

Supporting Information

Force-Assembled Triboelectric Nanogenerator with High Humidity-Resistant Electricity Generation Using Hierarchical Surface Morphology

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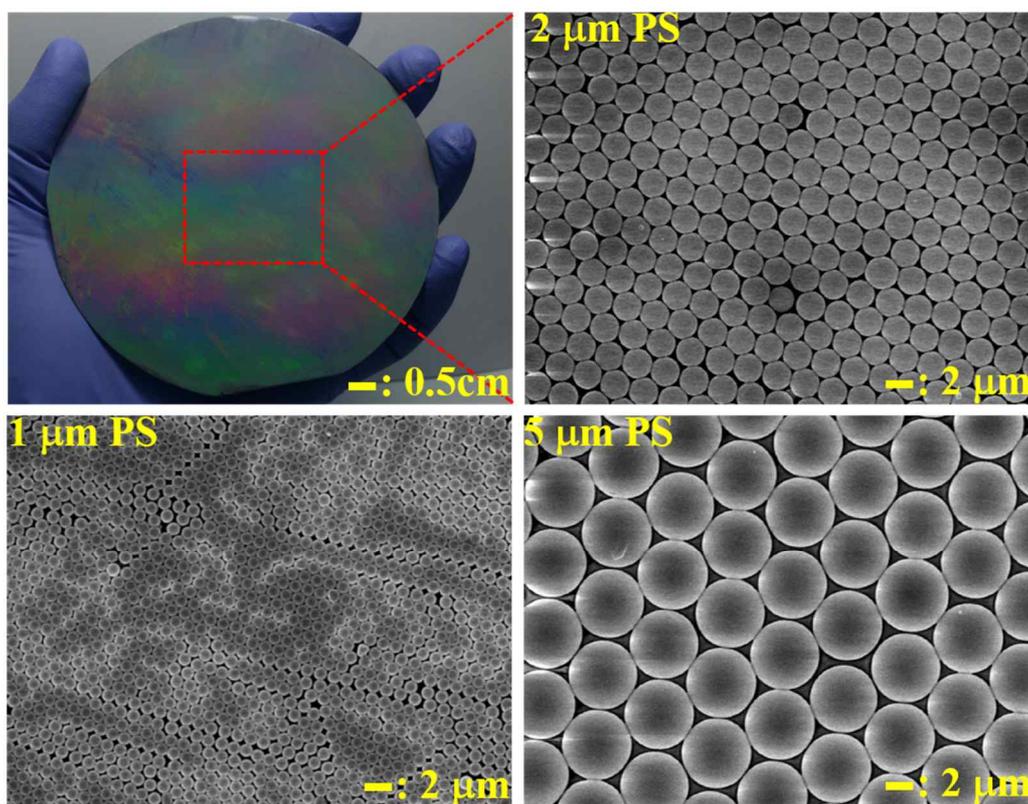


Figure S1. Photographic and SEM images of hexagonally-packed monolayer of PS (or silica) colloids with a diameter of 1, 2, and 5 μm onto the 4-inch Si wafer.

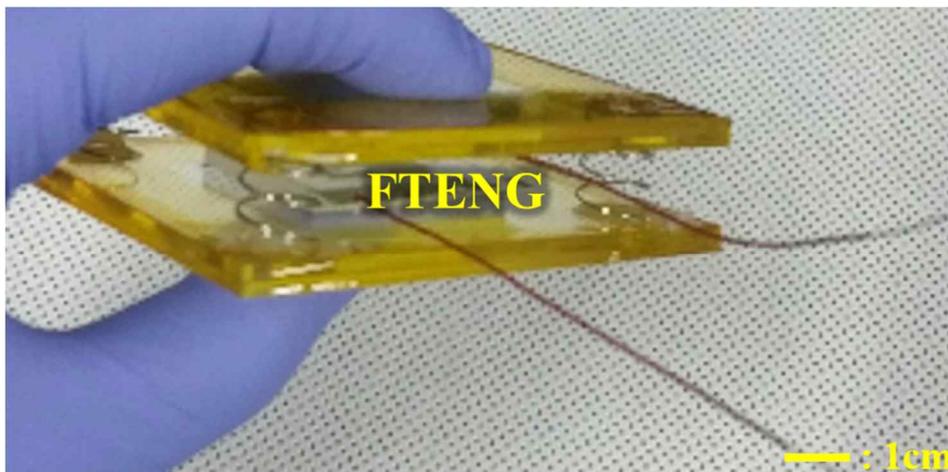


Figure S2. Photographic image of FTENG used in our study.

