Supporting Information (SI)

Fabrication of single-crystalline SnS-based piezo-assisted efficient single-electrode triboelectric nanogenerator for energy harvesting and sensing applications

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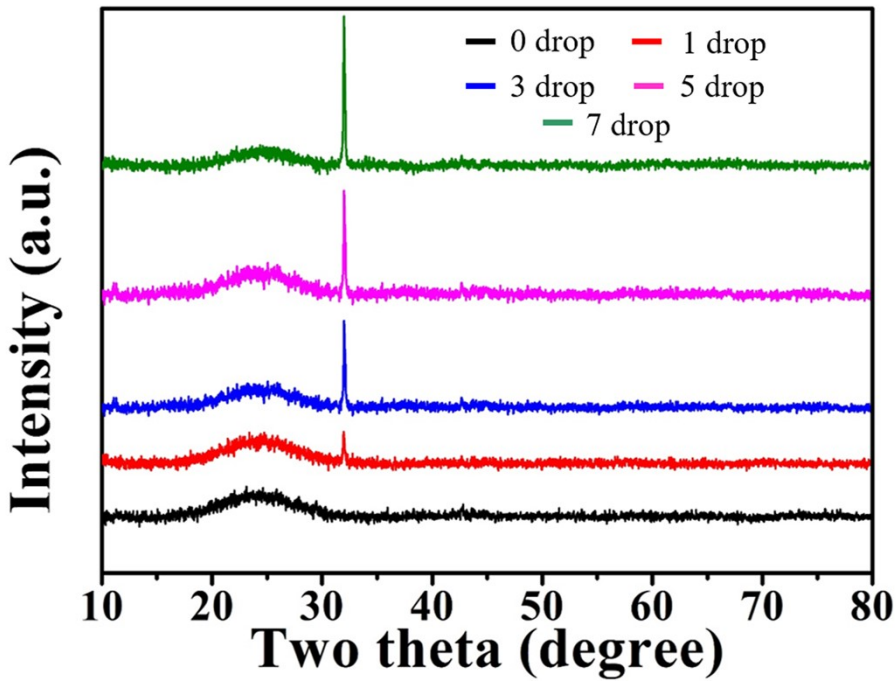

Fig. S1: XRD analysis of glass and glass with different drops of SnS solution.

