Supplementary file

Stretchable Nanogenerator with Micro-Nano Hierarchical Interfaces for Self-powered Biometric Authentication

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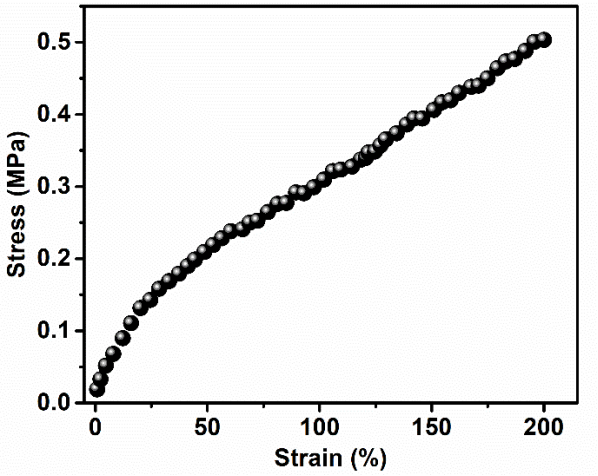
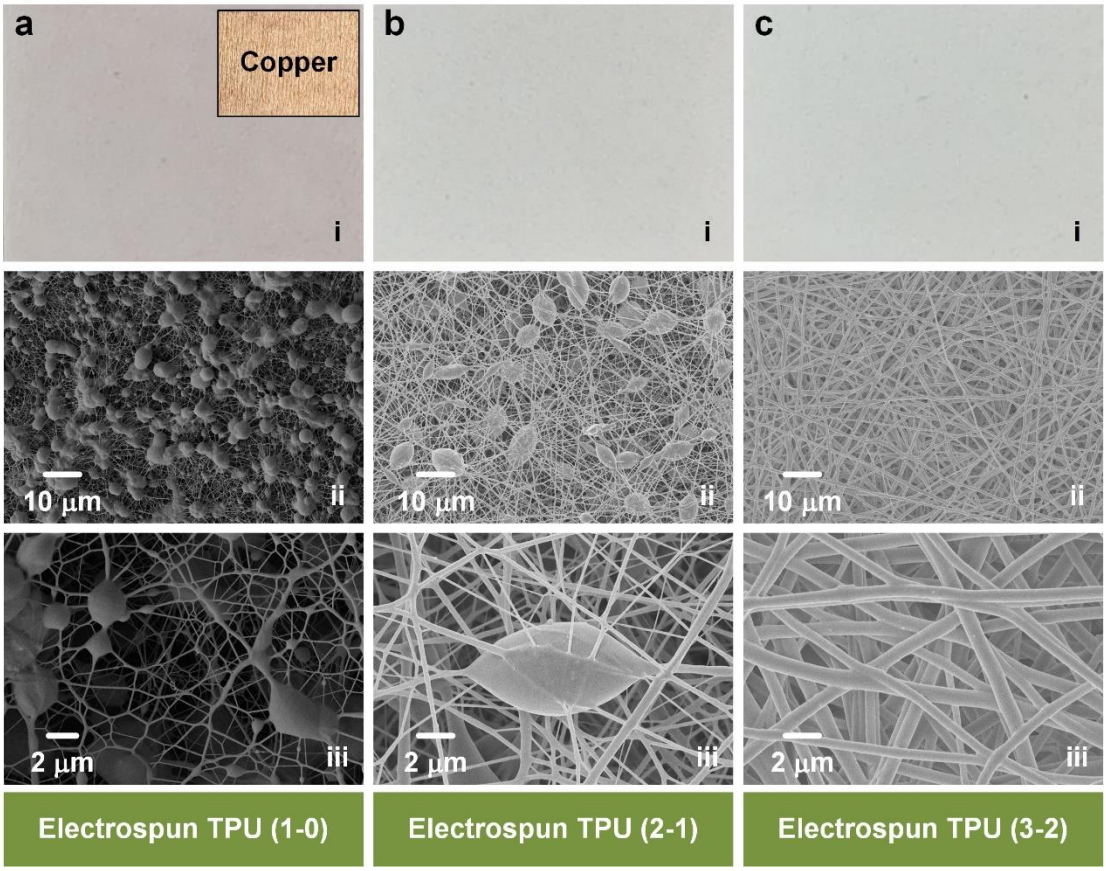
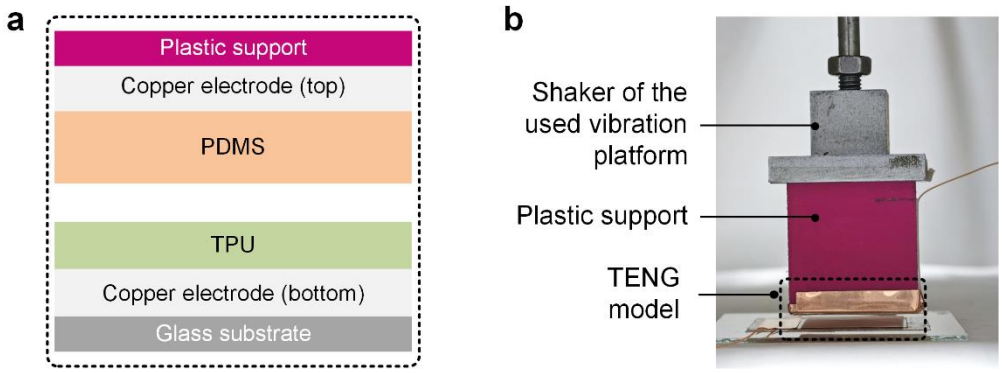


