ADVANCED MATERIALS

Supporting Information

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Electrochromic Fiber-Shaped Supercapacitors

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Supporting Information

Experimental Section

The mass of electrochemically deposited PANI is calculated according to the Faraday's Law:

$$m_{PANI} = \frac{MQ}{zF} = \frac{91 * Q}{2.5 * 96500}$$

where *M* is the average molar mass of the PANI (i.e., 91), *Q* is the total electric charge passed through the electrode during electrodeposition, *z* is the average valence number of PANI unit (i.e., 2.5) and *F* is the Faraday constant (i.e., 96500 C/mol). The mass of CNT sheet is calculated by the following equation:

$$m_{CNT} = SPn = \pi DL * \mathrm{P} * \frac{T}{20\ nm}$$

where *S*, *L* and *T* are the area, length and thickness of CNT sheet, respectively, *D* is the diameter of the elastic fiber, and *P* is the area density of CNT sheet. The mass of the CNT/PANI composite electrode is calculated by

$$m = m_{PANI} + m_{CNT}$$

The PANI content can be then calculated by

$$C_{PANI} = \frac{m_{PANI}}{m}$$

Measurement. The structures were characterized by SEM (Hitachi, FE-SEM S-4800 operated at 1 kV). Galvanostatic charge-discharge curves were recorded by an Arbin multi-channel electro-chemical testing system (Arbin, MSTAT-5 V/10 mA/16 Ch). Cyclic voltammograms and Nyquist plots were obtained from an electrochemical analyzer system (CHI 660D). The photographs were recorded by Nikon J1. The stretching processes were carried out by an HY0350 Table-top Universal Testing Instrument. UV-vis spectra were produced by UV-2550 from Shimadzu. To improve the measurement accuracy, the UV-vis spectra were recorded from the corresponding planar supercapacitor with aligned CNT/PANI composite film as electrodes under the same conditions. The resistances of the composite electrode during bending and stretching were traced by Keithley Model 2400 Source Meter.

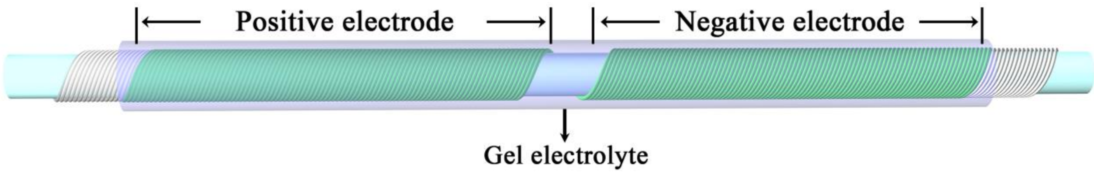

Figure S1. Schematic illustration to the structure of the electrochromic fiber-shaped supercapacitor.

