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Supporting Information

High-performance triboelectric nanogenerator with dual nanostructure for remote control of switching circuit

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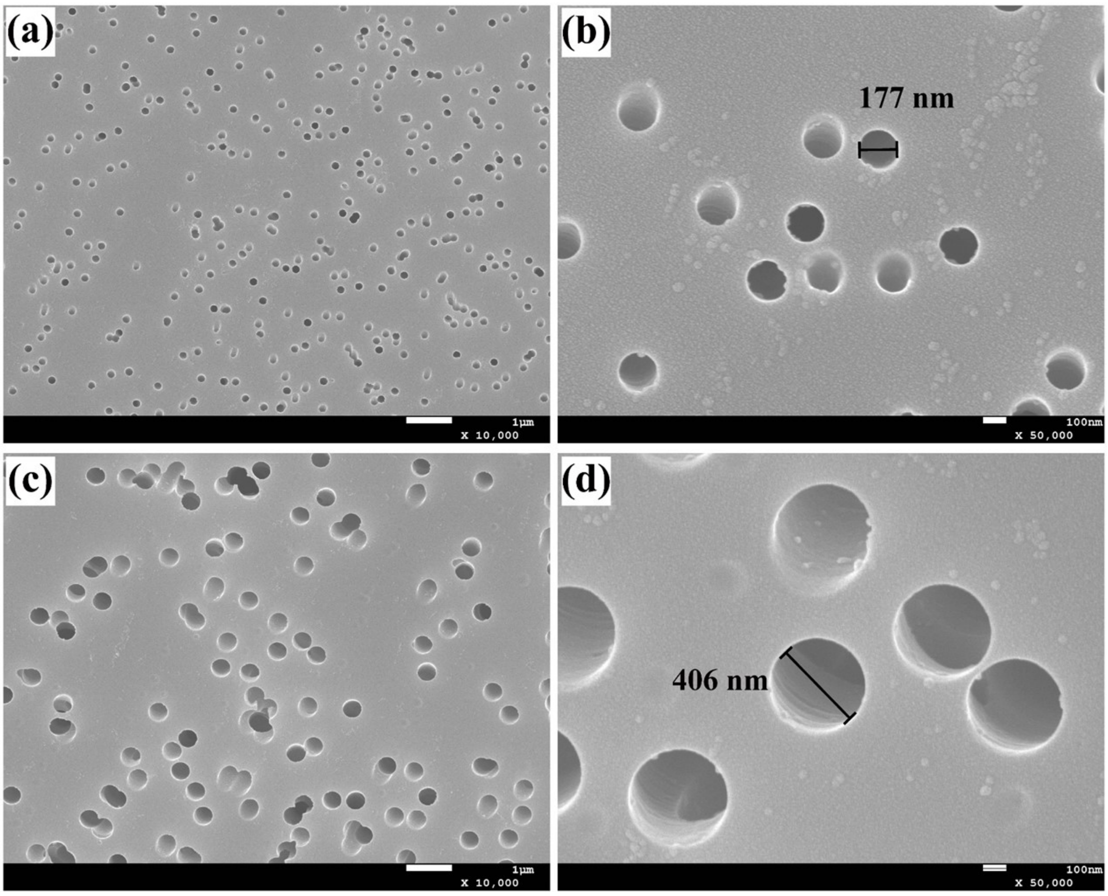

Figure S1 Surface morphology SEM images of (a, b) PC membrane with 200 nm diameter; (c, d) PC membrane with 400 nm diameter.