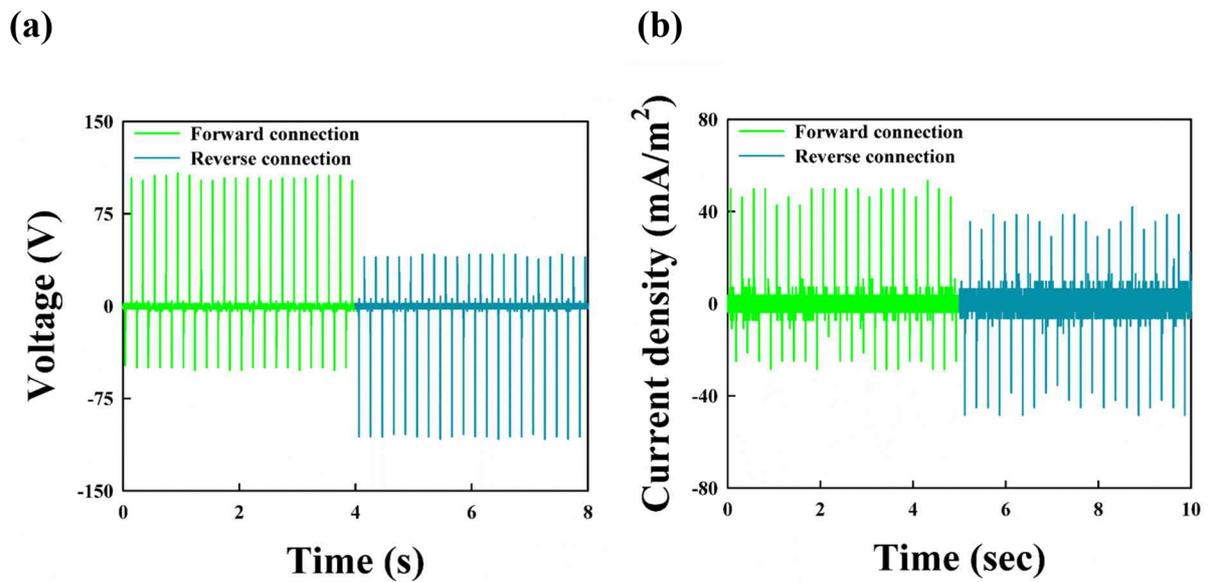


Figure S3. Polarity-switching tests about (a) output voltage and (b) current density of the 5 μm -intaglio-FTENG. When the voltage and current meters were initially connected to the 5 μm -intaglio-FTENG, the positive pulses were predominantly recorded during pushing. When the voltage and current meters were connected with reverse polarity, the pulses were also reversed. However, the magnitudes of the output voltages and currents under both conditions were nearly identical.

