Electronic Supplementary Material (ESI) for Nanoscale Advances.

Supplementary Information

The benefits of combining 1D and 3D nanofilers in piezocomposite nanogenerator for biomechanical energy harvesting

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S1. Reagents and materials

Barium acetate (ACS reagent, 99.0–102.0%) was obtained from Alfa Aesar. Calcium nitrate tetrahydrate (ACS reagent, 99%), ethanol (laboratory reagent, 96%), sodium hydroxide pellets (puriss. p.a. ACS reagent, ≥98%), hydrochloric acid (ACS reagent, 37%) and dichloromethane (ACS reagent, ≥99.9 %) were purchased from Sigma Aldrich. Deionised water (DI, the resistivity of 18.2 MΩ cm^{-1}) was obtained from a PURELAB-classic water purification system (ELGA LabWater). Polylactic acid (PLA) with reference Ingeo™ Biopolymer 6201D was purchased from NatureWorks. Commercially available Cu foil (>99.99%, 9 µm thickness) was purchased from MTI corporation.

S2. Confirmation of the composition of the BCZT multipods

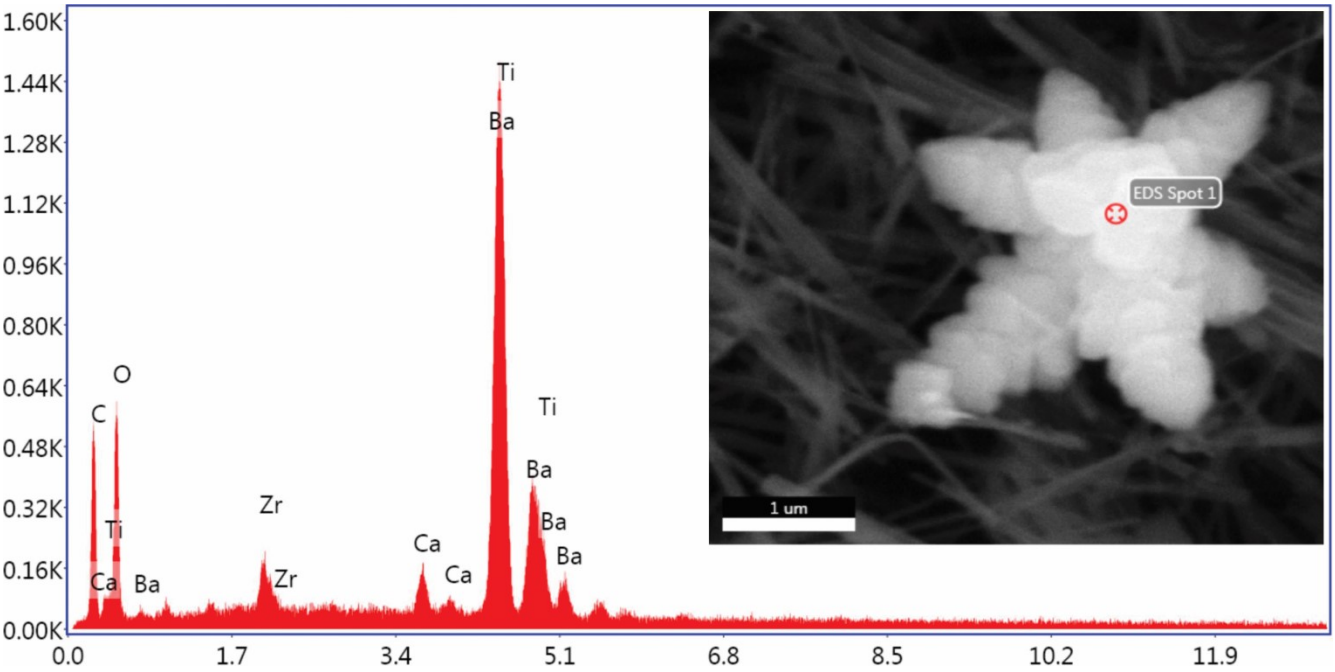

Fig. S1 Chemical composition of the multipods. The results of the Energy Dispersive X-ray (EDX) analysis (in inset SEM image of a single multipod).

