Supporting Information

Sensing-Transducing Coupled Piezoelectric Textile for Self-Powered Humidity Detection and Wearable Biomonitoring

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Supplementary Note 1. Materials constants of Sm-PMN-PT and PEI used in calculating the effective properties of the piezoelectric composites.

Sm-PMN-PT

Relative dielectric permittivity $\boldsymbol{\varepsilon}_r$

$$\begin{bmatrix} 9184 & & \\ & 9184 & \\ & & 9184 \end{bmatrix}$$

Piezoelectric coefficient **d**

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 1241 & 0 \\ 0 & 0 & 0 & 1241 & 0 & 0 \\ -446 & -446 & 1050 & 0 & 0 & 0 \end{bmatrix} \text{(pC/N)}$$

Elastic stiffness **c**

$$\begin{bmatrix} 207.3 & 166.4 & 109.3 & 0 & 0 & 0 \\ 166.4 & 207.3 & 109.3 & 0 & 0 & 0 \\ 109.3 & 109.3 & 110.1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 19.9 & 0 & 0 \\ 0 & 0 & 0 & 0 & 19.9 & 0 \\ 0 & 0 & 0 & 0 & 0 & 20.4 \end{bmatrix} \text{(GPa)}$$

PEI

Relative dielectric permittivity $\boldsymbol{\varepsilon}_r$

$$\begin{bmatrix} 3 & & \\ & 3 & \\ & & 3 \end{bmatrix}$$

Piezoelectric coefficient **d**

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \text{(pC/N)}$$

Elastic stiffness **c**

$$\begin{bmatrix} 1.78 & 0.96 & 0.96 & 0 & 0 & 0 \\ 0.96 & 1.78 & 0.96 & 0 & 0 & 0 \\ 0.96 & 0.96 & 1.78 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1.22 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1.22 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1.22 \end{bmatrix} \text{(GPa)}$$

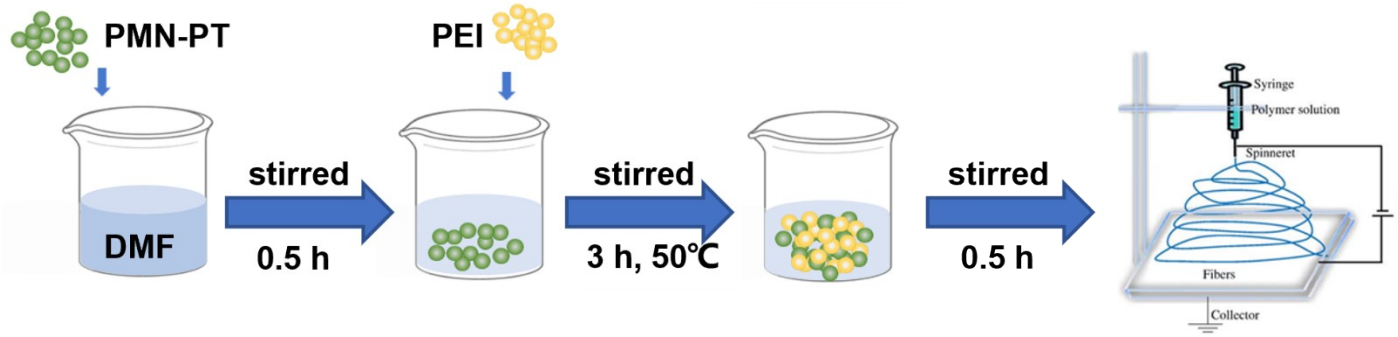

Figure S1. Synthesis process of sensing-transducing coupled piezoelectric (STP) textiles.