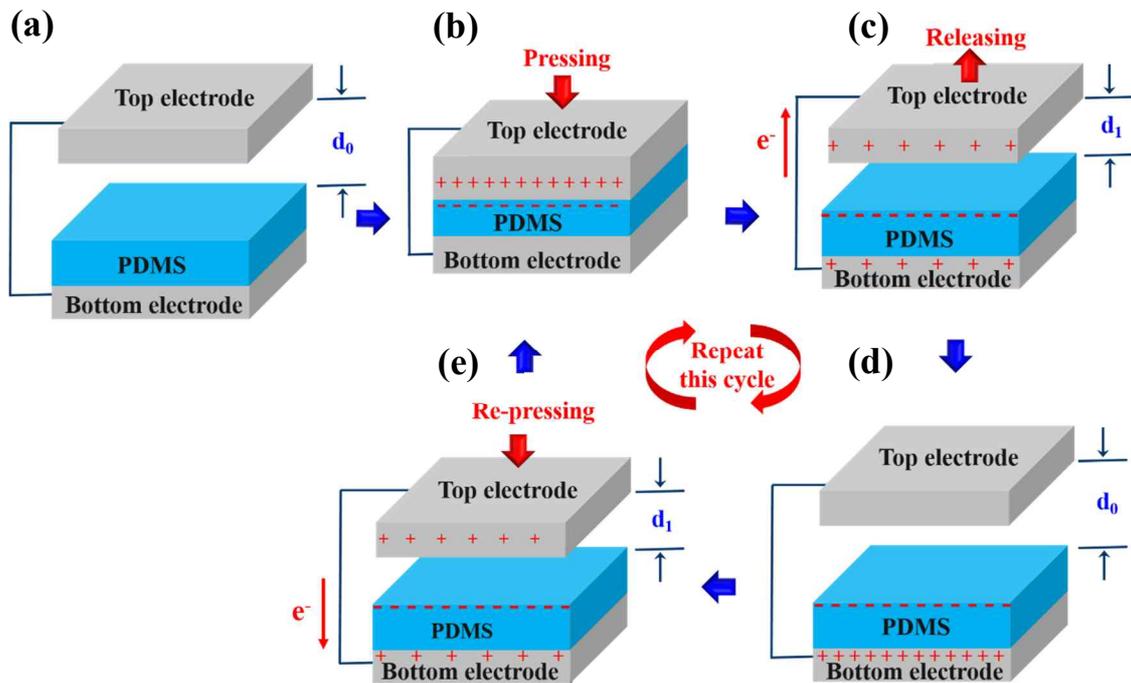
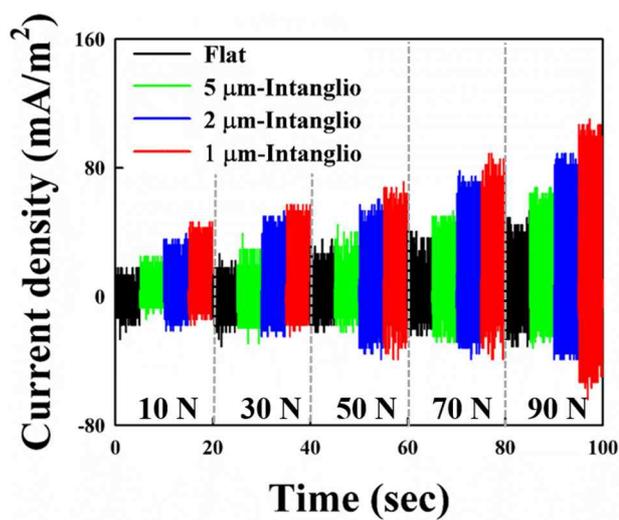


Figure S4. Schematic explaining the electric energy generation mechanism of FTENGs. (a) Initial position without a mechanical compressive force. (b) Intimate contact between the top (contact) electrode and PDMS film under a compressive force. (c) Separation of the top electrode and PDMS film after the removal of an external force. (d) Recovery of the separation distance. (e) Decrease of the separation distance under a re-applied compressive force.

(a)



(b)