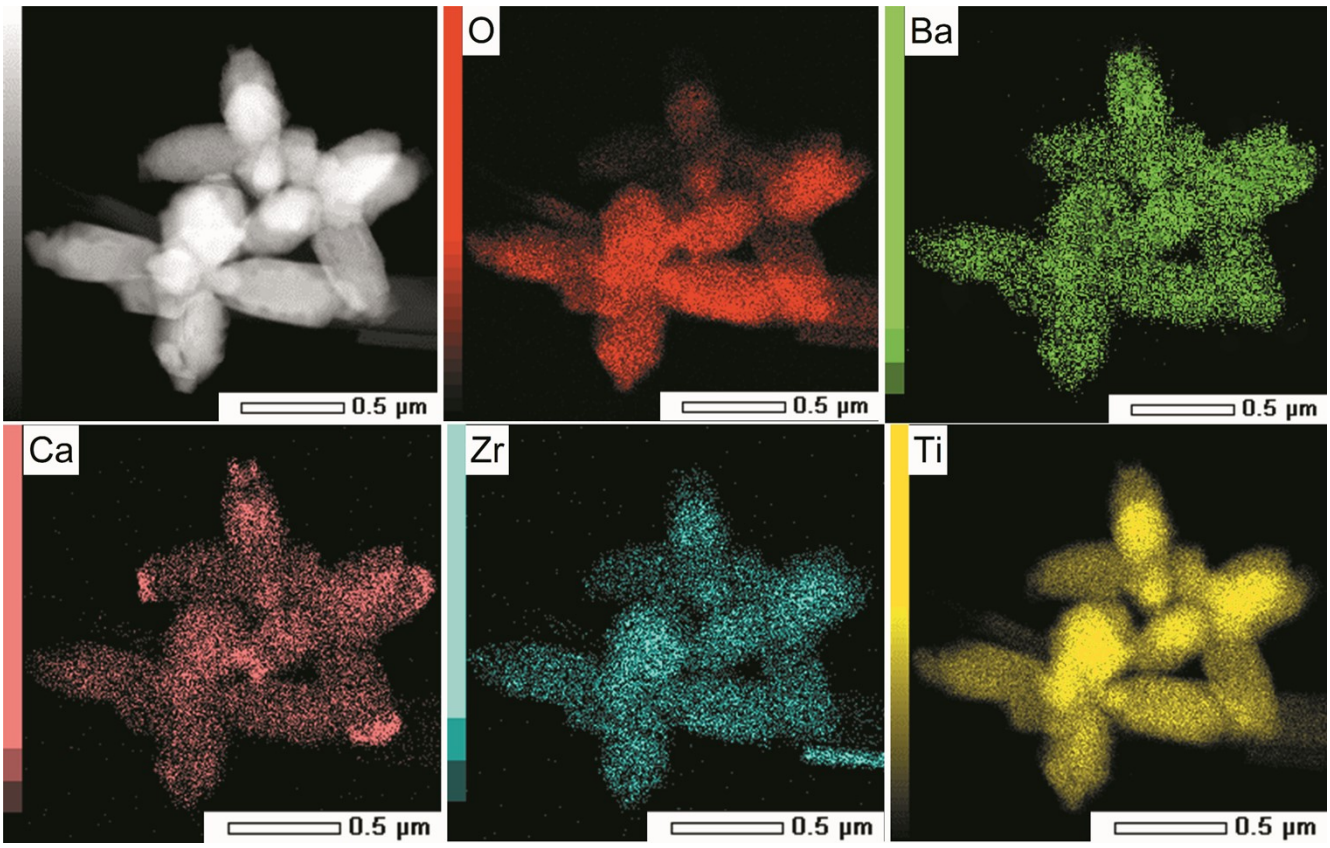

Fig. S2 TEM images and EDX elemental mapping images of the BCZT multipods. The red, green, pink, blue and yellow areas correspond to O, Ba, Ca, Zr, Ti elements, respectively.

