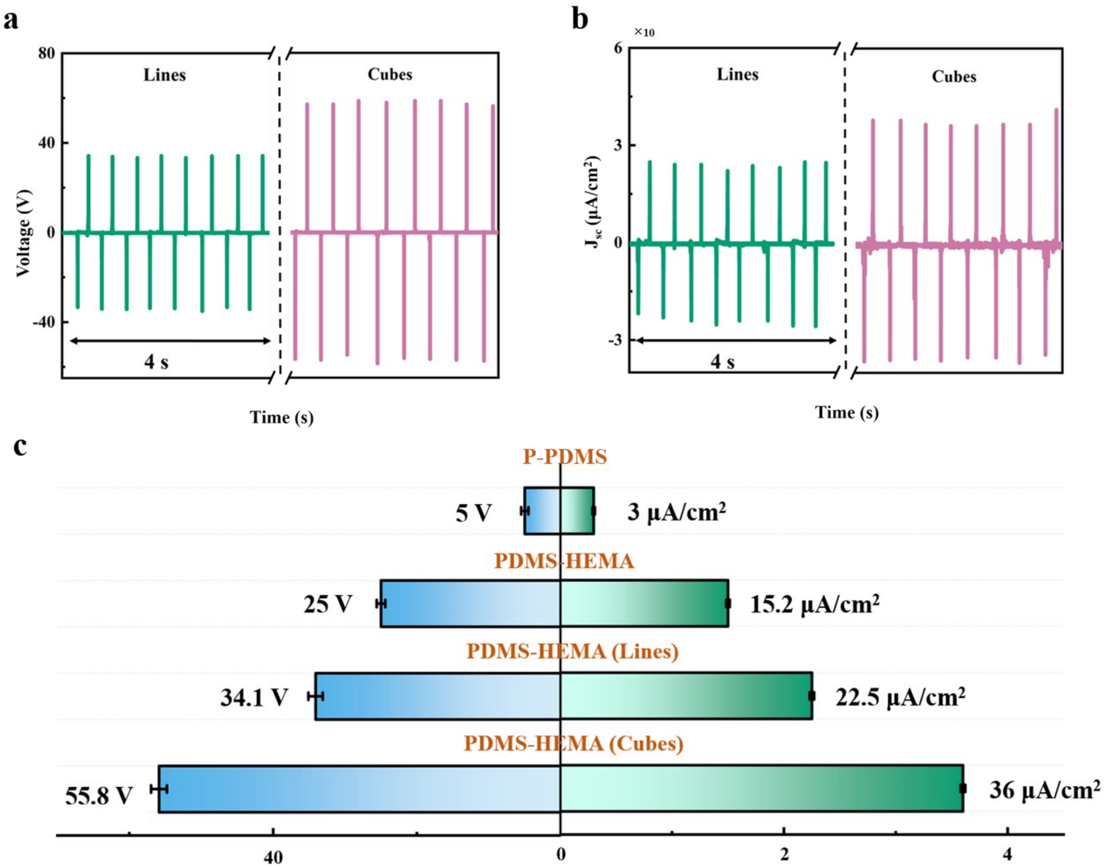

Fig. S9 (a) *Voc* and (b) *Jsc* of TENG with different patterned HEMA DN-PDMS films. (c) Summarized performances enhancement by monomer treatment and micro-structures.