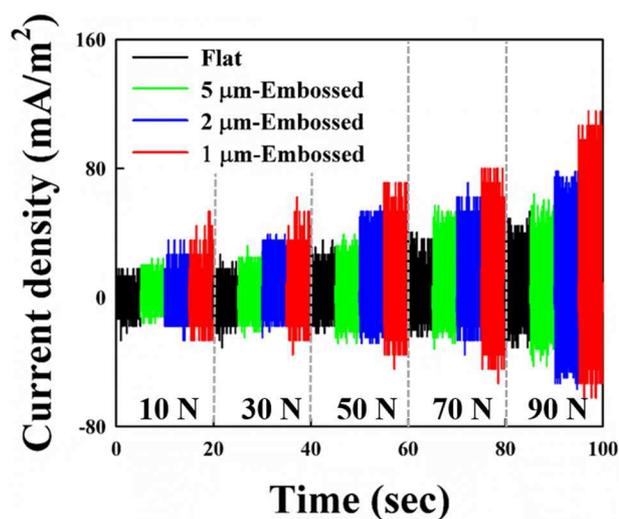


Figure S5. Variation of output current of (a) intaglio-FTENGs with a different micropore size (0.9, 1.9, and 4.8 μm) and (b) embossed-FTENGs with a different embossing feature size (0.8, 1.8, and 4.6 μm) as a function of applied compressive force (from 10 to 90 N).

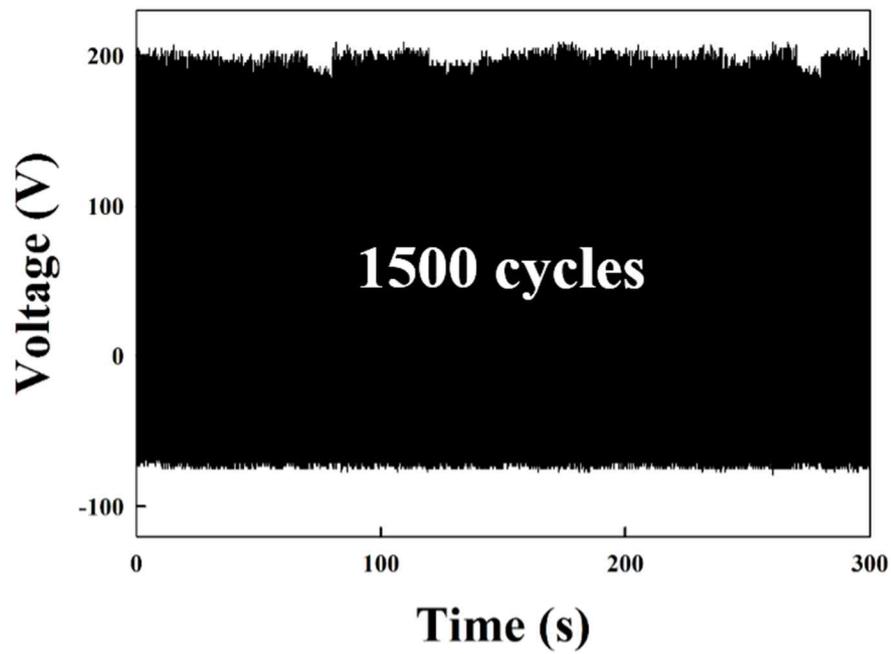


Figure S6. Electrical stability tests of the dual embossed-FTENGs remeasured after 5 weeks. The applied compressive force was 90 N.