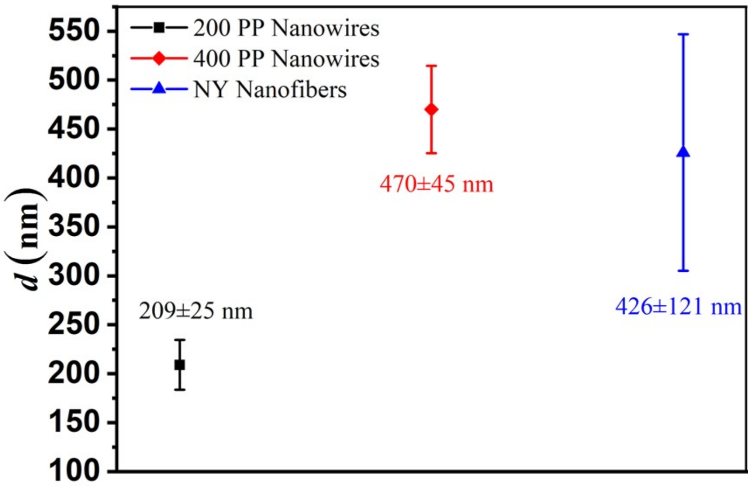

Figure S2 Statistical results of diameters of polypropylene nanowires and nylon nanofibers.

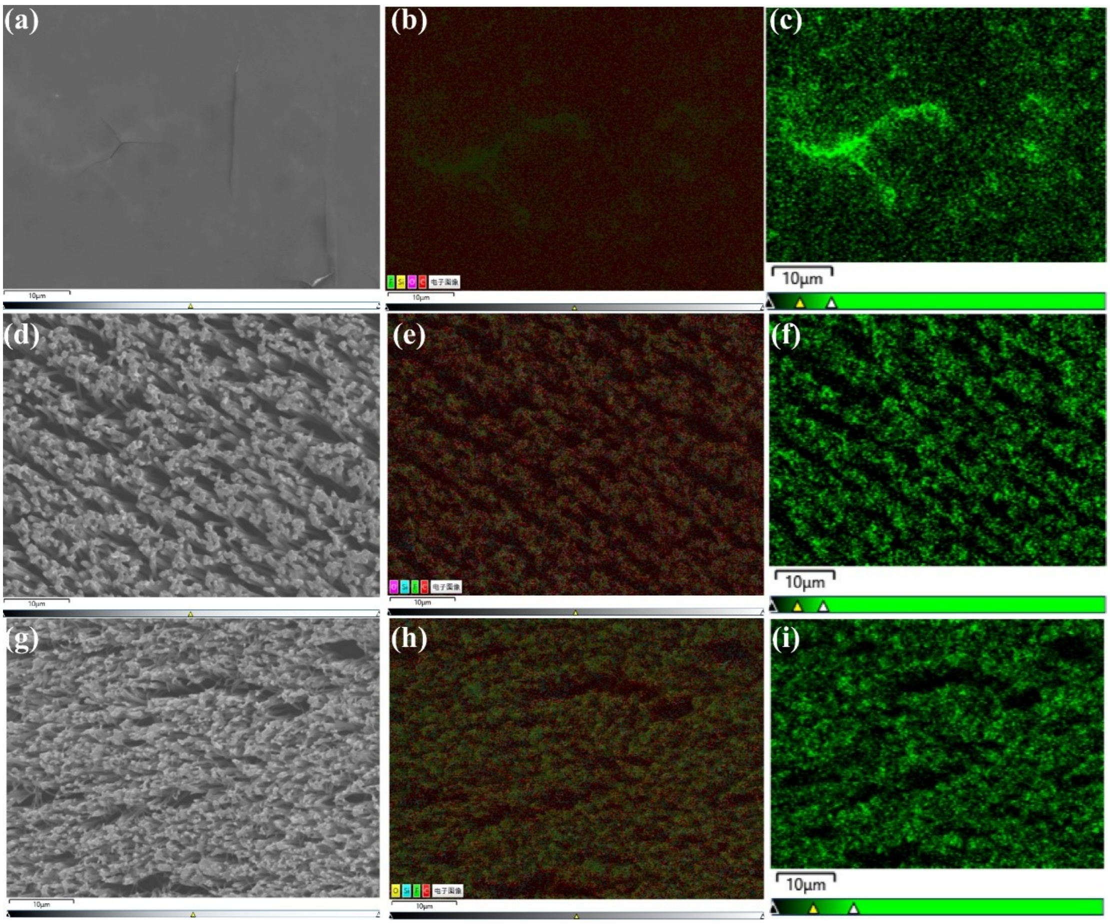

Figure S3 EDS elemental analysis spectrum of flat FPP (a) surface morphology (b) full spectrum (c) F1s spectrum; EDS elemental analysis spectrum of 400 FPP (d) surface morphology (e) full spectrum (f) F1s spectrum; EDS elemental analysis spectrum of 200 FPP (g) surface morphology (h) full spectrum (i) F1s spectrum.