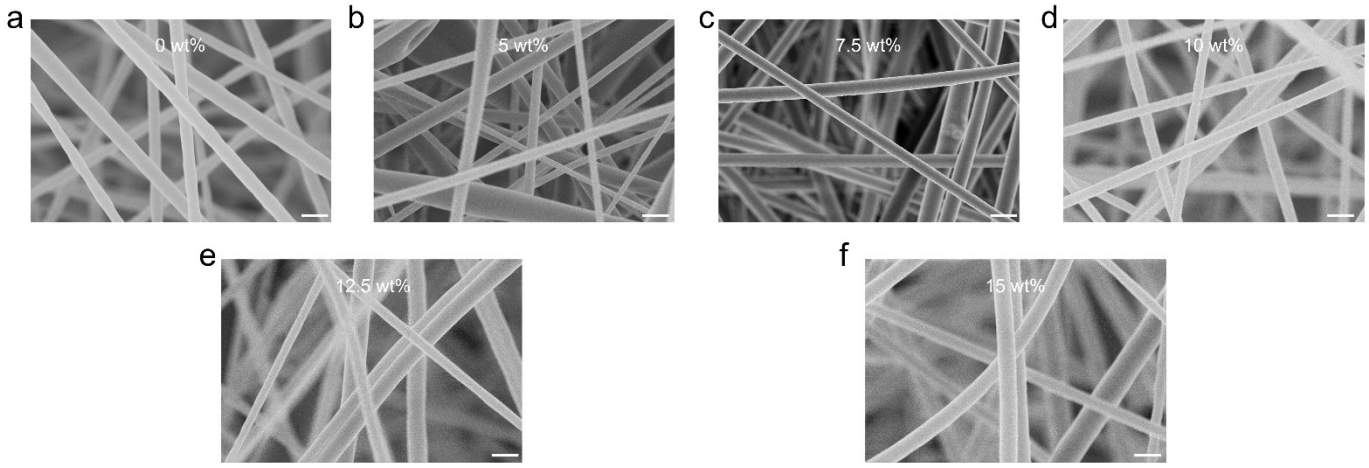

Figure S2. Scanning electron microscope (SEM) images of as-prepared textiles loaded with various mass fractions of Sm-PMN-PT ceramic. Scale bar: 500 nm.

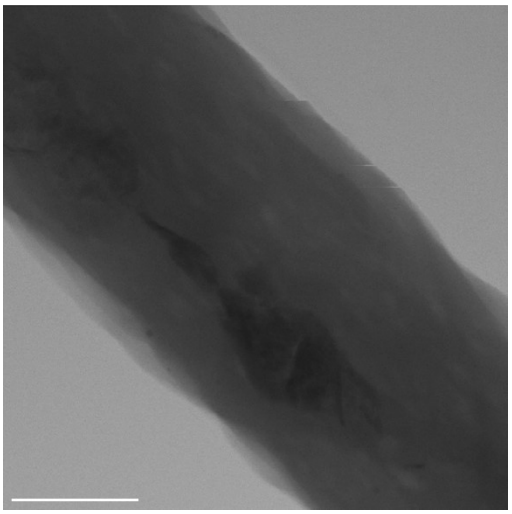

Figure S3. TEM image of the electrospun textiles after the inclusion of Sm-PMN-PT ceramic particles. Scale bar: 250 nm.

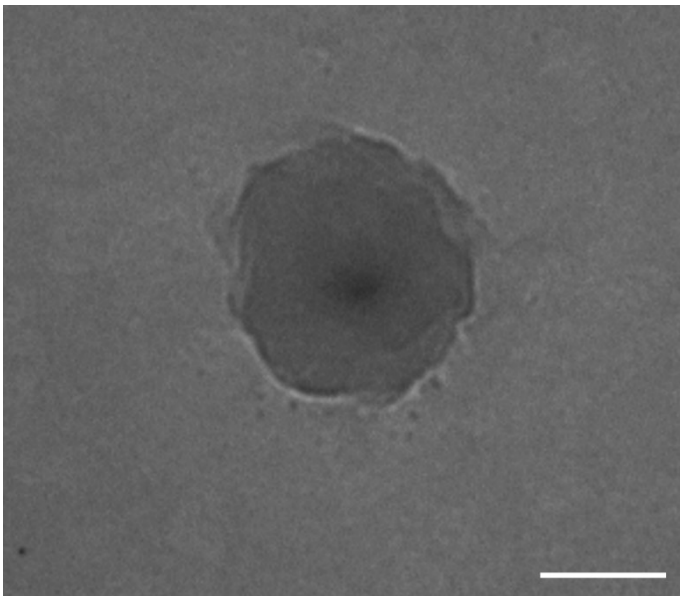

Figure S4. Scanning electron microscope (SEM) image of the Sm-PMN-PT nanoparticle. Scale bar: 50 nm.