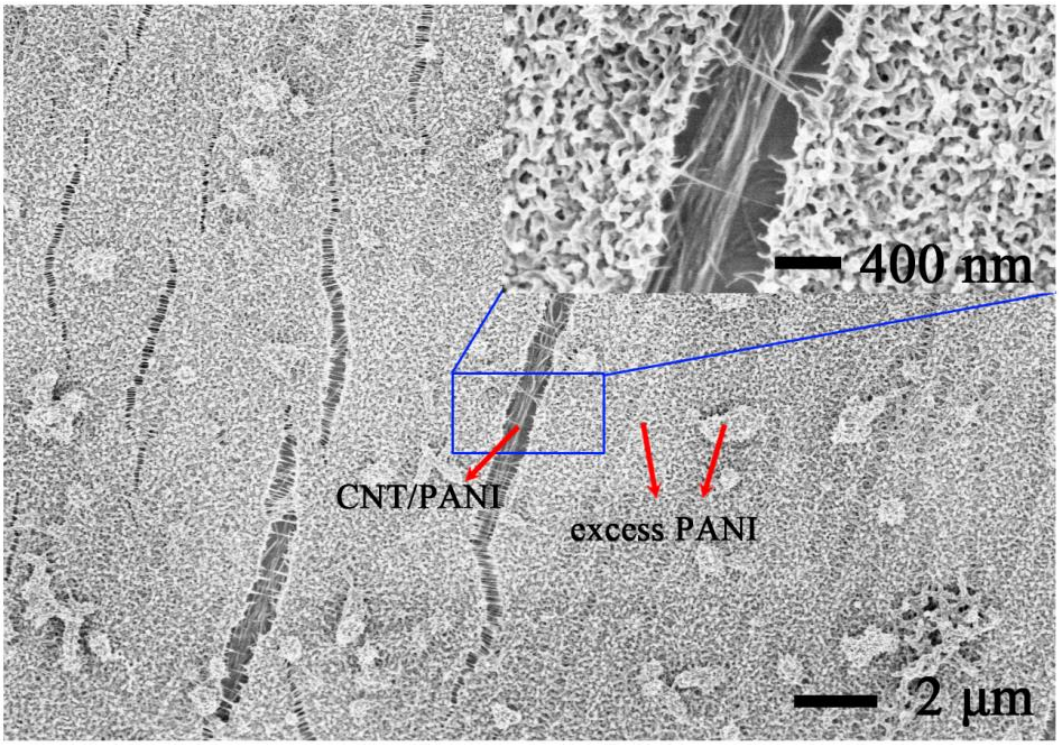

Figure S2. SEM image of CNT/PANI composite electrode with the PANI weight percentage of 90% (inserted, higher magnification of the area labeled by a blue box).

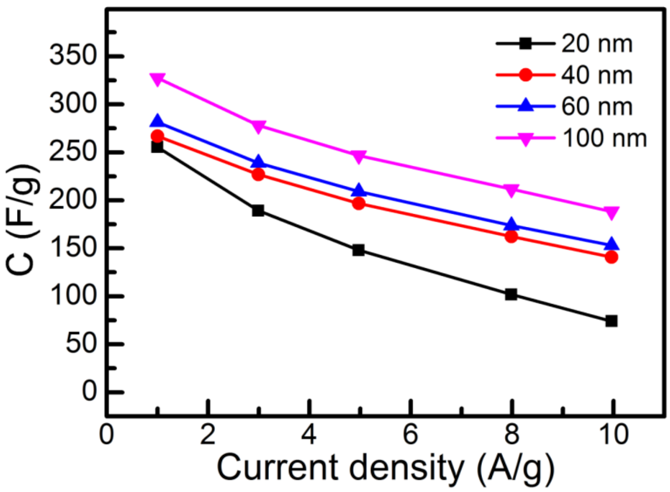

Figure S3. Specific capacitances at different current densities for smart fiber-shaped supercapacitors with different thicknesses of CNT sheets.

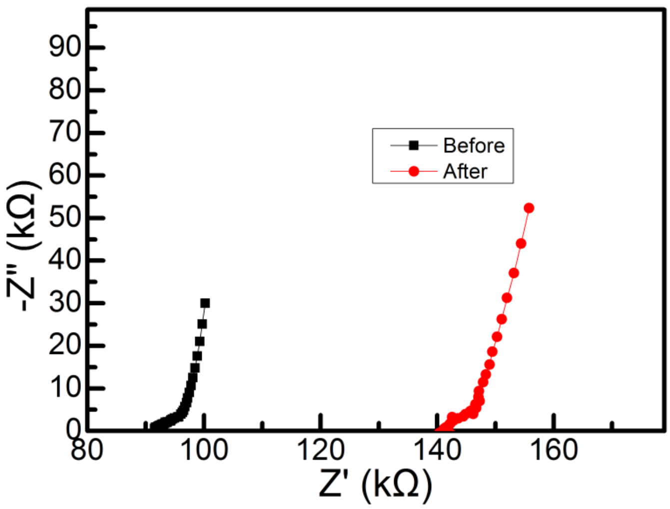

Figure S4. Nyquist plots of the supercapacitor before (black color) and after (red color) the long-life cycling.

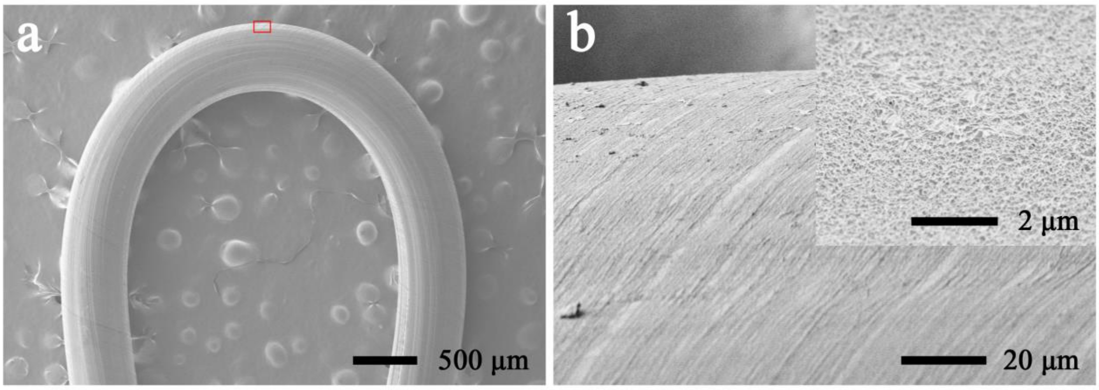

Figure S5. SEM images of an aligned CNT/PANI composite on elastic fiber at low (**a**) and high (**b**) magnifications under bending. **b** is magnified from the marked red box at **a**.