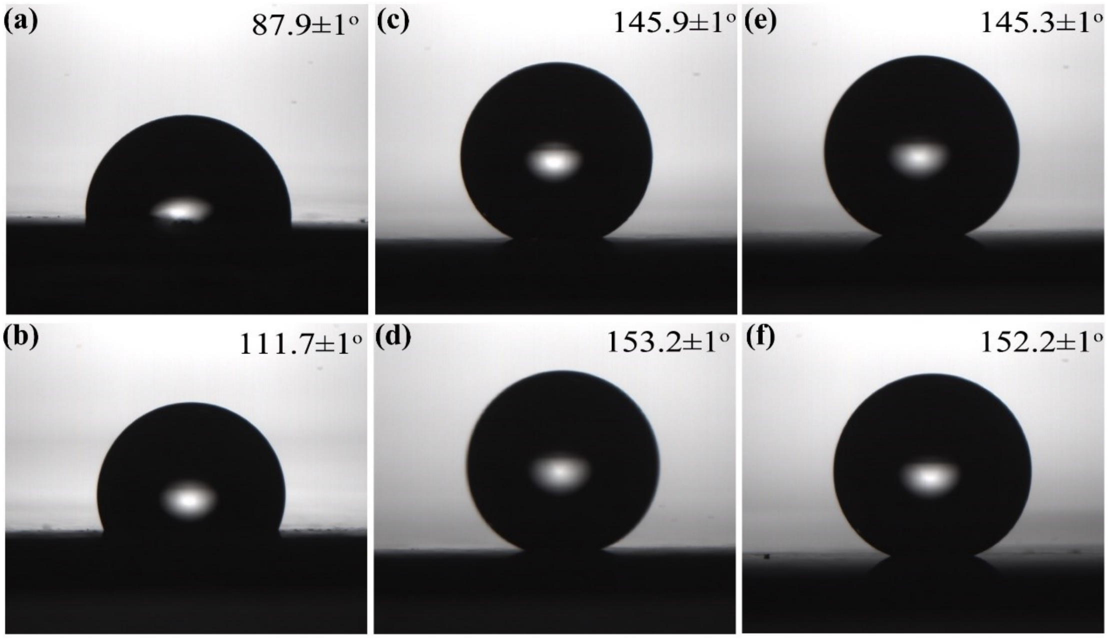

Figure S4 Contact angle images of (a) flat PP (b) flat FPP (c) 400 PP (d) 400 FPP (e) 200 PP (f) 200 FPP.

Since the actual polymerization of the polymer is very high, in order to control the calculation time and ensure that the calculation results have a correct trend, the degree of polymerization of PP is set as 10, and the degree of polymerization of nylon 11 is 5. The optimization of the polymer molecular structure is based on the b3lyp-D3BJ method and the 6-31G** basis set. The calculation of polymer molecular energy is based on the b3lyp-D3BJ method and the 6-311G** basis set. The calculated electrostatic surface potential diagram shows that PFTS has a more negative potential surface than PP as shown in Figure S5. The surface of nylon 11 shows a relatively positive electrostatic surface potential. It can be seen from the calculation results that the surface potential of the positive potential group and the surface potential of the negative potential group on the PP chain are both close to zero potential, resulting in a small color difference. The difference between the electrostatic surface potential of the positive potential group and the electrostatic surface potential of the negative potential group on the PFTS and nylon 11 chains is larger, proving that they have stronger ability to gain and lose electrons. Overall, PFTS exhibits stronger electronegative properties while nylon exhibits stronger electropositive properties, which means that when PFTS comes into contact with NY, it can generate more triboelectric charges than PP.