S3. Thickness of the 20 vol% HZTO-nw+BCZT-mp/PLA film

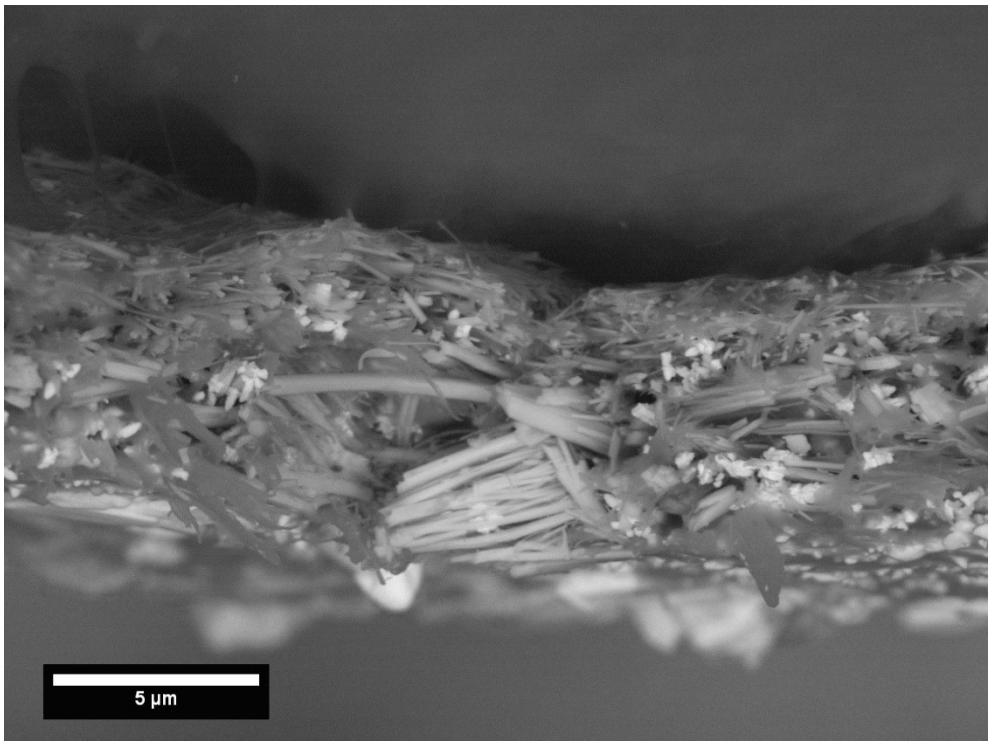

Fig. S3 Low-magnification view of the cross-section of the 20 vol% HZTO-nw+BCZT-mp/PLA film.

S4. Thermal and mechanical properties of PLA and HZTO-nw+BCZT-mp/PLA nanocomposite films