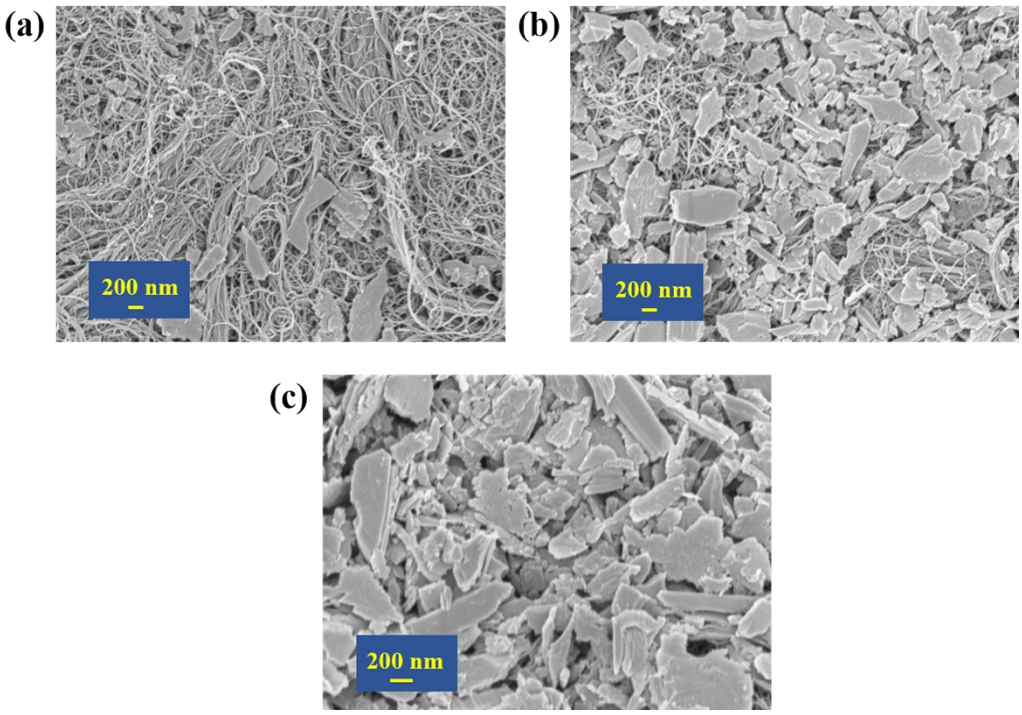

Fig. S2: FESEM images of CNT membrane with 1 mL SnS solution (a), CNT membrane with 2 mL SnS solution (b), CNT membrane with 4 mL SnS solution (c).

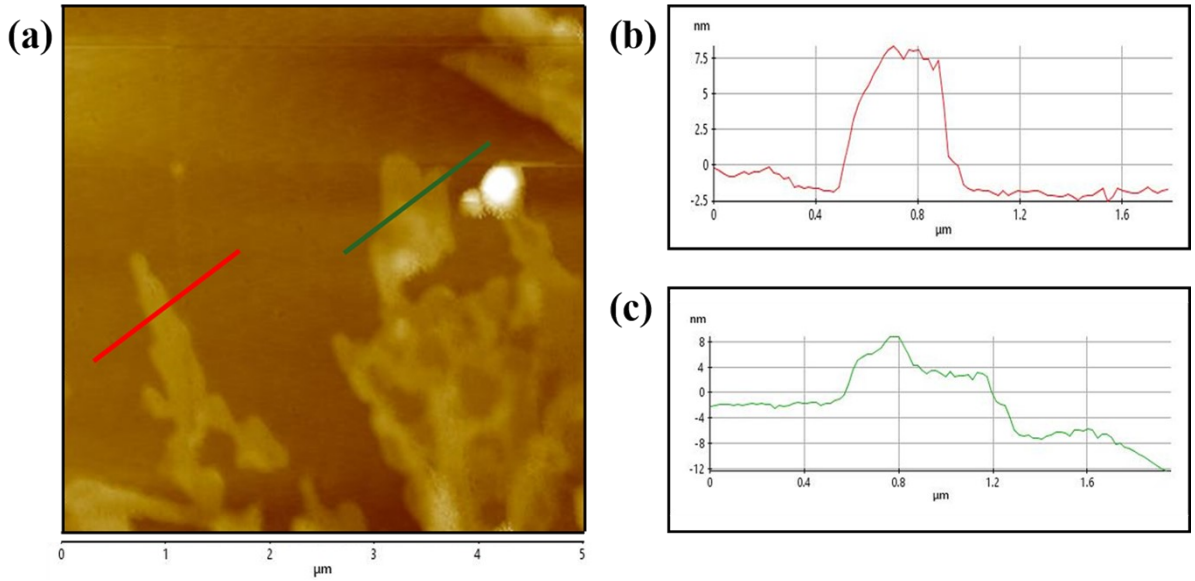

Fig. S3: (a) AFM topographic images of SnS (b,c) height profile of the marked places in (a).