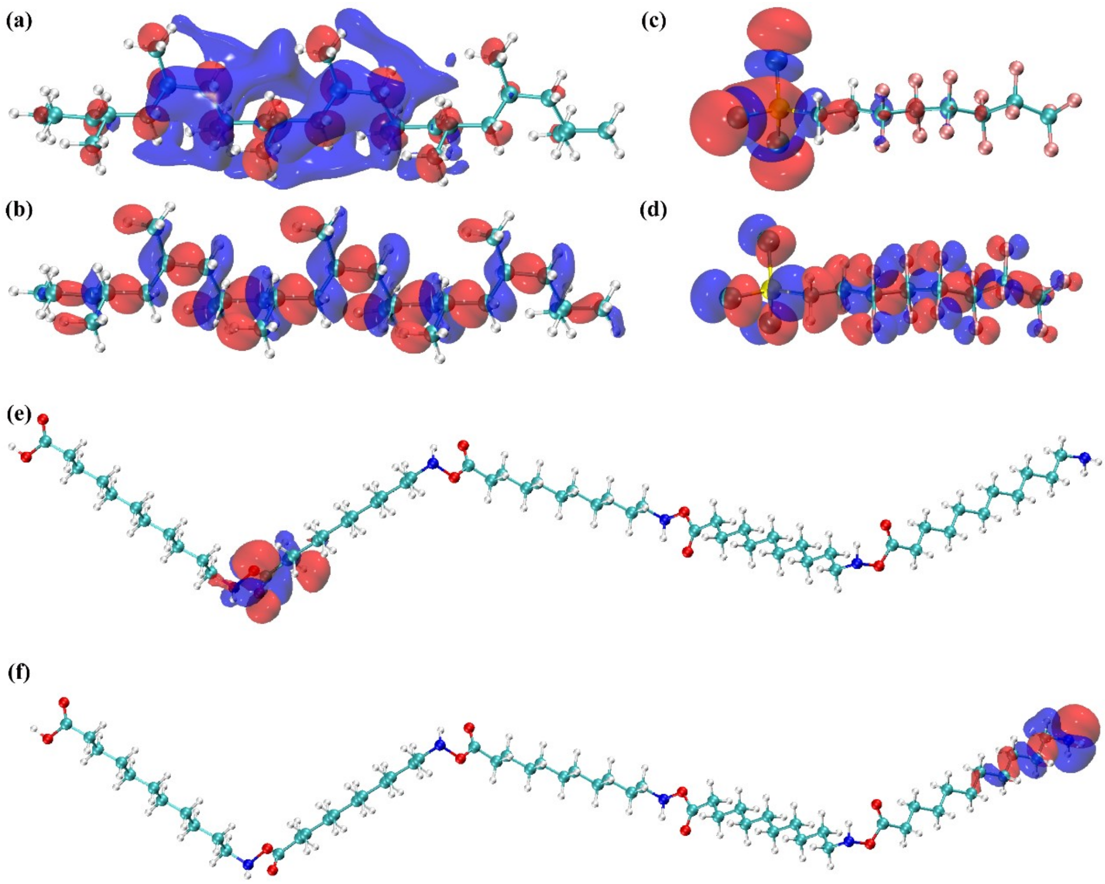

Figure S5 (a) LUMO and (b) HOMO of PP; (c) LUMO and (d) HOMO of PFTS; (e) LUMO and (f) HOMO of nylon 11.

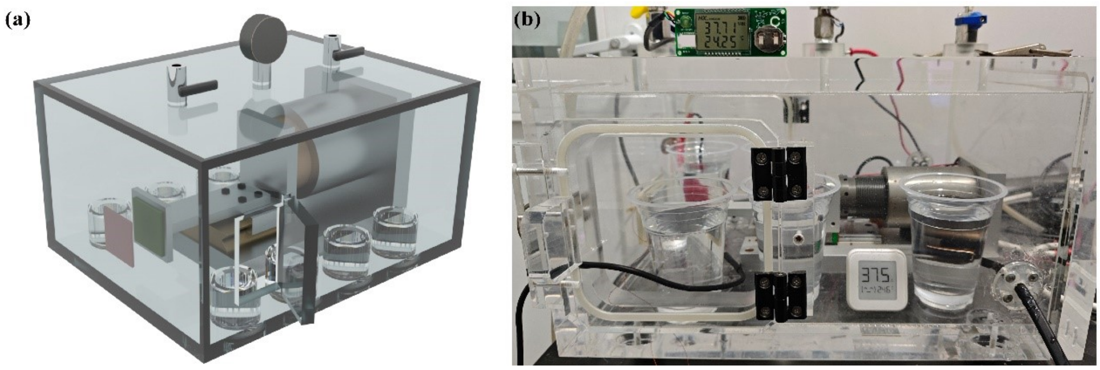

Figure S6 Schematic diagram and photograph of the sealed box used to control humidity.