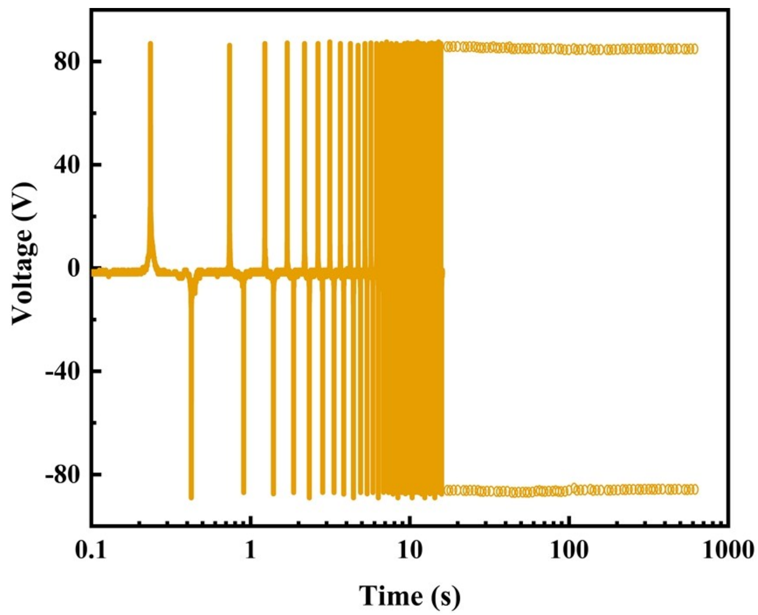

Fig. S10 Stability test for the TENG with MAA DN-PDMS.

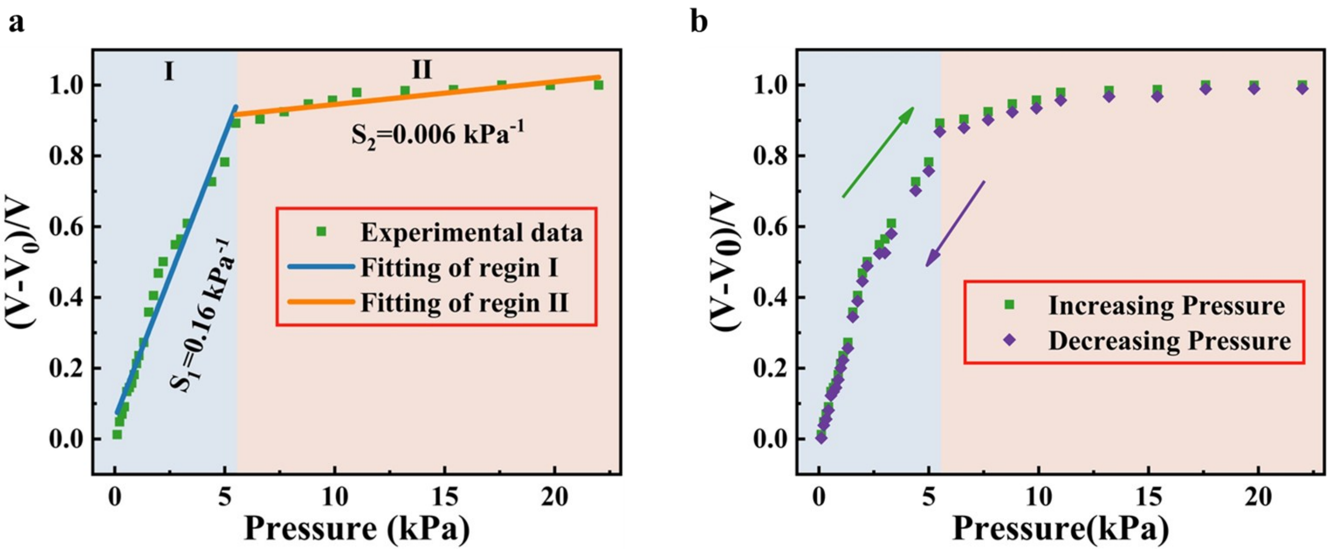

Fig. S11 (a) Sensitivity of the TENG. (b) Hysteresis curve of the TENG.