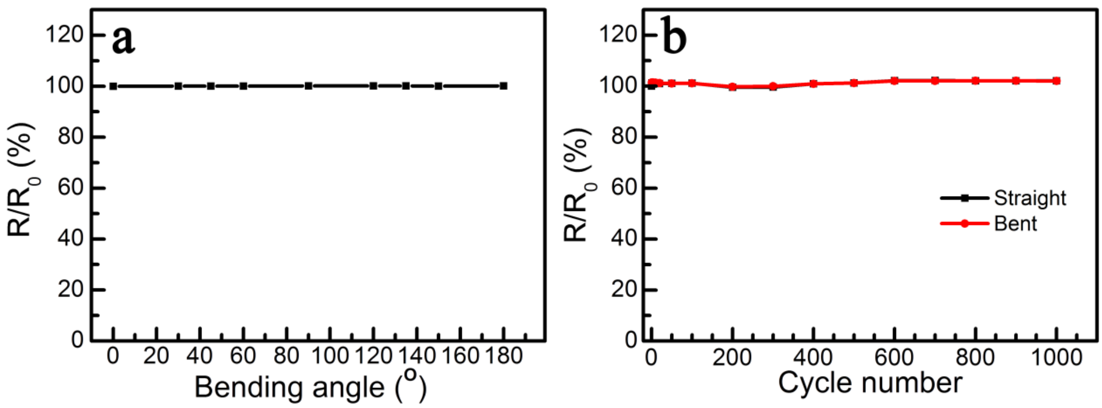

Figure S6. Dependence of electrode resistance on bent angle (**a**) and bent cycle number (**b**) with a bent angle of 180 °. R_0 and R correspond to the resistances before and after bending, respectively.

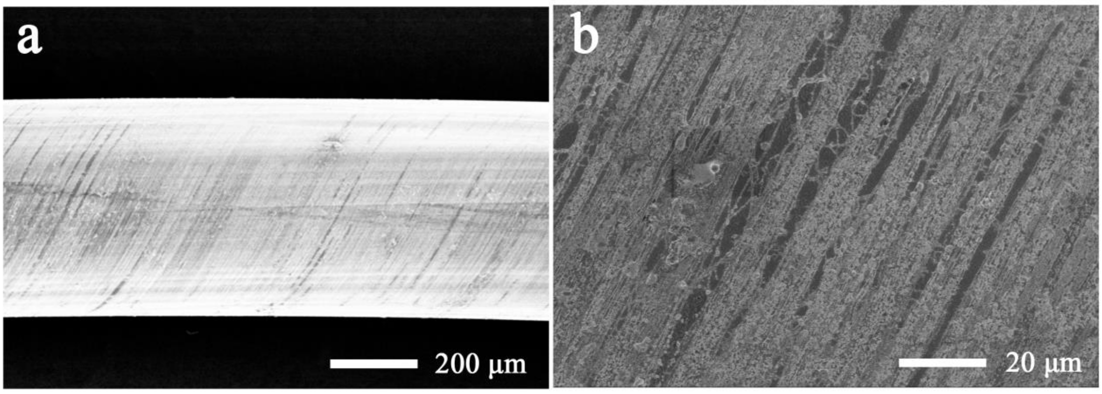

Figure S7. SEM images of an aligned CNT/PANI composite on elastic fiber at a stretched state at low (**a**) and high (**b**) magnifications.