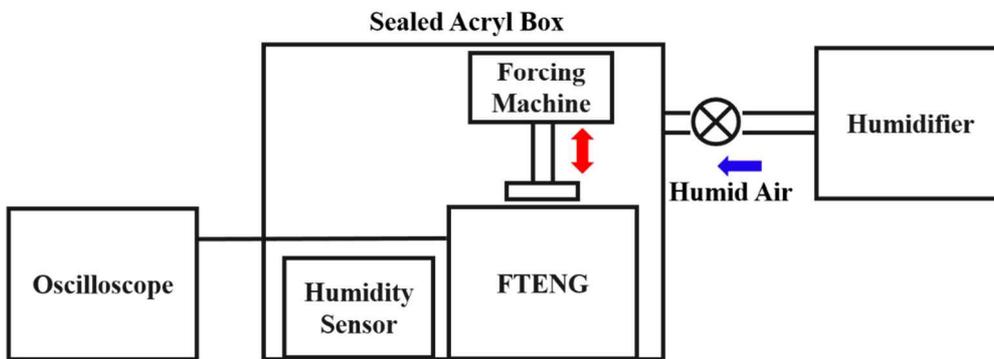
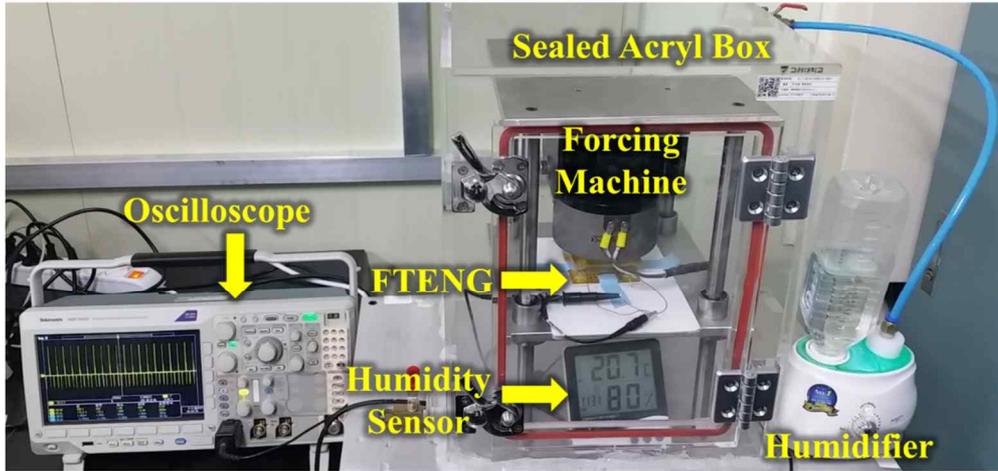


Figure S7. The apparatus and schematic used for the measurement of humidity-related electric output.

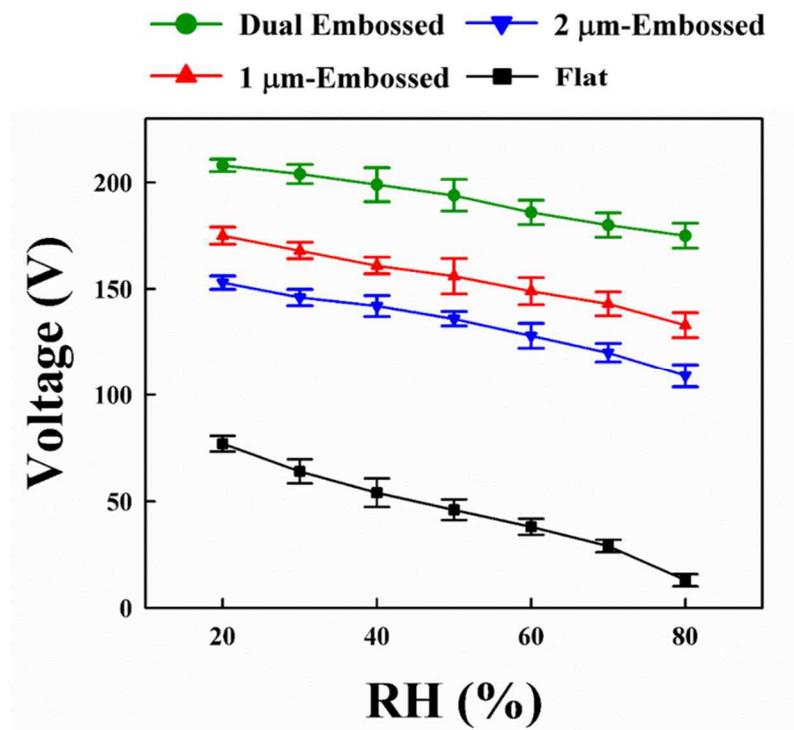


Figure S8. Total output voltages of flat TENG, 1 μ m, 2 μ m-embossed and dual embossed-FTENGs as a function of relative humidity.