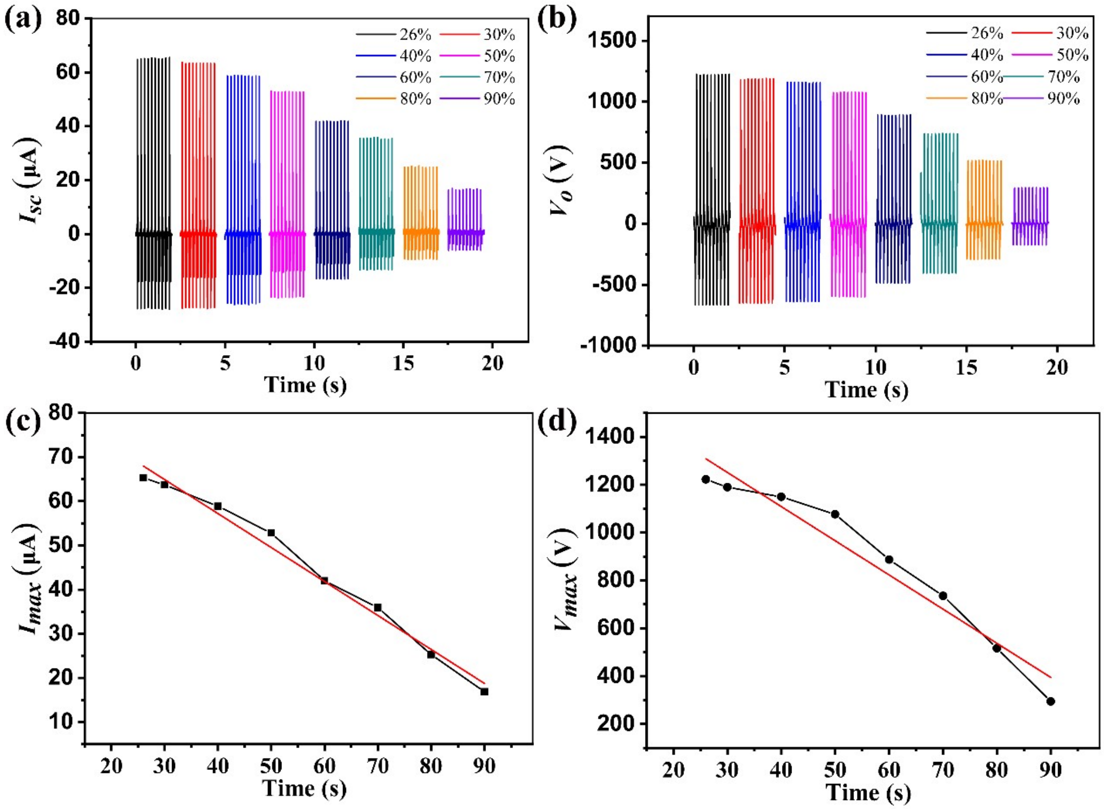

Figure S7 Output performance of 200 FPP@Nano NY TENG under different humidity (a) I_{sc} (b) V_{o} (c) I_{max} (d) V_{max}

Table S1 A comparison of the charge density of CS-TENGs fabricated through structural design and surface modification.

Author	Reporting year	Method	Charge density (μC/m²)
Y.H. Liu et al.[1]	2021	Surface modification	~37
J. Han et al.[2]	2024	Single nanostructure	~51.3
Y.G. Feng et al.[3]	2016	Single nanostructure + Surface modification	~65
J.C. Qian et al.[4]	2019	Surface modification	~100
Y. Wu et al.[5]	2023	Single nanostructure	~125
This work		Dual nanostructure + Surface modification	~161.5

References

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