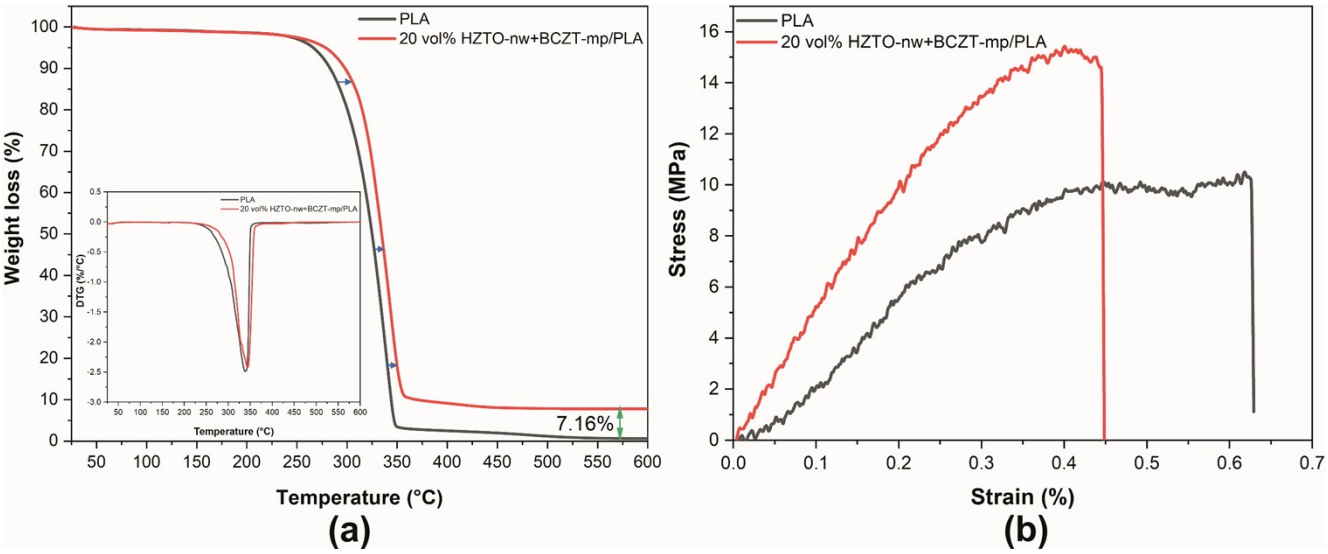

Fig. S4 (a) The thermogravimetric (TG) curves (in inset their respective derivative thermograms (DTG) curves), (b) typical stress–strain curves of neat PLA and 20 vol% HZTO-nw+BCZT-mp/PLA films.