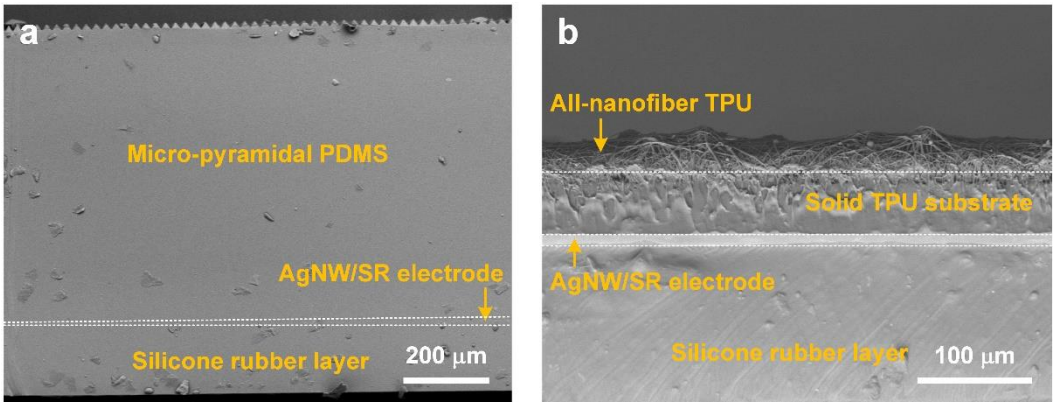
Supplementary Figure 1 Stress-strain curve of the developed STENG.



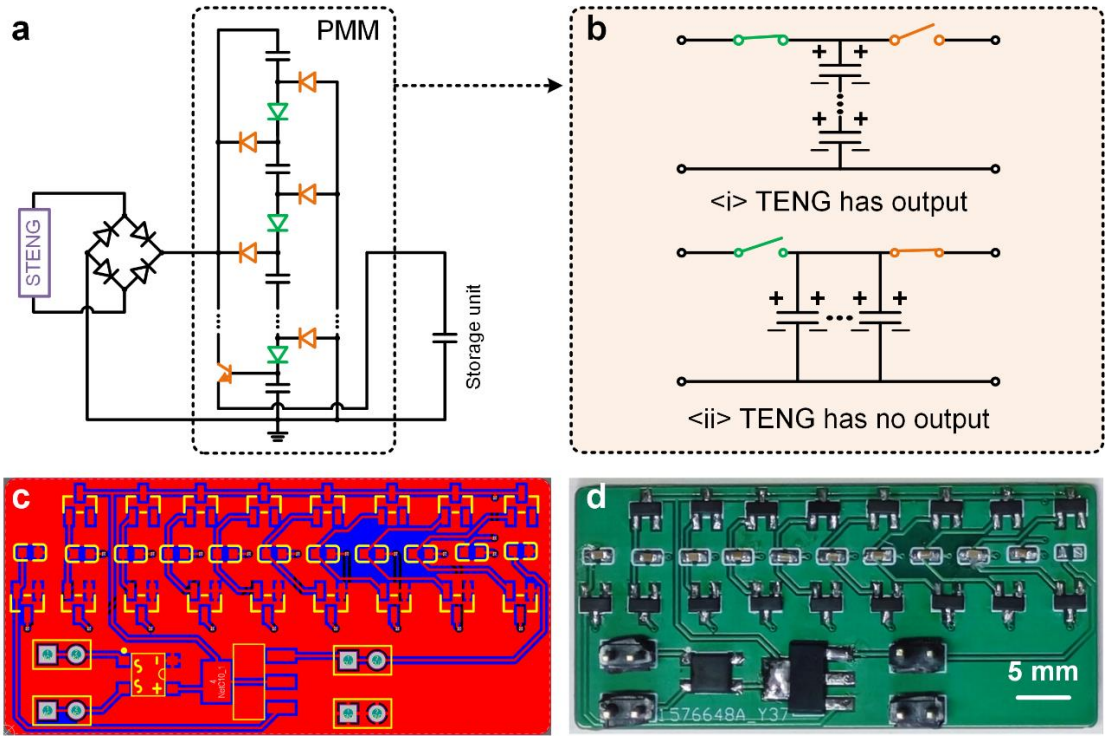
Supplementary Figure 2 Photograph and surface morphology of (a) electrospun TPU (1-0), (b) electrospun TPU (2-1), and (c) electrospun TPU (3-2) (i.e., TPU nanofiber). Notably, the TPU solution consists of liquid TPU and toughening agent with different ratios. The "TPU (m-n)" means that the weight ratio of liquid TPU and toughening agent is m:n. The background color of the photographs of the PDMS film and TPU mat resulted from their placement on a copper foil.