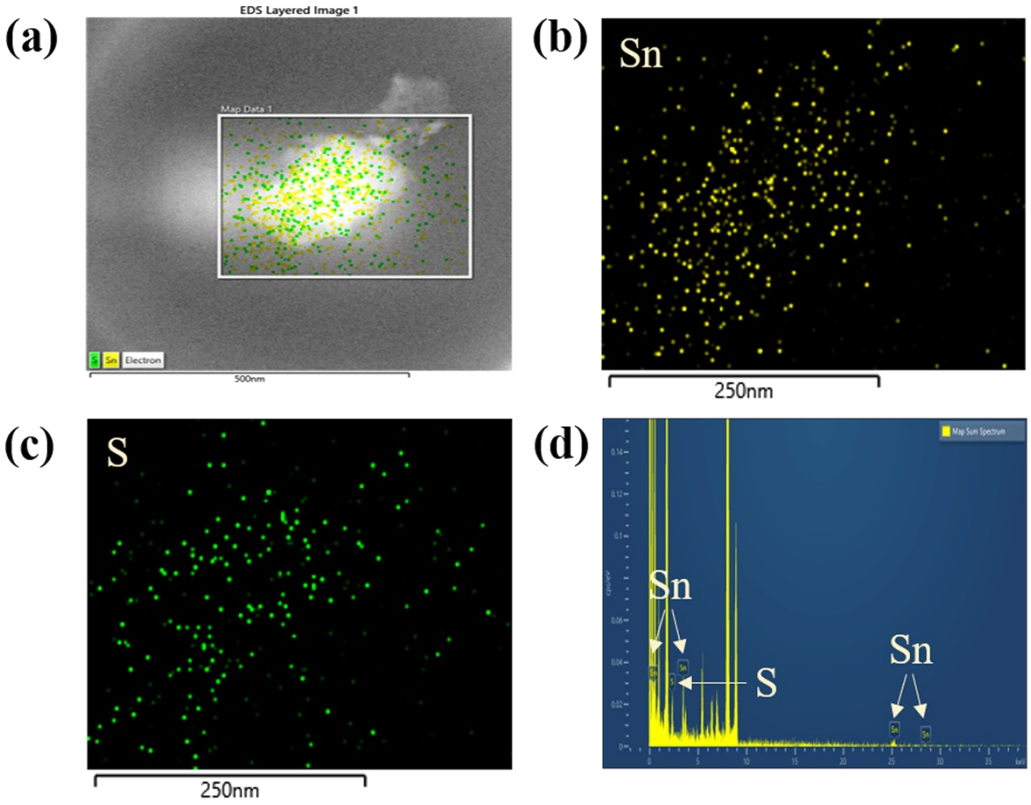

Fig. S4: (a) EDS layered image of SnS flake, (b-c) elemental mapping of Sn and S,

respectively, (d) EDAX pattern of SnS.

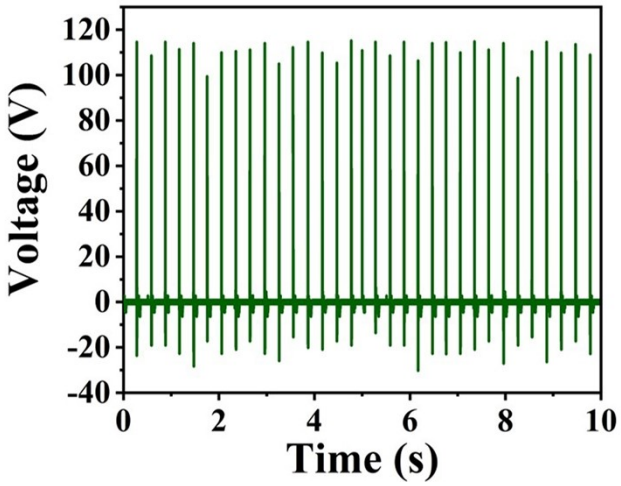

Fig. S5: Output performance of the S-TENG fabricated with bulk SnS (0.004 g).