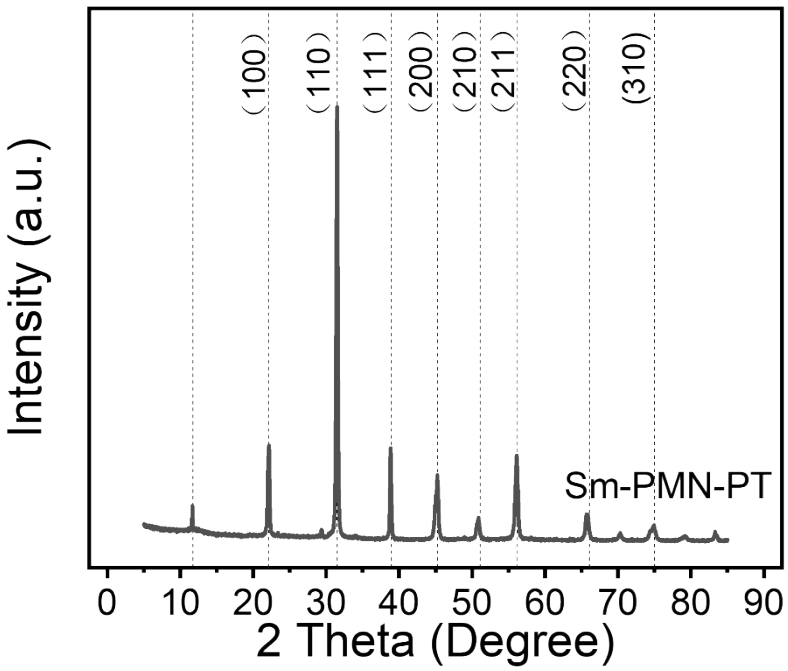

Figure S5. X-ray diffraction (XRD) spectra of the Sm-PMN-PT powder.

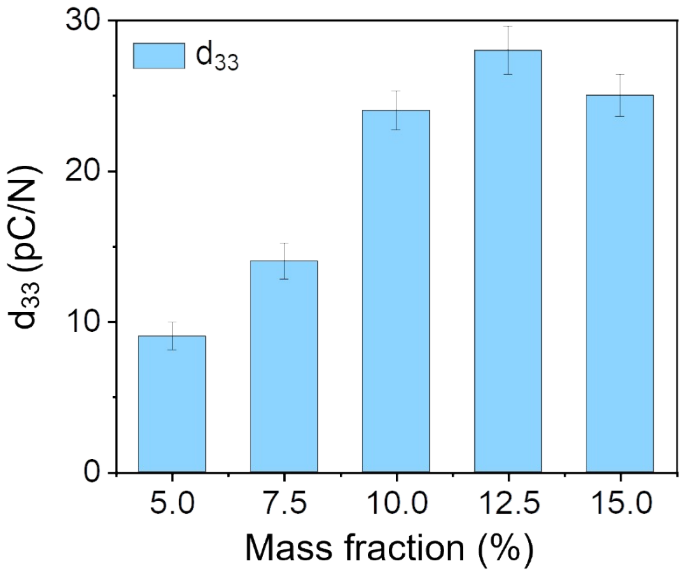

Figure S6. Piezoelectric constant (d_{33}) of electrospun films with different Sm-PMN-PT contents measured by d_{33} meter.

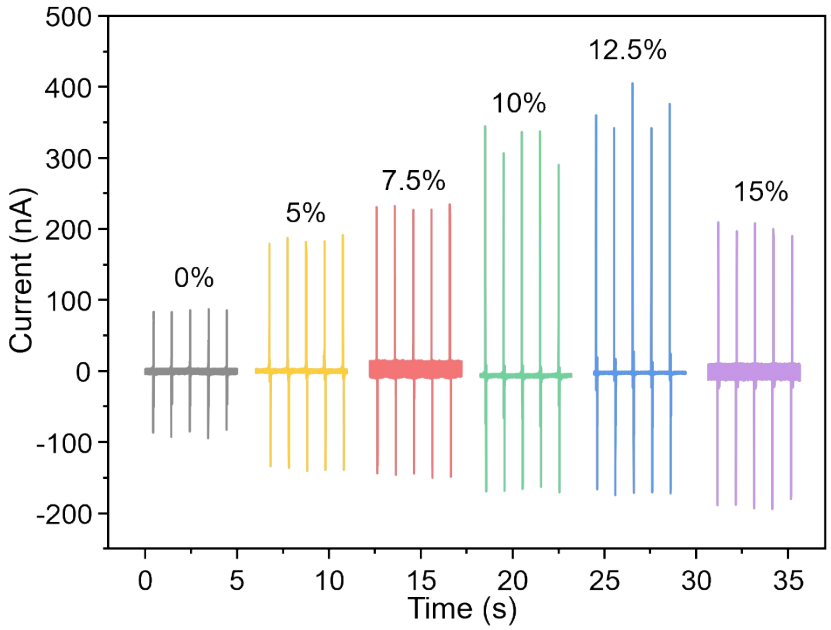

Figure S7. Output current of the electrospun STP textiles doped with various Sm-PMN-PT mass fractions under a fixed force of 5 N.

