Enhanced energy harvester performance by tension annealed carbon nanotube yarn at extreme temperatures

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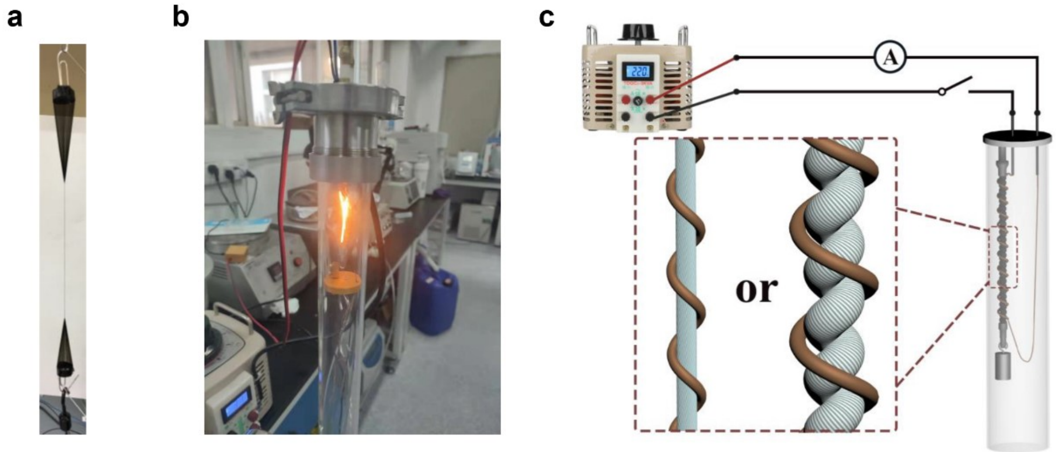

Figure S1. Setup for incandescent tension annealing process on CNT yarn. (a) Optical image of a cone-spun twisted CNT yarn. (b) ITAP for a coiled CNT yarn. (c) Schematic illustration for ITAP.

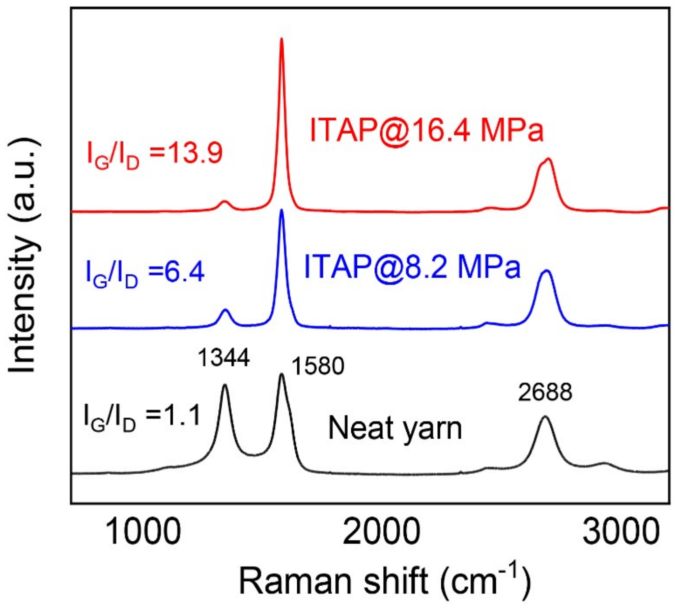

Figure S2. The ratio of the G-to-D peak intensities, I_G/I_D, in the Raman spectra for a neat CNT yarn and two ITAP CNT yarns. It can be seen that I_G/I_D increases from averages of 1.1 for the neat CNT yarn, to 6.4 and 13.9 for the ITAP@8.2 and ITAP@16.4 CNT yarns, respectively.