S5. Effect of HZTO-nw+BCZT-mp concentration

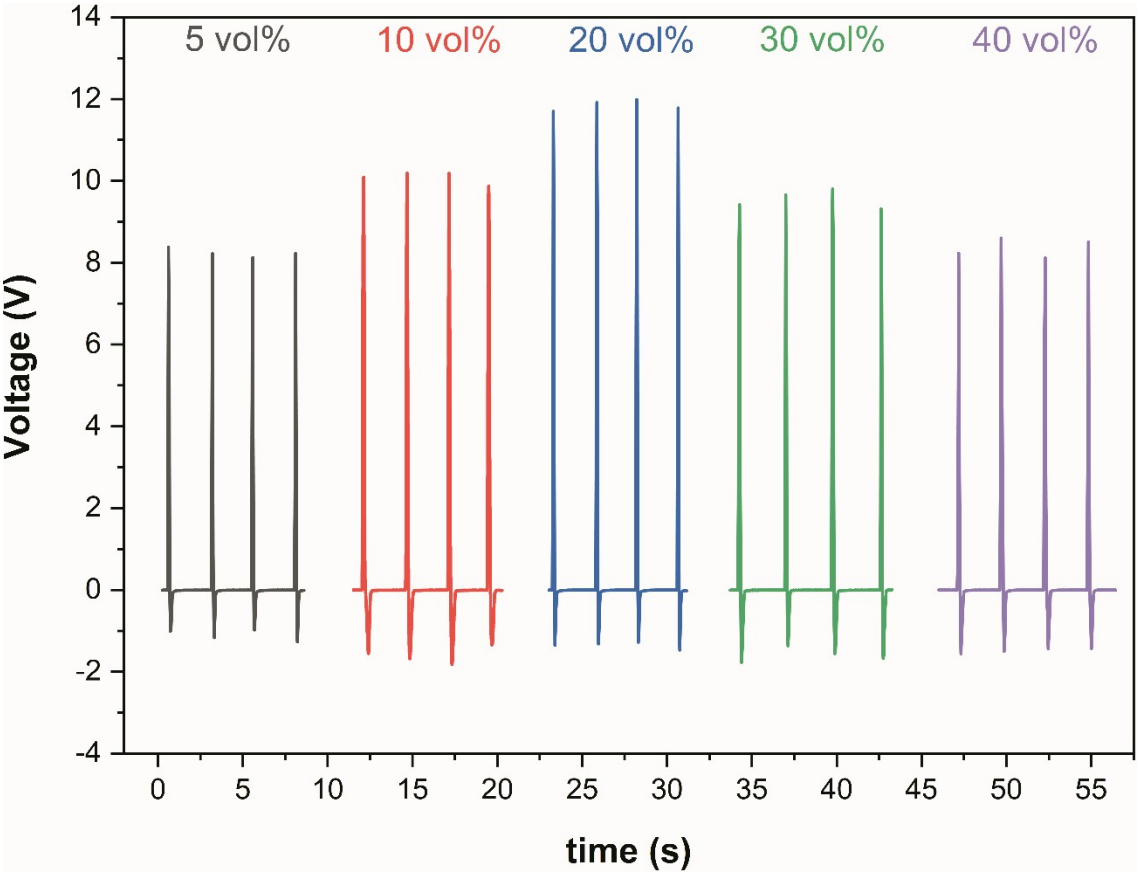

Fig. S5 The output voltage of HZTO-nw+BCZT-mp/PLA nanocomposite film-based nanogenerators with different filler concentrations.