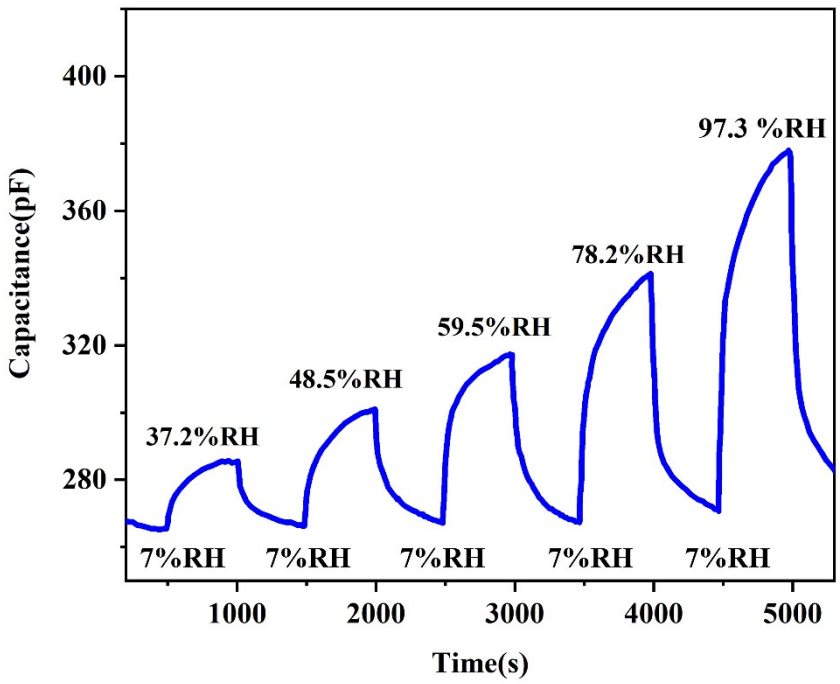

Figure S8. Dynamic capacitance of as-received STP textiles in response to various relative humidity.

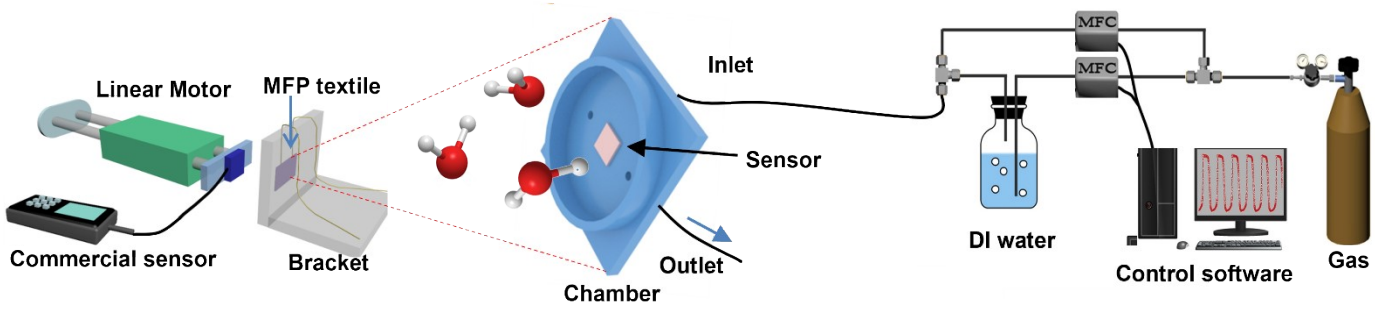

Figure S9. The measurement system for active humidity sensing behaviors characterization of the as-electrospun STP textiles.