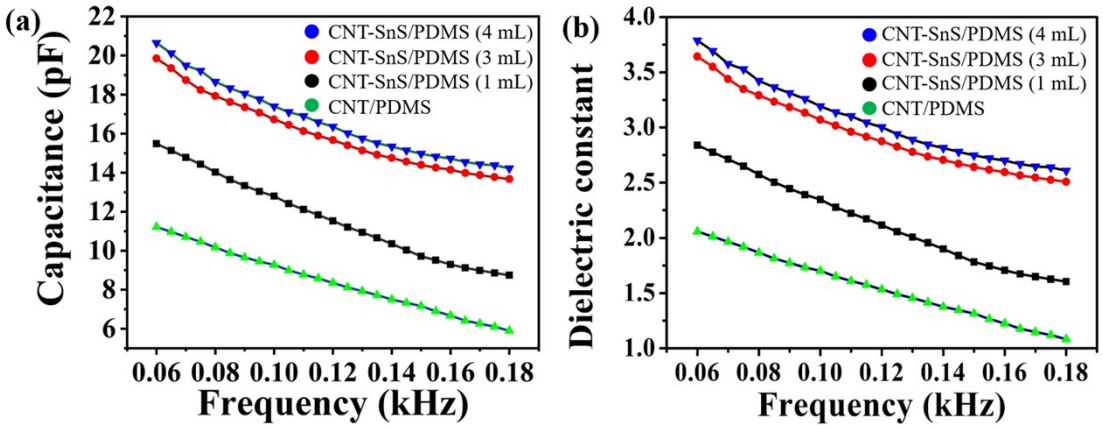

Fig. S6: Capacitance of composite films without SnS and with different amounts of SnS.

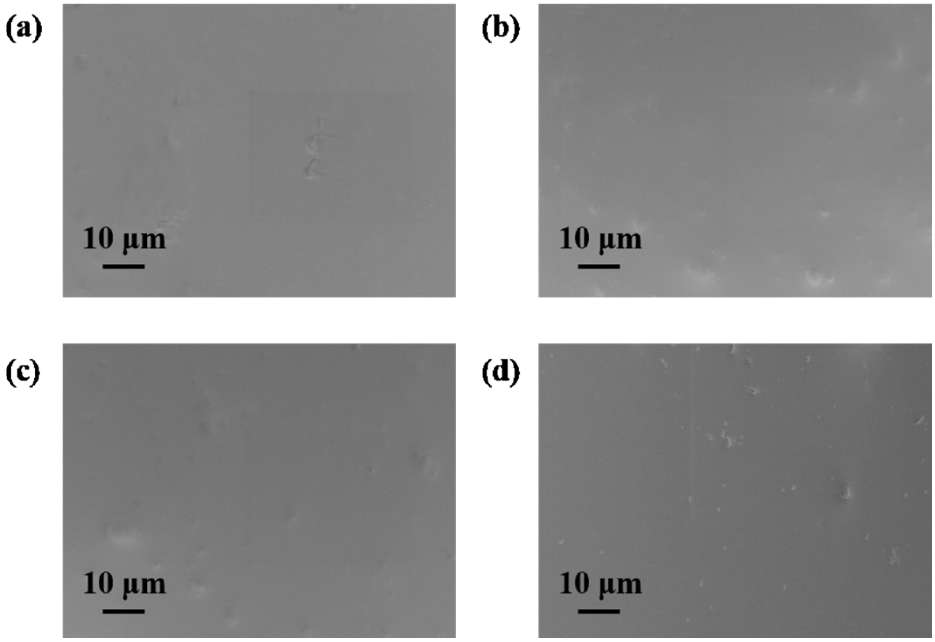

Fig. S7: Surface morphology of the device of (a) CNT/PDMS, (b) CNT-SnS/PDMS (1 mL), (c) CNT-SnS/PDMS (2 mL), (d) CNT-SnS/PDMS (3 mL).

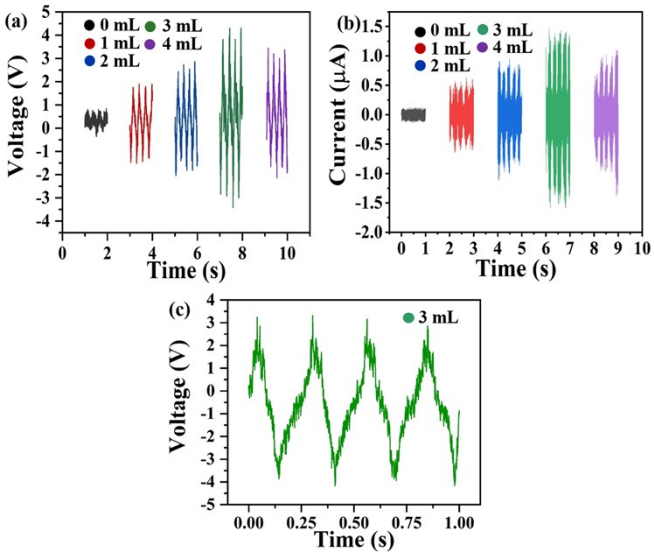

Fig. S8: Under bending (a) output voltage generation from the S-PENG under different SnS content, (b) output current generation from the S-PENG under different SnS content, (c) switching polarity test of the S-PENG.