S6. Simulation of the mechanical stress and the piezoelectric potential of c-PNG

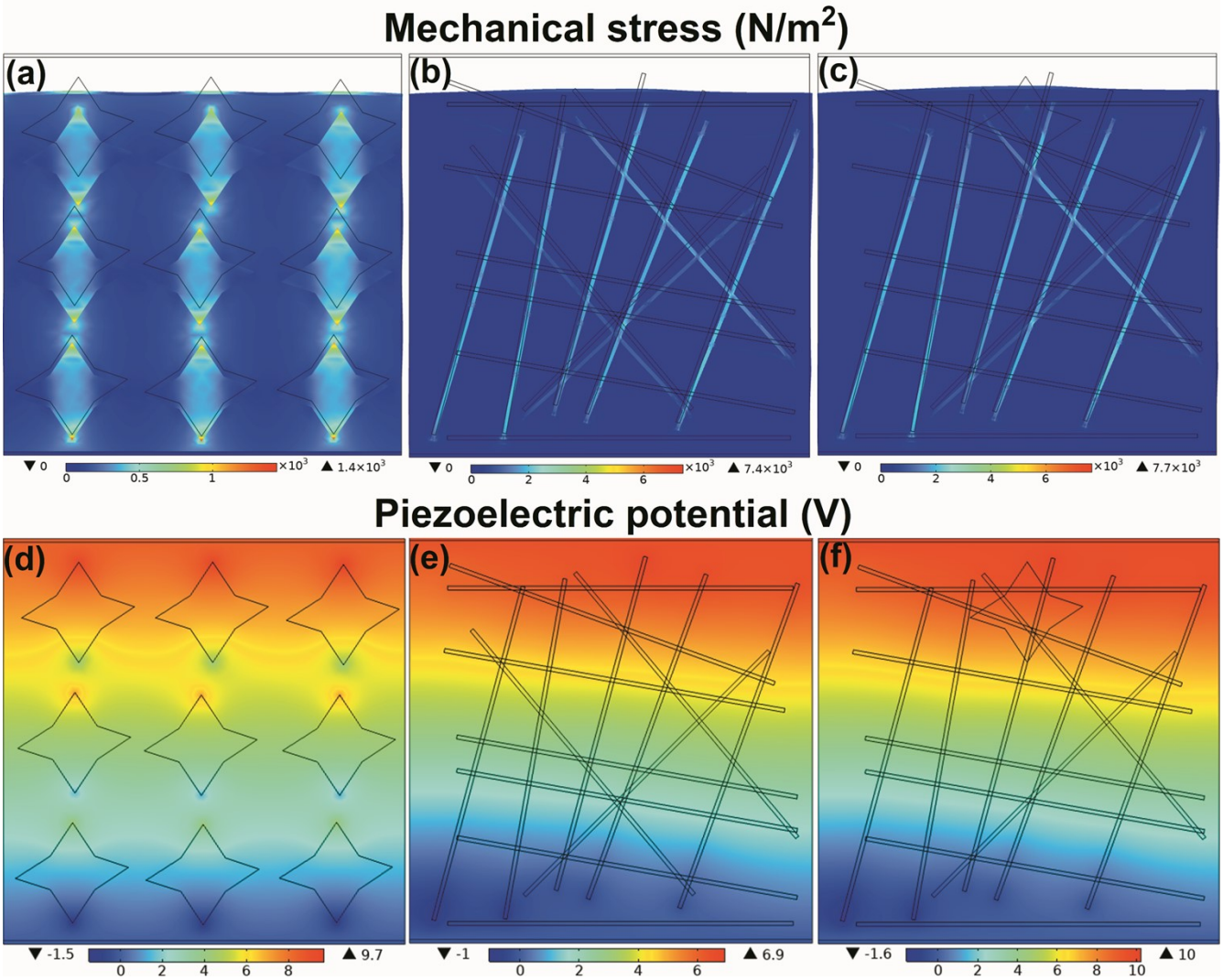

Fig. S6 The simulated distribution by FEA of (a–c) mechanical stress and (d–f) piezoelectric potential under a compression of 2 N of c-PNG using different fillers.

S7. The dynamic pressure sensitivity of the c-PNG

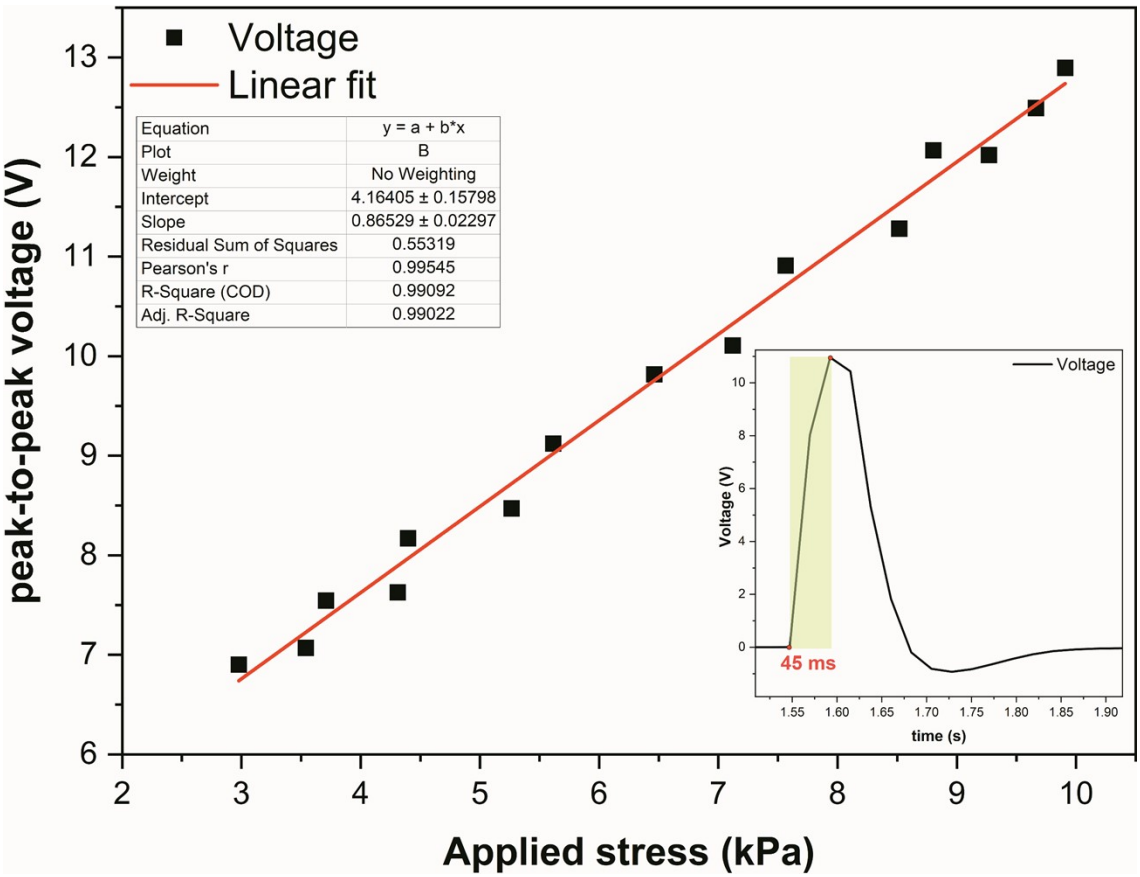

Fig. S7 The dynamic pressure sensitivity of the c-PNG at low mechanical stress (in the upper inset the fitting results, and in the bottom inset enlarged view of the peak voltage under 10.5 kPa at 1 Hz).