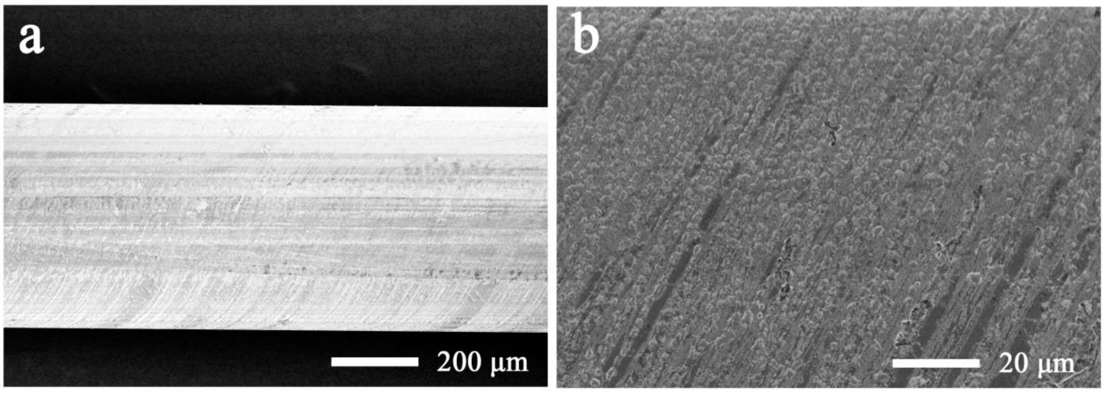

Figure S8. SEM images of a released elastic fiber with a layer of aligned CNT/PANI composite on the surface at low (**a**) and high (**b**) magnifications.

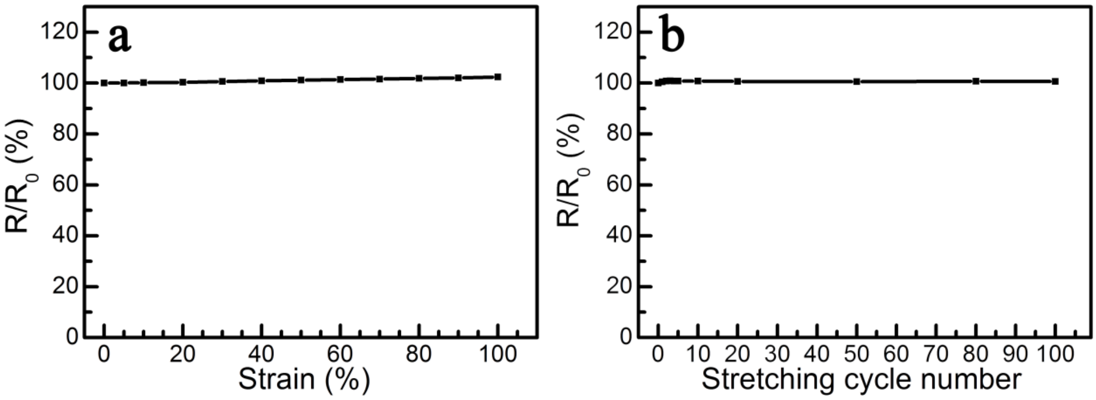

Figure S9. Dependence of electrode resistance on strain (**a**) and stretched cycle number (**b**) with a strain of 100%. R_0 and R correspond to the resistances before and after stretching, respectively.

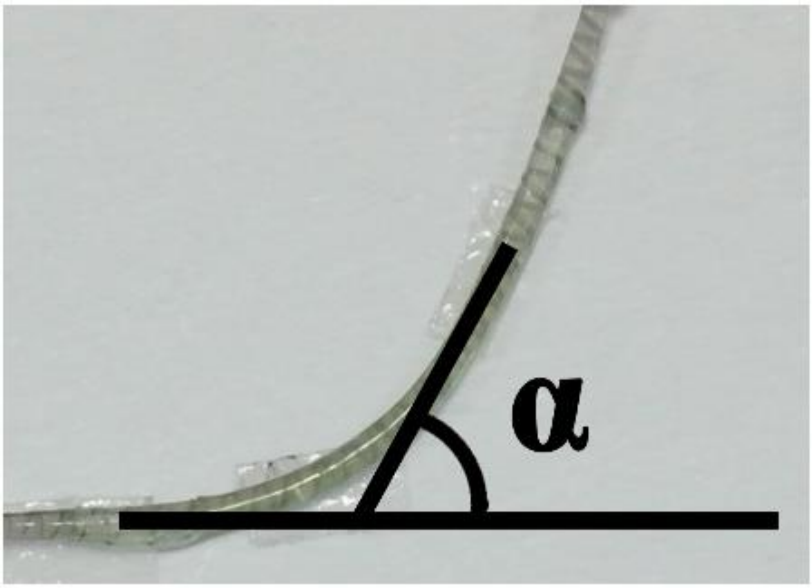

Figure S10. Photograph of bending the fiber-shaped supercapacitor.