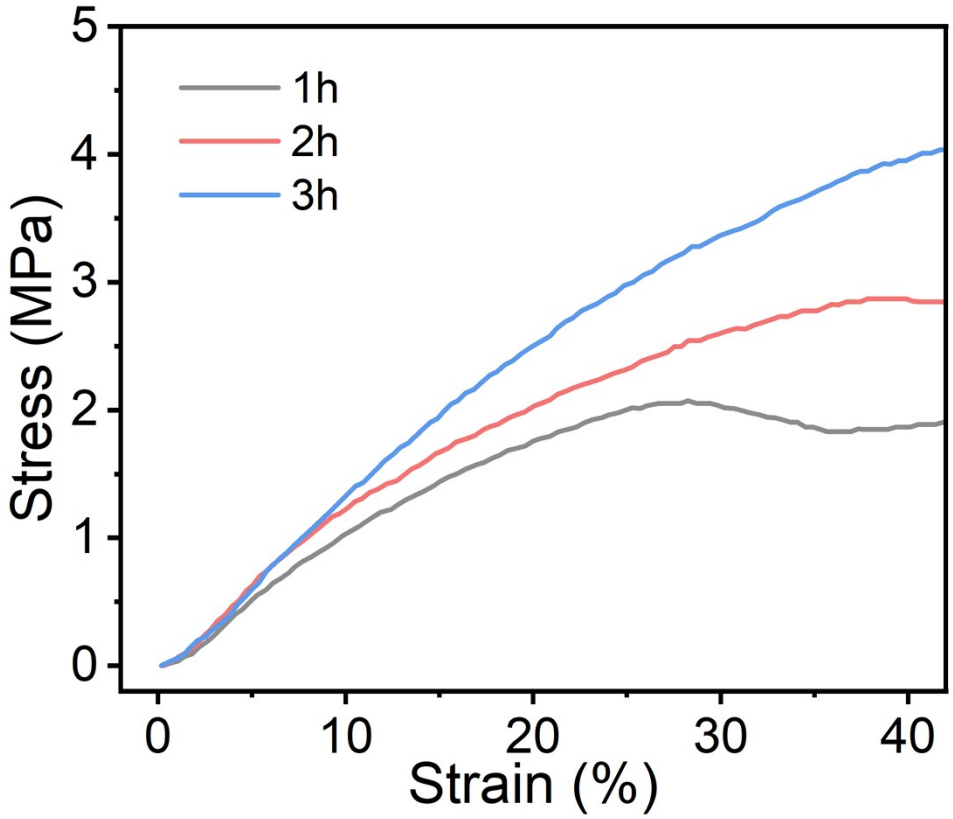

Figure S10. Stress-strain curves of as-prepared STP textiles fabricated with various electrospinning time.

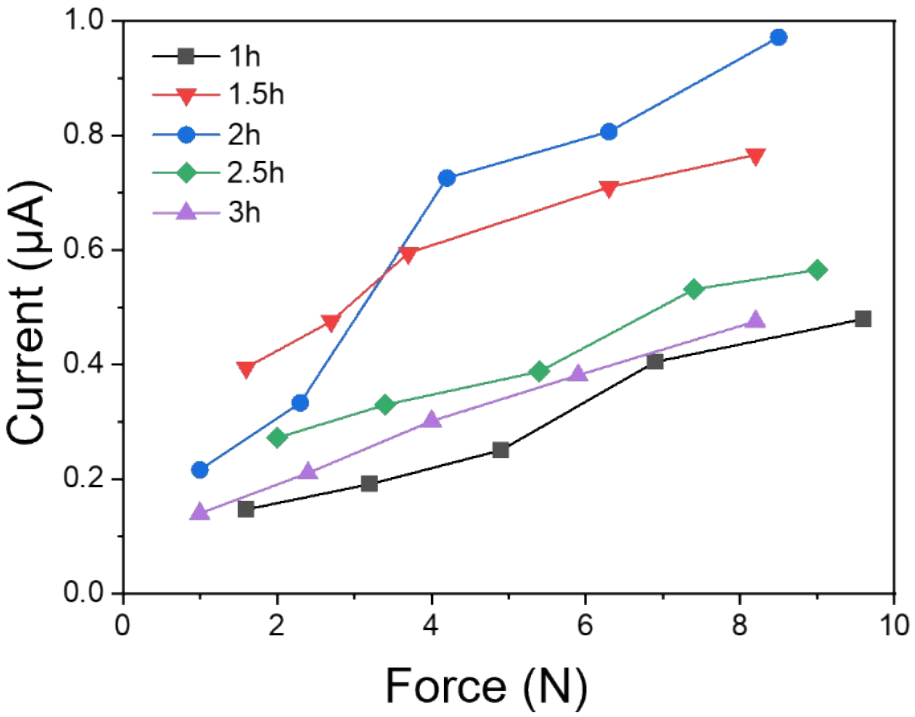

Figure S11. Output current of as-electrospun STP textiles fabricated with various duration.