S8. The voltage-stability test of the c-PNG under finger bending/unbending motions

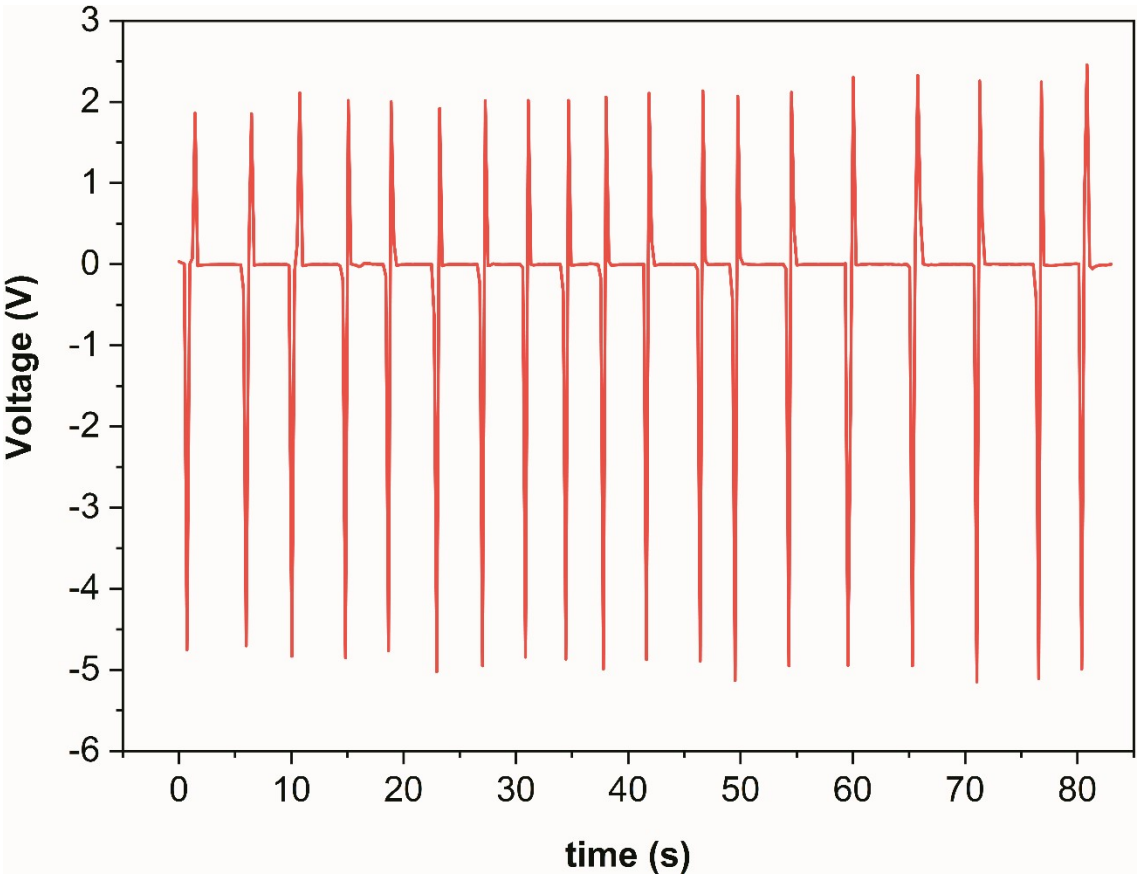

Fig. S8 The voltage-stability test of the c-PNG under finger bending/unbending motions.

S9. Supporting videos

- **Video S1:** Effect of pressing amplitude.
- **Video S2:** Effect of pressing duration.
- **Video S3:** Lighting a red LED using finger bending.
- **Video S4:** Lighting a red LED using finger tapping.
- **Video S5:** Lighting one blue LED (part 1) and two blue LEDs (part 2) using hand slapping.
- **Video S6:** Driving a calculator using hand slapping.