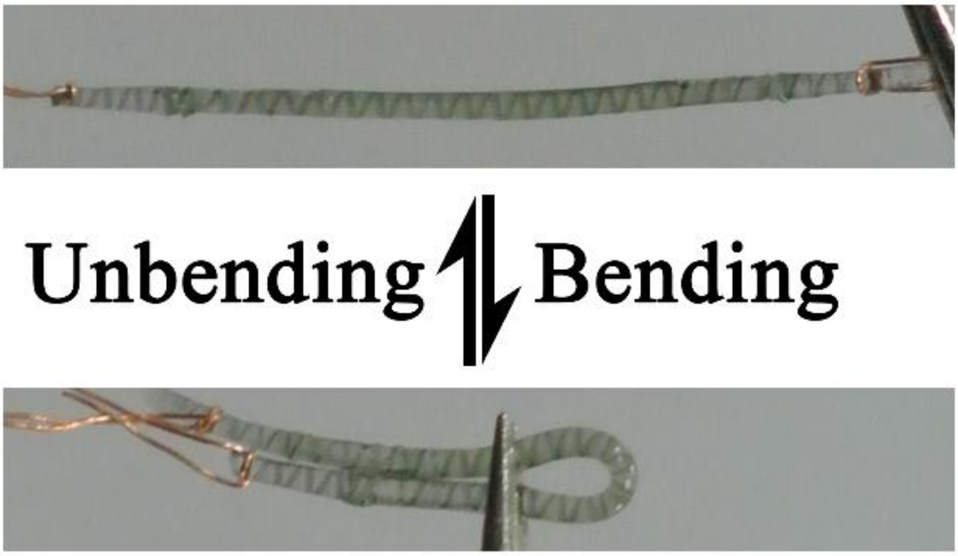

Figure S11. Photograph of bending the fiber-shaped supercapacitor for cycles.

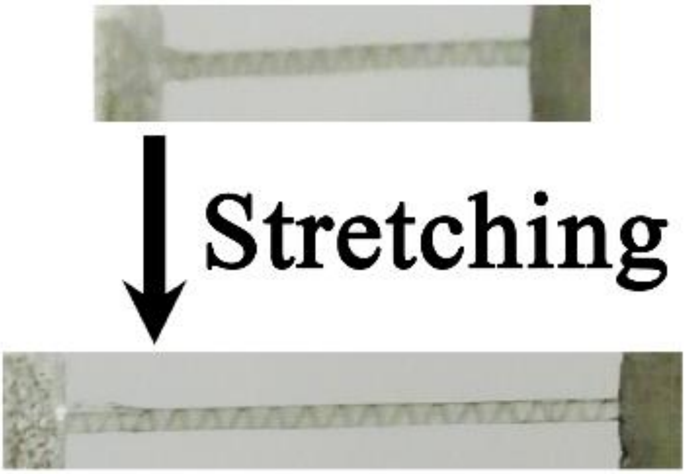

Figure S12. Photograph of stretching the fiber-shaped supercapacitor.

Figure S13. Photograph of stretching the fiber-shaped supercapacitor for cycles.