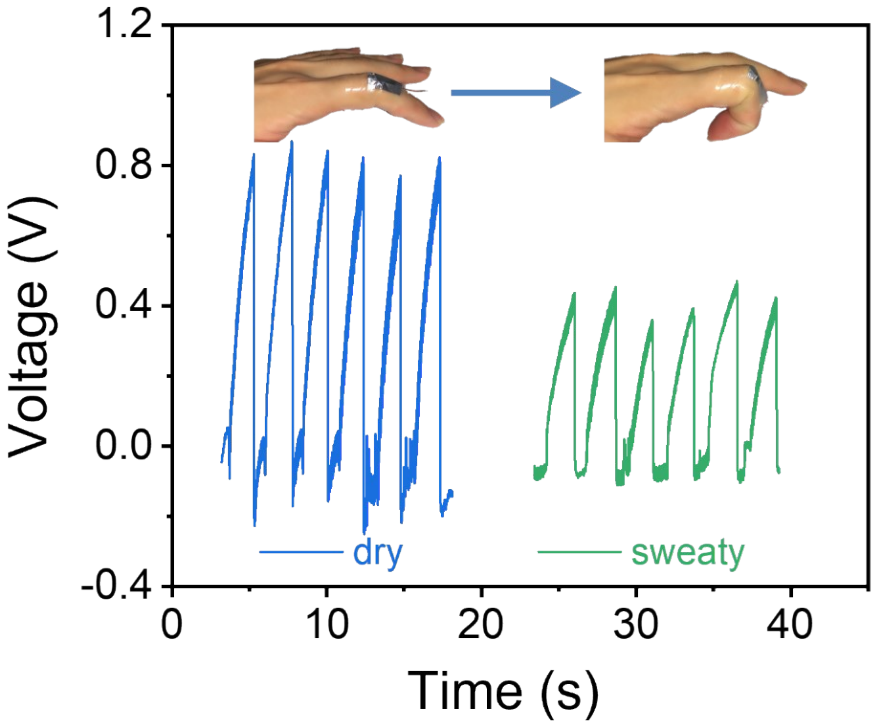

Figure S12. Dynamic waveforms of as-prepared STP textiles in response to bending finger under dry and sweaty condition.

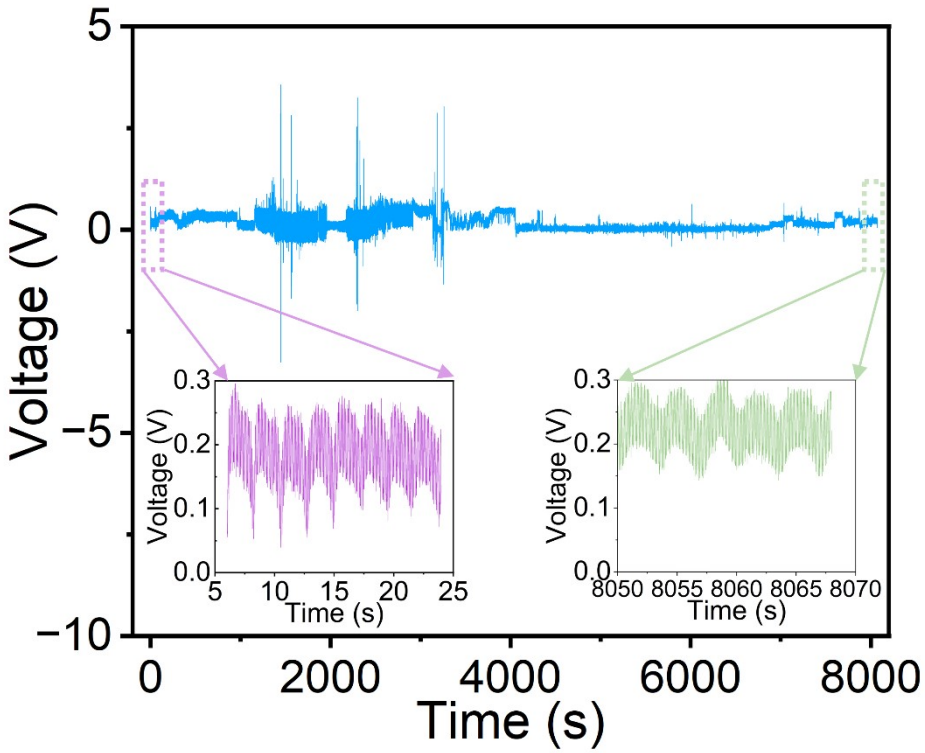

Figure S13. Durability of the prepared STP textile taped on the facial mask for long-term respiration monitoring.