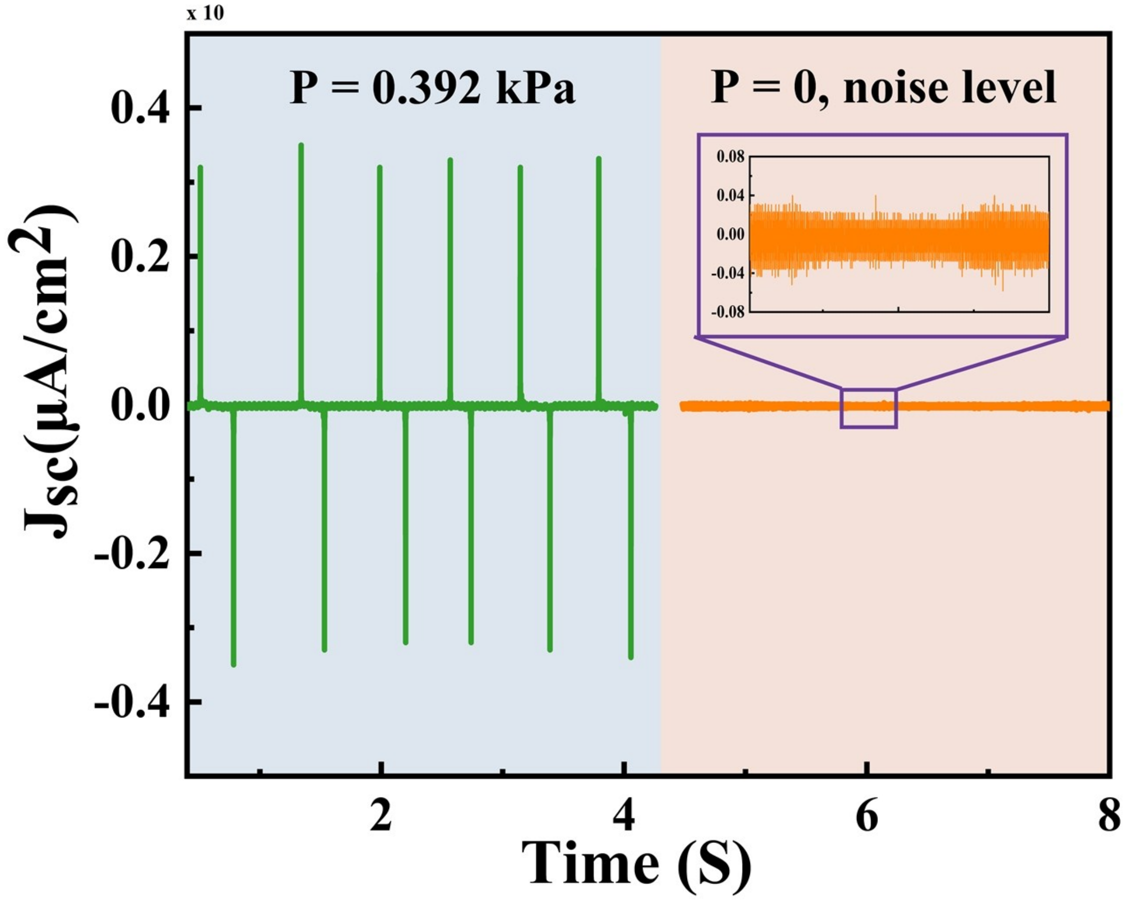

Fig. S12 The measurement of the detection limit of the TENG through the short-circuit current density (J_{sc}). The left panel in the plot shows the output J_{sc} with a gentle pressure applied on the TENG, while the right panel shows the measurement of the noise level magnitude. The inset is the enlarged view of the J_{sc} for the noise level with no pressure on. With this measurement the detection limit of the TENG could be deducted with the following equation.[1]

$$P_0 = \frac{P}{J_{sc}/J_{sc,noise}} = \frac{0.392}{3.2/0.031} kPa = 3.8\ Pa$$

Table S1. The (equilibrium) surface concentration of monomer (C_s), and diffusivity of the monomer (D_{12}) for several monomers in the P-PDMS film.

	EGDMA	**HEMA**	**MAA**
C_s (no units)	0.241	0.256	0.279
D_{12}(μm/cm^2)	0.033	0.136	0.295

Table S2. The comparison of the *Voc* with reported work.