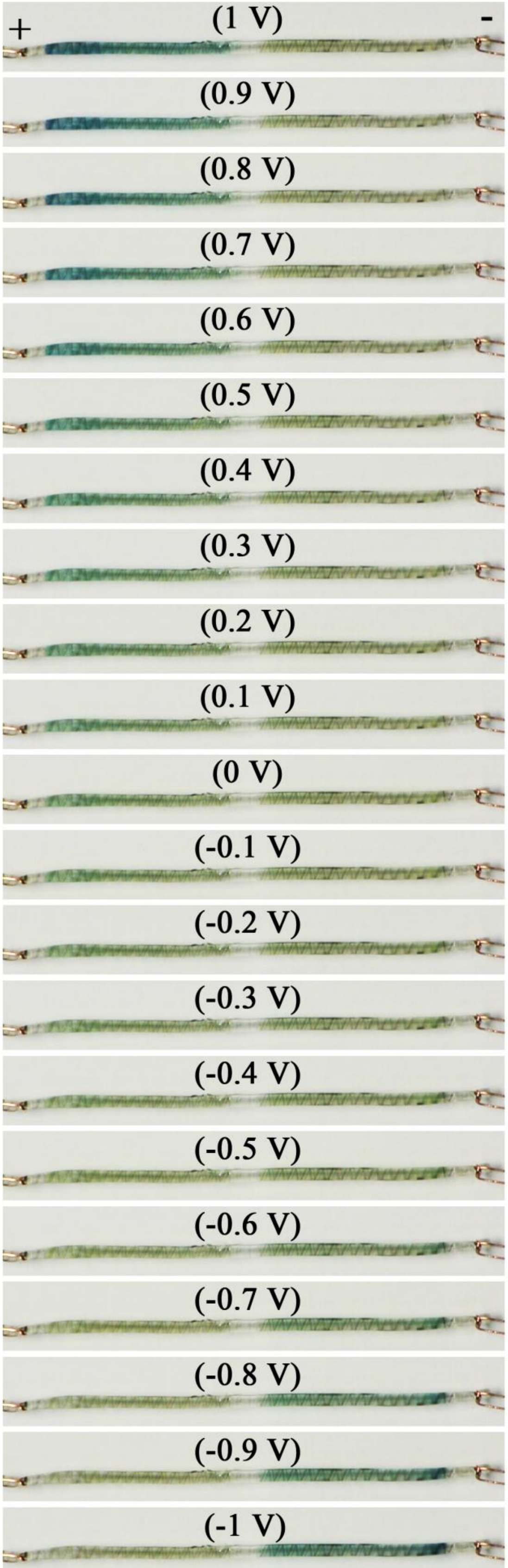

Figure S14. Different colors of a fiber-shaped supercapacitor at different potentials.

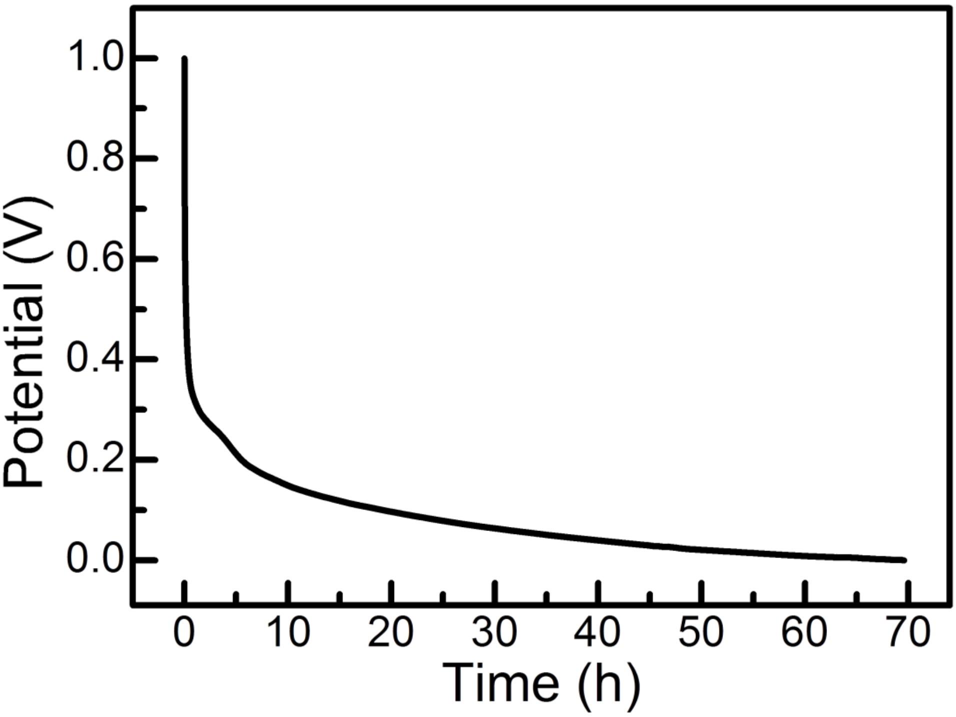

Figure S15. Potential decay during a self-discharge process.