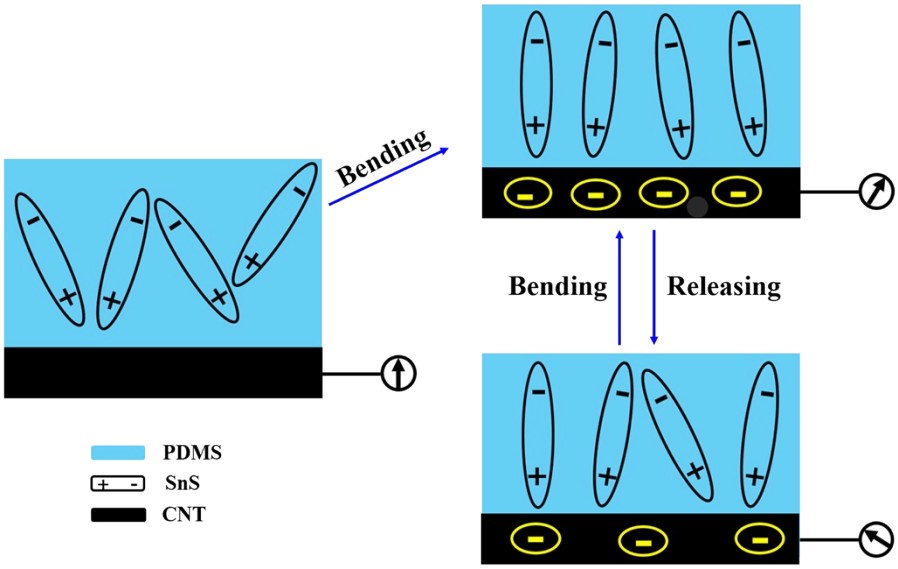

Fig. S9: Mechanism of output generation of S-PENG.

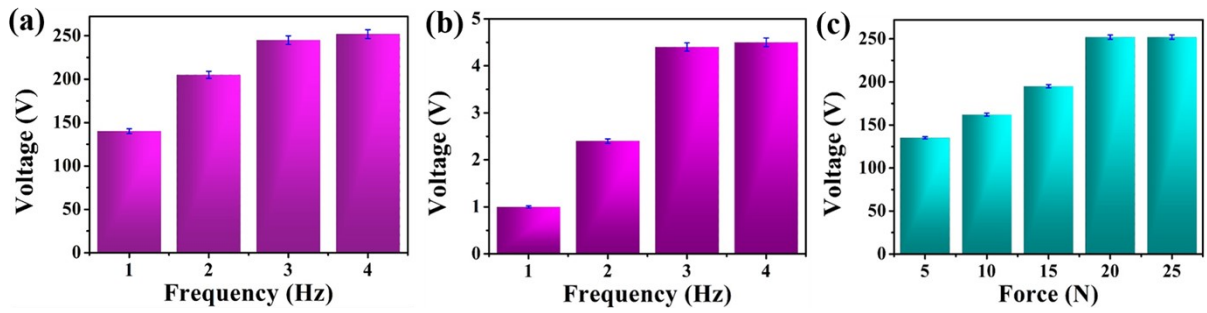

Fig. S10: (a) Variation of the output of S-TENG under different frequencies, (b) variation of the output of S-PENG under different frequencies, (c) variation of the output of S-TENG under different forces.

Calculation of applied force on the NG

The calculation of the applied force developed by finger tapping includes the physical model composed of the gravity and pulse terms. [1] When a mass (here finger) taps on the NG, these two processes can be regarded as a) initially touching the film's surface and b) completely

acting on the film. The velocity of the mass increases and reaches a maximum value in the first process and steadily decreases to zero in the second one. Hence, the calculation depends on the kinetic energy and momentum theorem; we have the following two equations:

$$mgh = \frac{1}{2}mv^2 .....(i)$$

$$(F - mg)\Delta t = mv.....(ii)$$

Where m is the mass of the finger, h is the falling height, v is the maximum velocity of falling, F is the contact force, and Δt is the time spanning during the second process. Here, m= ~1.5 kg is measured using a laboratory balance, Δt = 0.35 s is the average time variation between the two successive voltage peaks, h = ~0.12 m, and g = 9.8 N/kg. Therefore, the above values determine the input force, F ~21.26 N.