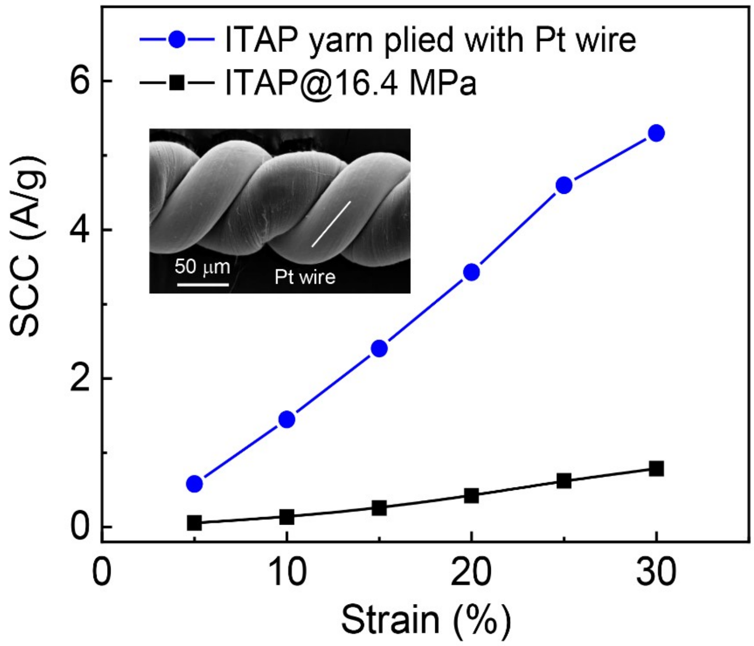

Figure S3. The strain dependence of generated SCC for an ITAP@16.4 MPa yarn and an ITAP@16.4 MPa CNT yarn plied with a 0.05-mm-diameter Pt wire.

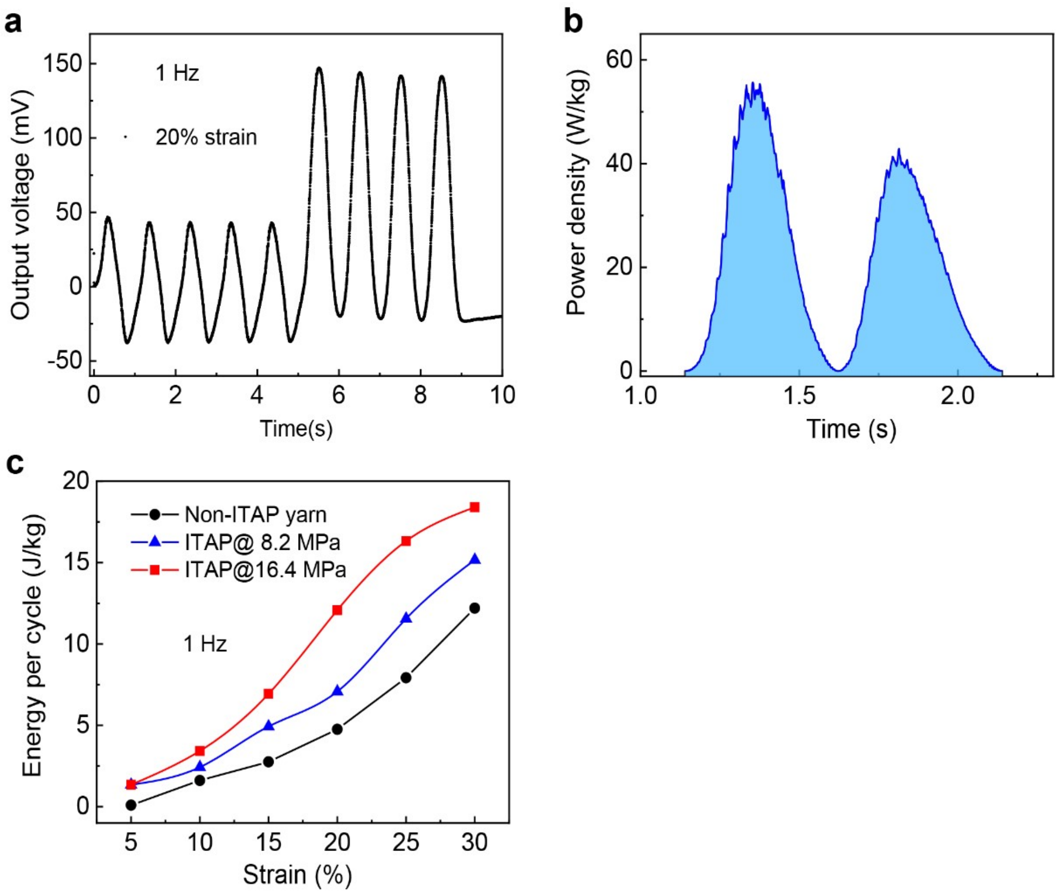

Figure S4. (a) The output voltage as a function of time for an ITAP@8.2 CNT yarn with and without the load resistance. (b) The calculated output power density as a function of time during a cycle. (c) The strain dependence of generated energy density per cycle for a non-ITAP yarn, an ITAP@8.2 MPa yarn, and an ITAP@16.4 MPa, respectively.