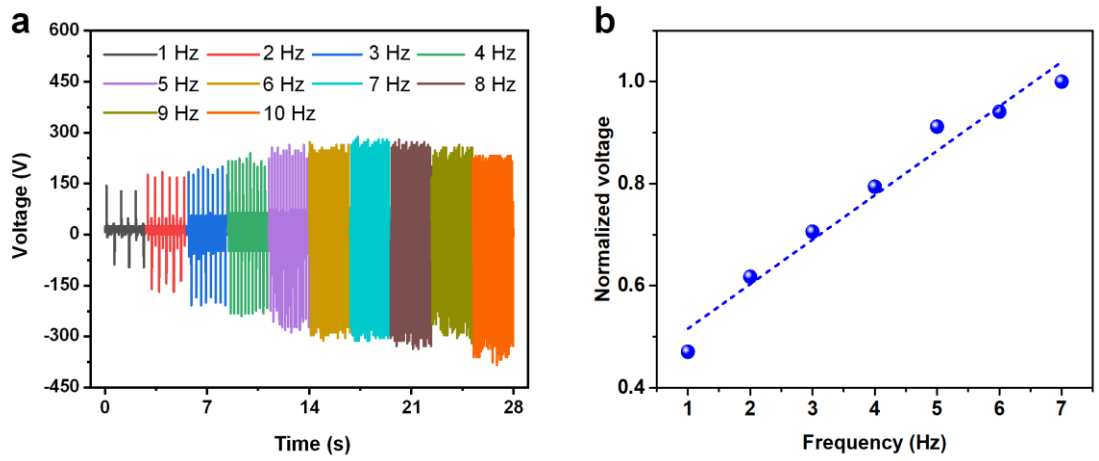
Supplementary Figure 3 TENG model used for studying the effect of different TPU on the output of STENG. (a) Schematic of the TENG model. (b) Photograph of the TENG model.



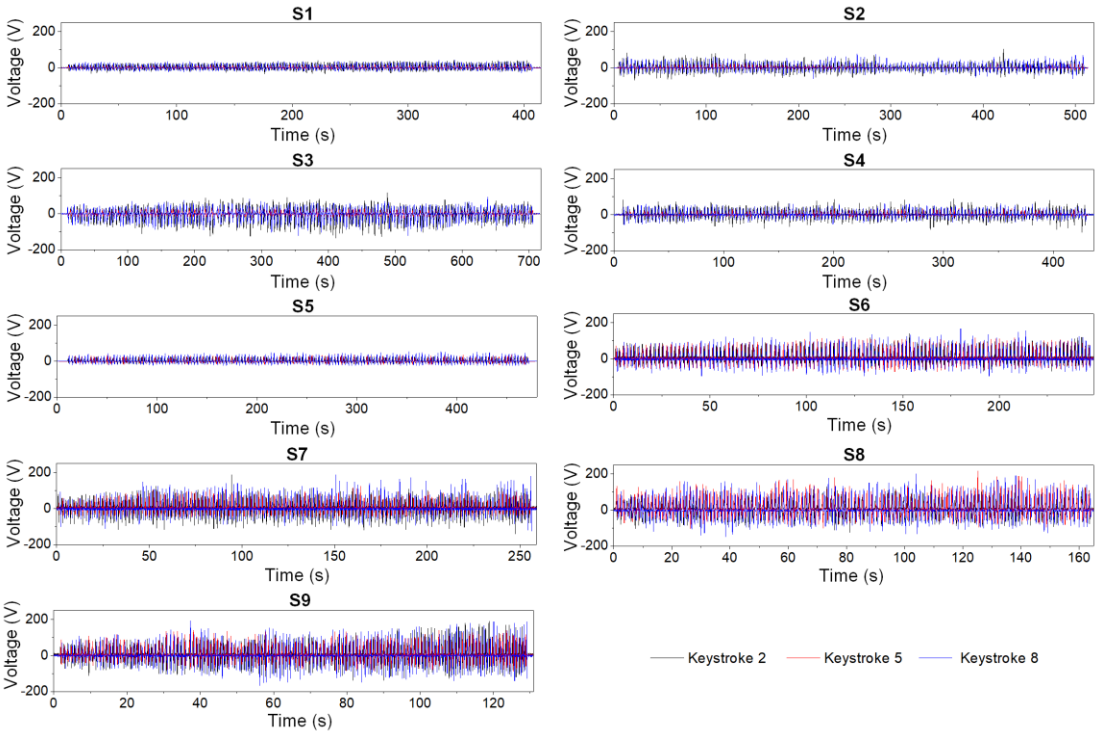
Supplementary Figure 4 Interfacial view of layer-by-layer functional components of STENG after 16500 working cycles. (a) Top part consisted of micro-pyramidal PDMS, AgNW/SR electrode, and silicone rubber layer. (b) Bottom part consisted of all-nanofiber TPU, solid TPU substrate, AgNW/SR electrode, and silicone rubber layer.