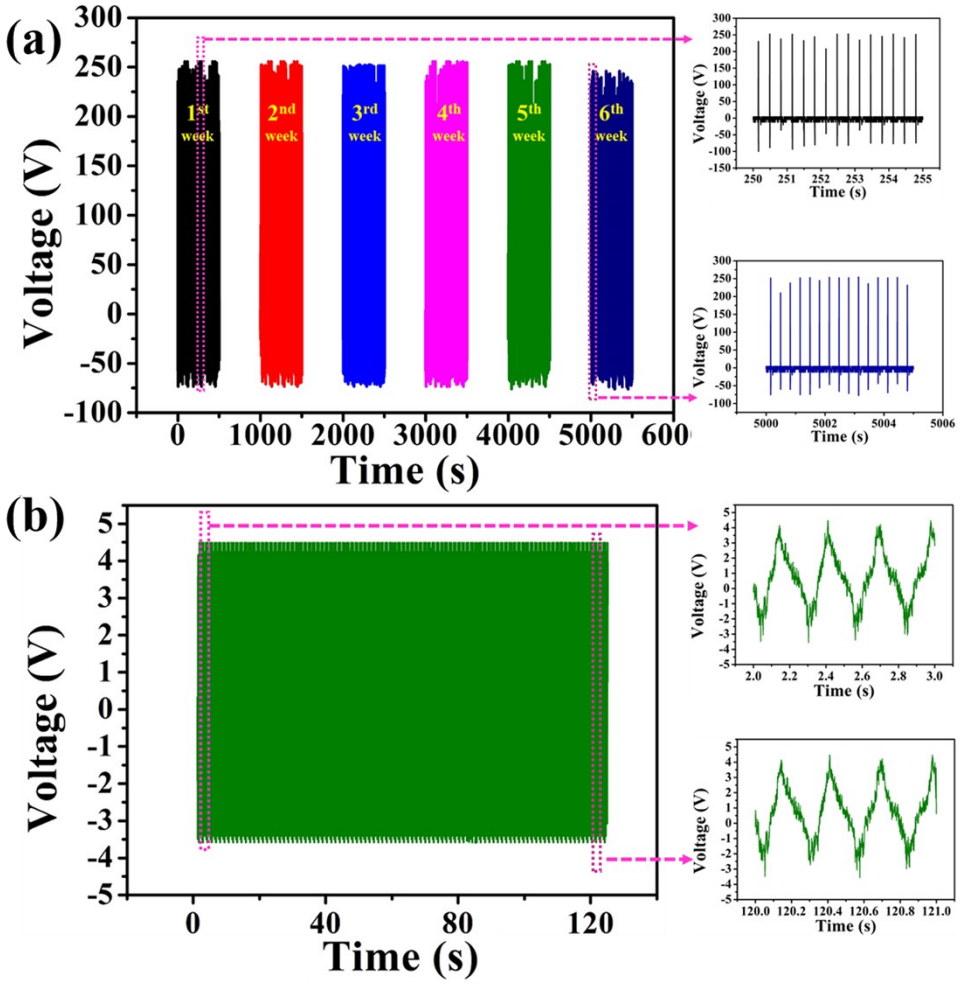

Fig. S11: (a) Cycle stability of S-TENG, (b) cycle stability of S-PENG.

Video file 1: Powering LEDs, stopwatch, and calculator

Video file 2: Power generation from different contact materials

Video file 3: Power generation from several human movements

Reference:

1. C. Hou, T. Huang, H. Wang, H. Yu, Q. Zhang, and Y. Li, *Scientific Reports*, 2013, **3(1)**, 1-6.