Materials	Initial voltage (V)	Optimized voltage (V)	Size	Reference
PDMS/ITO	4	18	3 cm × 3 cm	[2]
PDMS/Cu	5.34	22.04	N/A	[3]
PDMS/PTFE/AgNWs	1.5	N/A	1 cm × 1 cm	[4]
PTFE/Al	1.2	6.2	1 cm × 1.5 cm	[5]
PDMS/Ag	N/A	5	1 cm × 1 cm	[6]
PDMS/AgNWs	2.5	18	2 cm × 2 cm	[7]
PDMS/ITO	10	N/A	1.5 cm × 1.5 cm	[8]
PDMS/AgNWs	N/A	75	2 cm × 2 cm	[9]
PDMS/Al	32	42.5	2 cm × 2 cm	[10]
PDMS/PAMPS ionogel	N/A	2.8	2 cm × 1.5 cm	[11]
PDMS/ITO	**5**	**84**	**1 cm × 1 cm**	**This work**
PDMS/ITO	**17.4**	**301**	**2 cm × 2 cm**	**This work**

Table S3. Measured channel depths for PDMS micro-patterned substrates with different monomers.

Soak time (min)	EGDMA (μm)	HEMA (μm)	MAA (μm)
10	4.5 ± 0.15	6.5 ± 0.1	10.2 ± 0.21

References

1. L. Lin, Y. Xie, S. Wang, W. Wu, S. Niu, X. Wen and Z. L. Wang, *ACS Nano*, 2013, **7**, 8266-8274.
2. F. R. Fan, L. Lin, G. Zhu, W. Wu, R. Zhang and Z. L. Wang, *Nano Lett.*, 2012, **12**, 3109-3114.
3. J. Huang, X. Fu, G. Liu, S. Xu, X. Li, C. Zhang and L. Jiang, *Nano Energy*, 2019, **62**, 638-644.
4. G. Yao, L. Xu, X. Cheng, Y. Li, X. Huang, W. Guo, S. Liu, Z. L. Wang and H. Wu, *Adv. Funct. Mater.* 2019, 1907312.
5. Z. Liu, Y. Ma, H. Ouyang, B. Shi, N. Li, D. Jiang, F. Xie, D. Qu, Y. Zou, Y. Huang, H. Li, C. Zhao, P. Tan, M. Yu, Y. Fan, H. Zhang, Z. L. Wang and Z. Li, *Adv. Funct. Mater.*, 2019, **29**, 1807560.
6. X. Wang, H. Zhang, L. Dong, X. Han, W. Du, J. Zhai, C. Pan and Z. L. Wang, *Adv. Mater.*, 2016, **28**, 2896-2903.
7. C. Zhang, Y. Fan, H. Li, Y. Li, L. Zhang, S. Cao, S. Kuang, Y. Zhao, A. Chen, G. Zhu and Z. L. Wang, *ACS Nano*, 2018, **12**, 4803-4811.
8. S. F. Leung, K. T. Ho, P. K. Kung, V. K. S. Hsiao, H. N. Alshareef, Z. L. Wang and J. H. He, *Adv. Mater.*, 2018, **30**.
9. L. Lin, N. Y. Xie, H, S, Wang, Z, W, Wu, M, S, Niu, N, X, Wen, Z. L. Wang, *ACS Nano*, 2013,

7, 8266-8274.

10. D. Kim, I.-W. Tcho, I. K. Jin, S.-J. Park, S.-B. Jeon, W.-G. Kim, H.-S. Cho, H.-S. Lee, S. C. Jeoung and Y.-K. Choi, *Nano Energy*, 2017, **35**, 379-386.

11. G. Zhao, Y. Zhang, N. Shi, Z. Liu, X. Zhang, M. Wu, C. Pan, H. Liu, L. Li and Z. L. Wang, *Nano Energy*, 2019, **59**, 302-310.