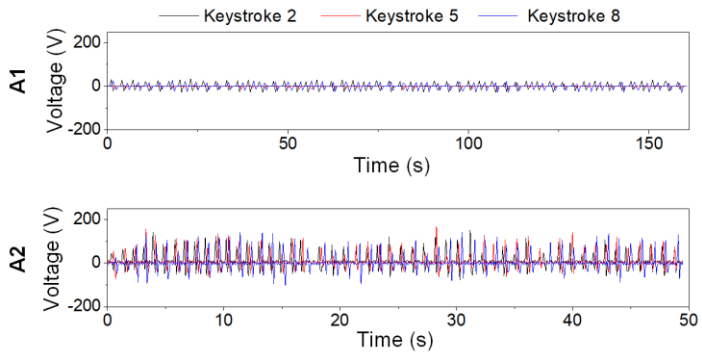
Supplementary Figure 5 A transistor-controlled power management circuit (TC-PMM) developed in a previous study to improve the huge impedance mismatch between the STENG and the energy storage unit (i.e., an external capacitor). (a) Schematic of the TC-PMM. (b) Equivalent circuit model of the TC-PMM, in which the transistors serve as electronic switches to automatically change the connection types of capacitors, thereby the charging state of the capacitors, i.e., series in charging state, and parallel in discharging state. When the triboelectric pair is in the separating or approaching step, the green diodes are working and the orange transistors are in an off state, the energy storage unit is charged by the STENG. (c) Layout of the TC-PMM. (d) Photograph of the TC-PMM.



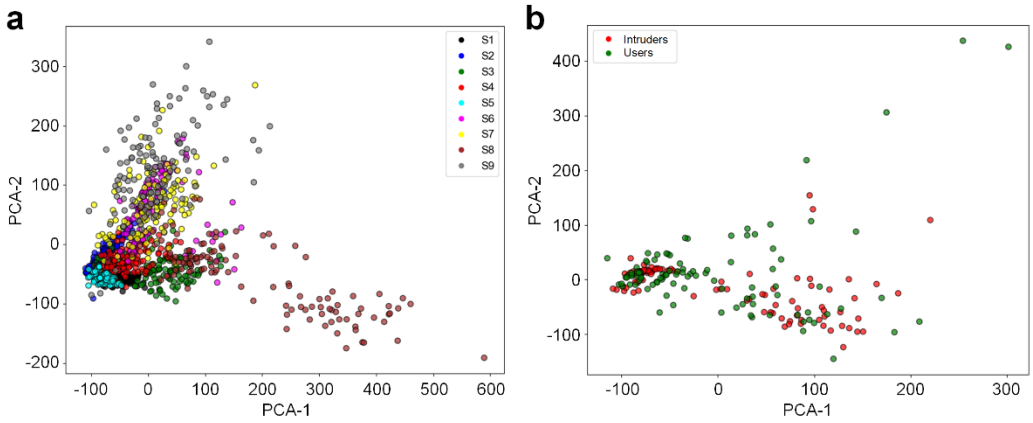
Supplementary Figure 6 Study on the effect of the frequency input of the external excitation on the voltage output of the STENG. (a) Voltage outputs of the STENG at different excitation frequencies. (b) The almost linear relationship between the excitation frequency and the STENT output provides a feasibility of the STENG for self-powered sensing, such as self-powered biometric authentication.



Supplementary Figure 7 The collected 120 sets of data from night users (S1-S9).



Supplementary Figure 8 The collected 50 sets of data from two intruders (A1-A2).



Supplementary Figure 9 The feature visualization result of (a) the data from all users, and (b) the data from users and intruders in a 2D space based on Principal Component Analysis (PCA).