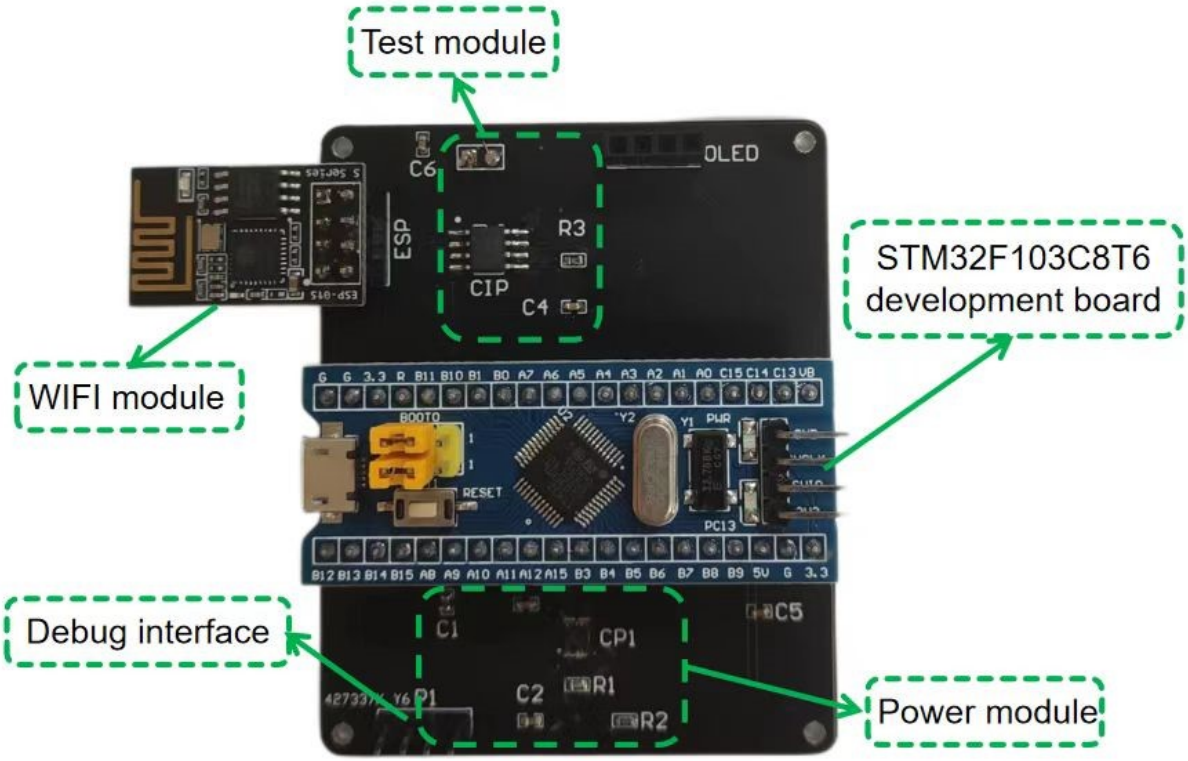

Figure S14. Photograph of the processing circuit board.