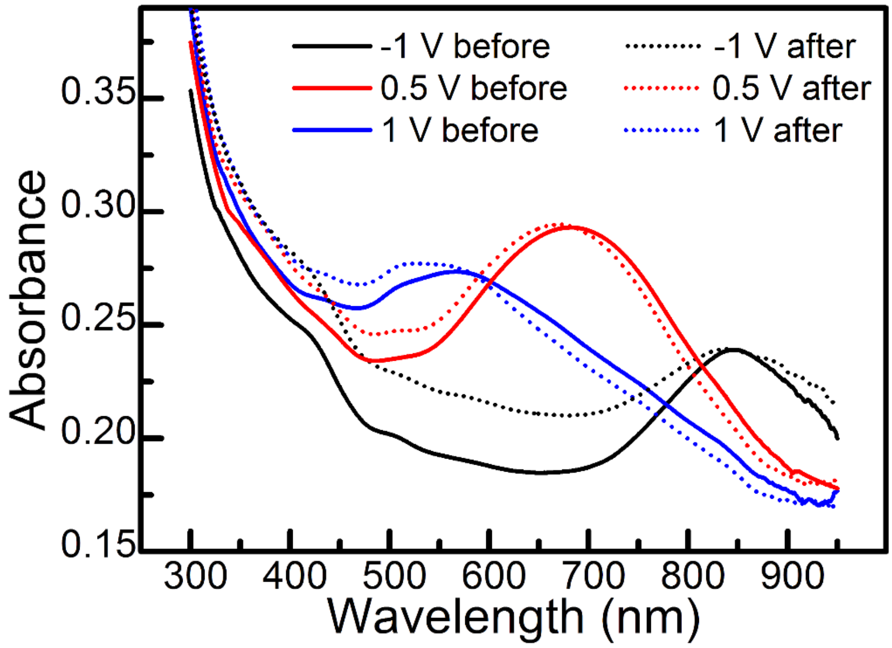

Figure S16. UV-vis spectra of the aligned CNT/PANI composite electrode at different potentials before and after the first charge-discharge cycle.

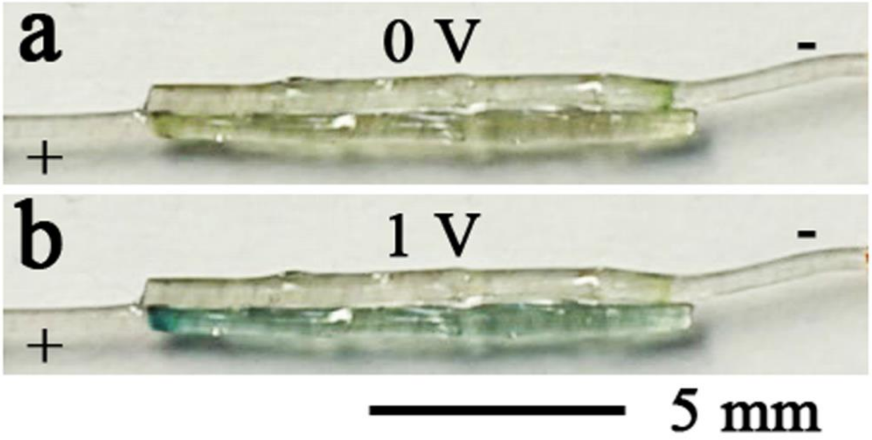

Figure S17. Chromatic transitions of a smart fiber-shaped supercapacitor during a charging-discharging process after 3000 long-life cycles at 1 A/g. The supercapacitor was fabricated by attaching two aligned CNT/PANI composite fibers in parallel.