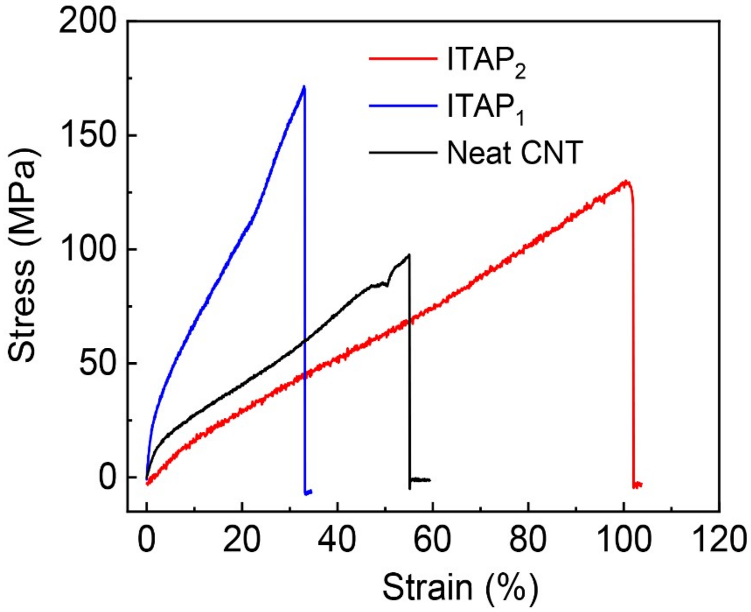

Figure S5. Stress-strain curves for a coiled neat CNT yarn, a coiled $ITAP_1$ yarn (doing the ITAP process after it was coiled), and $ITAP_2$ (doing the ITAP process before it was coiled) yarn, respectively.

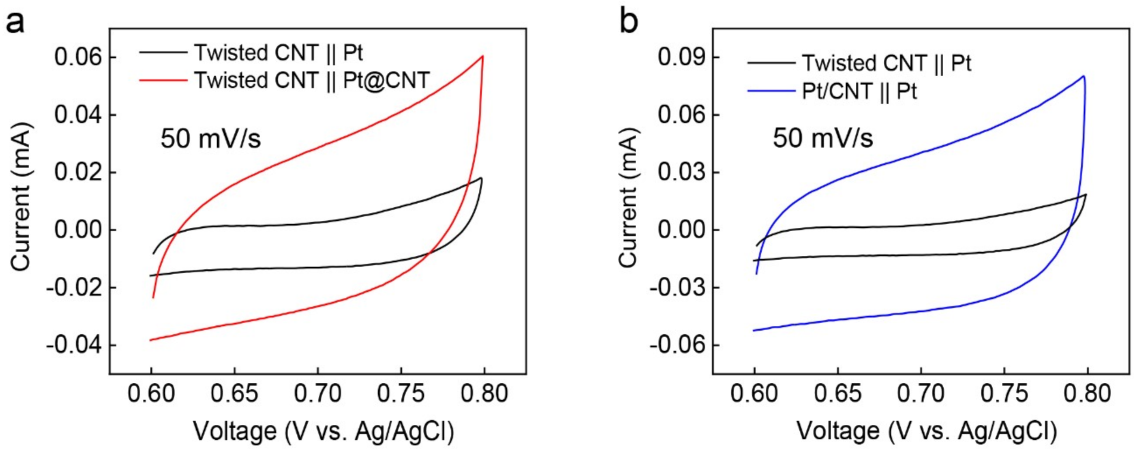

Figure S6. (a) The comparison of CV results for a fully-twisted CNT yarn that uses Pt mesh and Pt mesh containing multi-layers CNT sheets as counter electrode, respectively. (b) The comparison of CV results for a fully-twisted CNT yarn and Pt mesh containing multi-layers CNT sheets that uses a same Pt wire as the counter electrode.

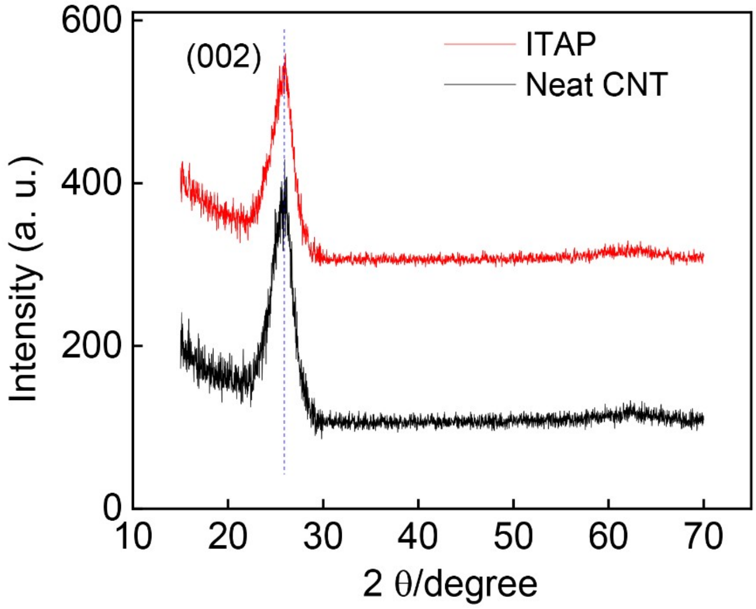

Figure S7. X-ray diffraction pattern of a CNT yarn and an ITAP yarn.