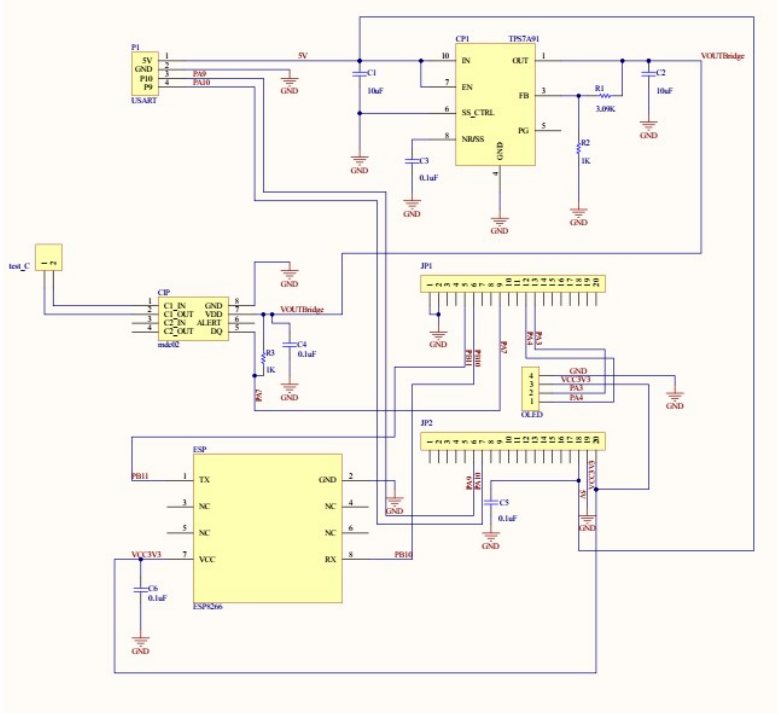

Figure S15. Circuit diagram of processing circuit for respiratory monitoring system.

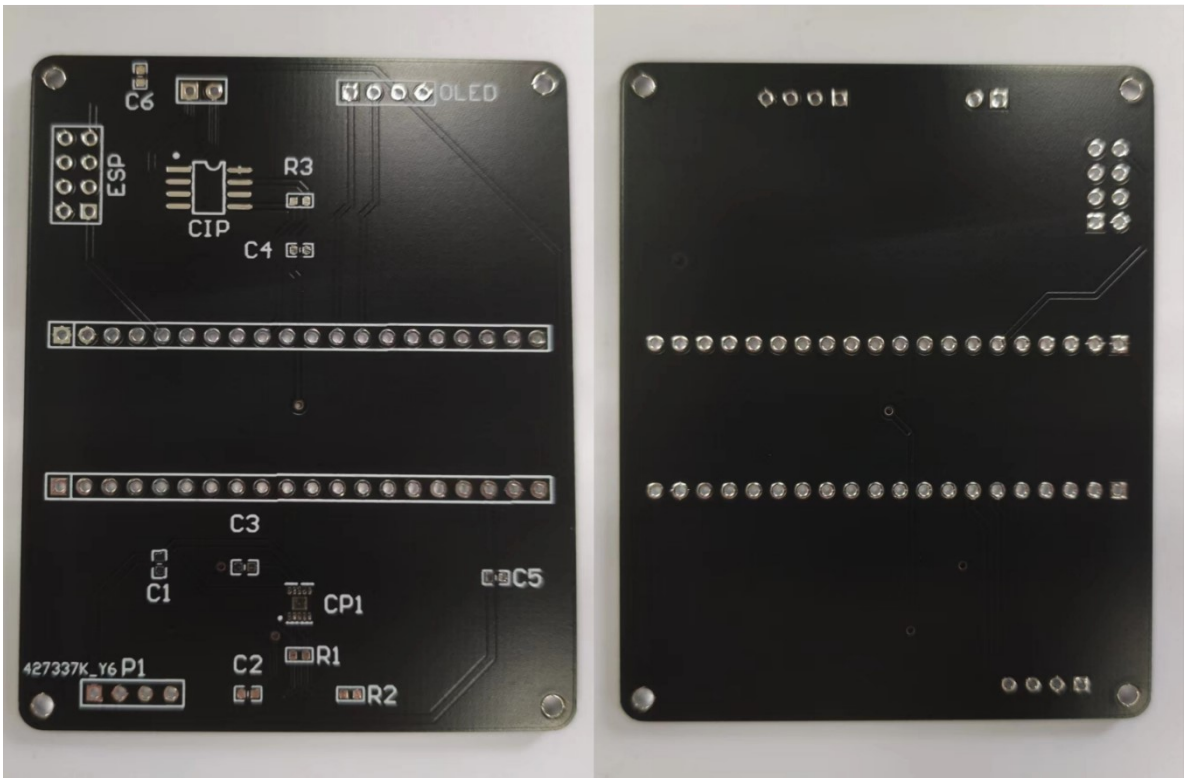

Figure S16. The front and back sides of Printed circuit board without electric components.