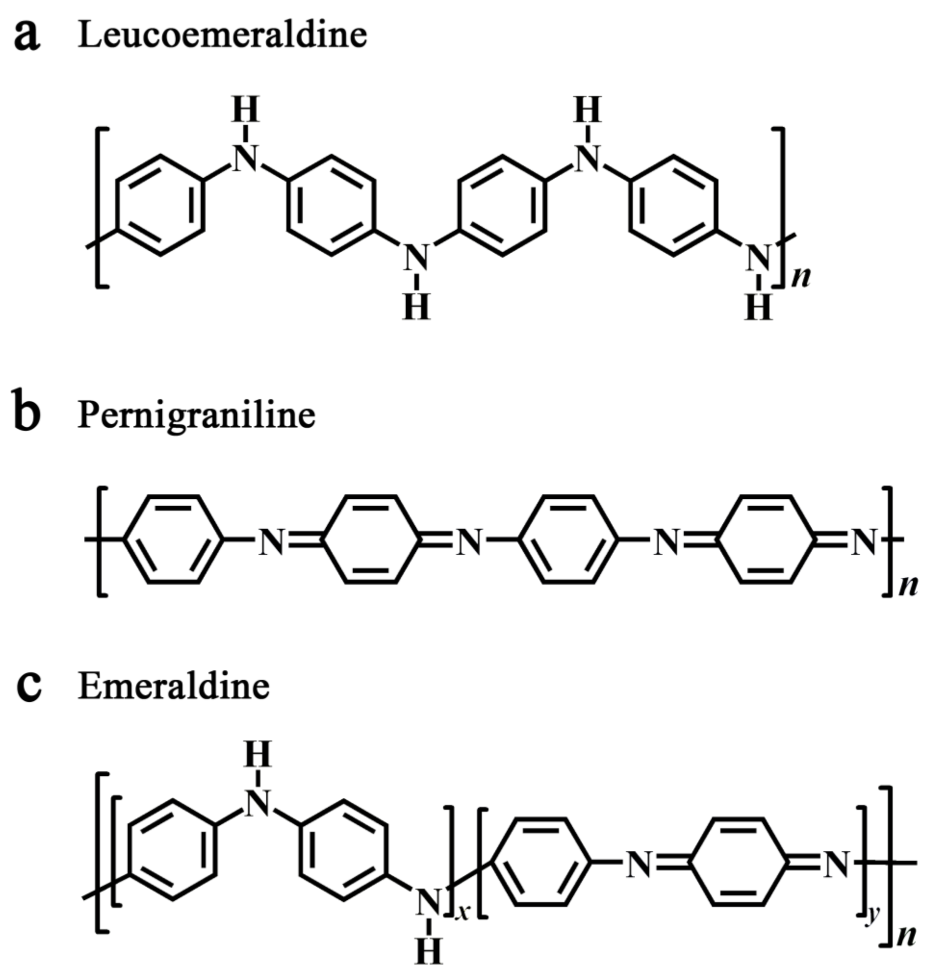

Figure S18. Chemical structure of PANI at three oxidation states.

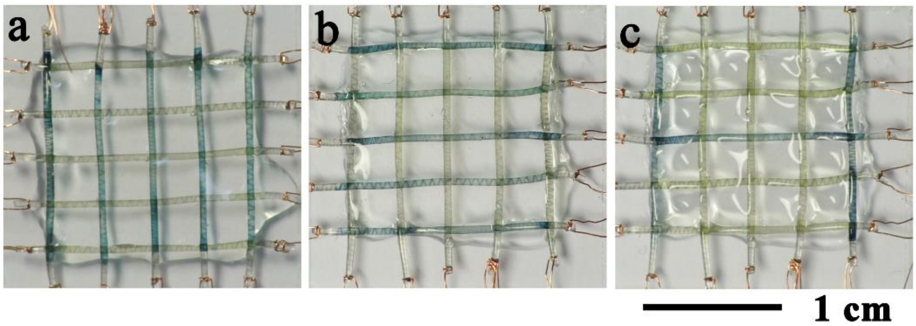

Figure S19. a and **b.** An energy storage textile being woven from electrochromic fiber-shaped supercapacitors at discharged and charged state. **c.** Electrochromic fiber-shaped supercapacitors being designed and woven to display different signs of ”H”.

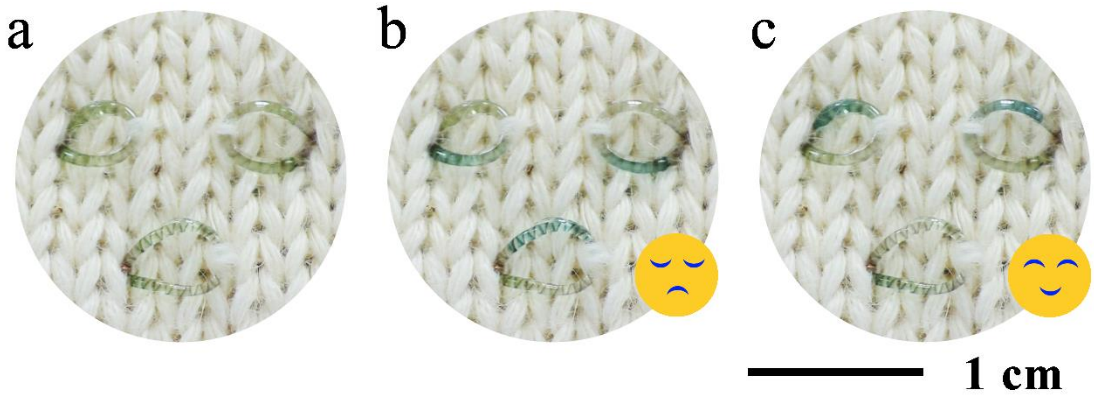

Figure S20. Electrochromic fiber-shaped supercapacitors being woven into a cotton textile to show a human face at 0 V (**a**), crying face at -1 V (**b**) and smiling face at 1 V (**c**), respectively.