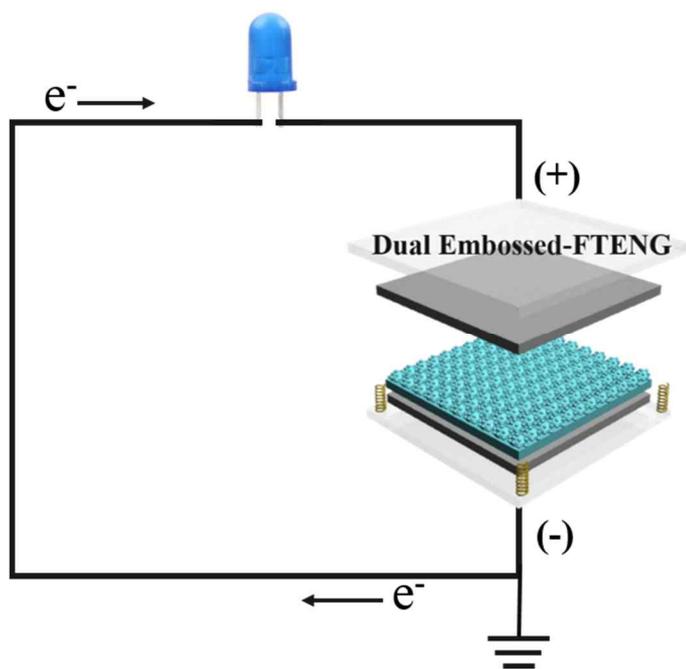


Figure S9. Schematic diagram showing the direct illumination of 100 LEDs through FTENGs without external power supplies or additional capacitors.

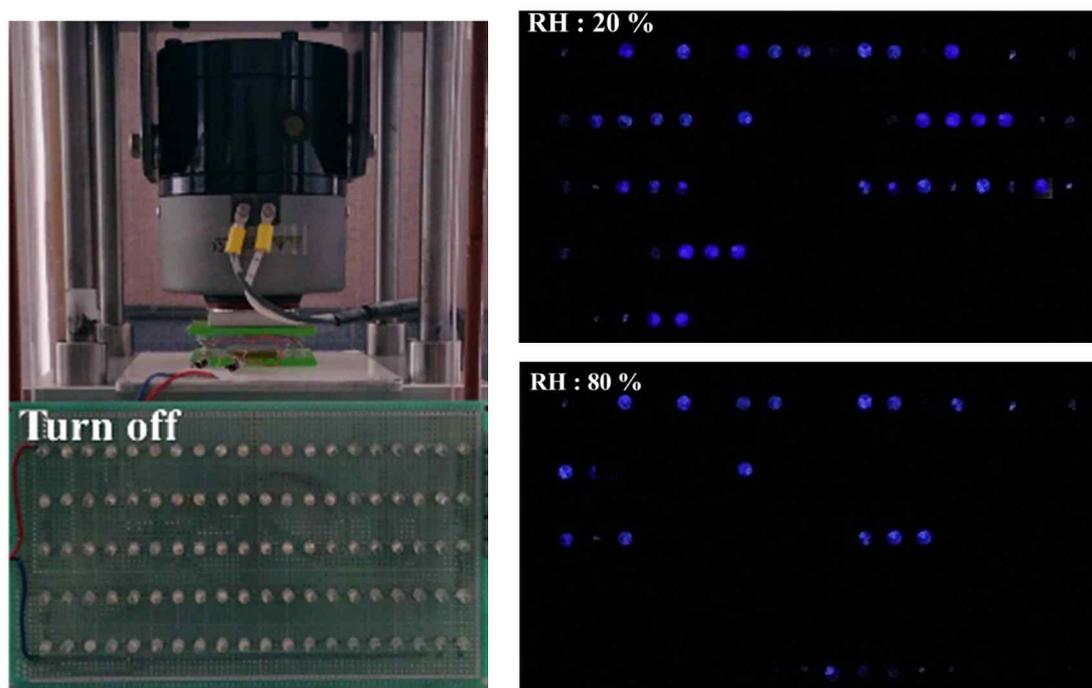


Figure S10. The use of electrical energy generated by the flat TENGs to operate 100 LEDs at 20 and 80 % RH (with the force of 90 N).

Video

Video including humidity test (**Video S1**) and LED demonstration (**Video S2**) has been now added to Supporting Information.