Supporting Information

Experimental Section

Carbon nanotube (CNT) arrays were synthesized by a typical chemical vapor deposition method. In a quartz tube furnace, a silicon wafer with Fe (1.2 nm)/Al_2O_3 (3 nm) on its surface was used as catalyst, ethylene sserved as carbon source, and a mixture gas of Ar/H_2 was used as carrying gas. The growth temperature and time were 740 ^oC and 10-20 min, respectively. Aligned CNT sheets were continuously pulled out of the CNT array with a thickness of ~250 μm.

The gel electrolyte was prepared by dissolving 1 g of PVA in 9 g of deionized water at 90 ^oC for 2 hours. After cooling down to room temperature naturally, 1 g of a H_3PO_4 aqueous solution (85 wt%) was added to the above solution and stirred to form a homogeneous mixture.

The charging-discharging processes of the integrated “energy fiber” was summarized below. As shown in Figure 1a, the PC part and ES parts shared a TiO_2 nanotube modified Ti wire, while the positive CNT sheet electrode had been separated in the two parts. Upon the light illumination, the switch was turned on to the red line, i.e., the positive electrodes of the PC and ES parts were connected to complete the photocharging process. When the voltage reached the plateau which indicated the completeness of the photocharging process, the switch was turned on to the blue line through which electronic devices could be powered to realize the discharging process. Note that here the light was turned off. During the photocharging and galvanostatic discharging process of the integrated “energy fiber”, the voltage of the ES part will be slightly lower than that of the PC part as some electric power would be used for the connection part. For instance, the shared Ti wire had electrical resistance.

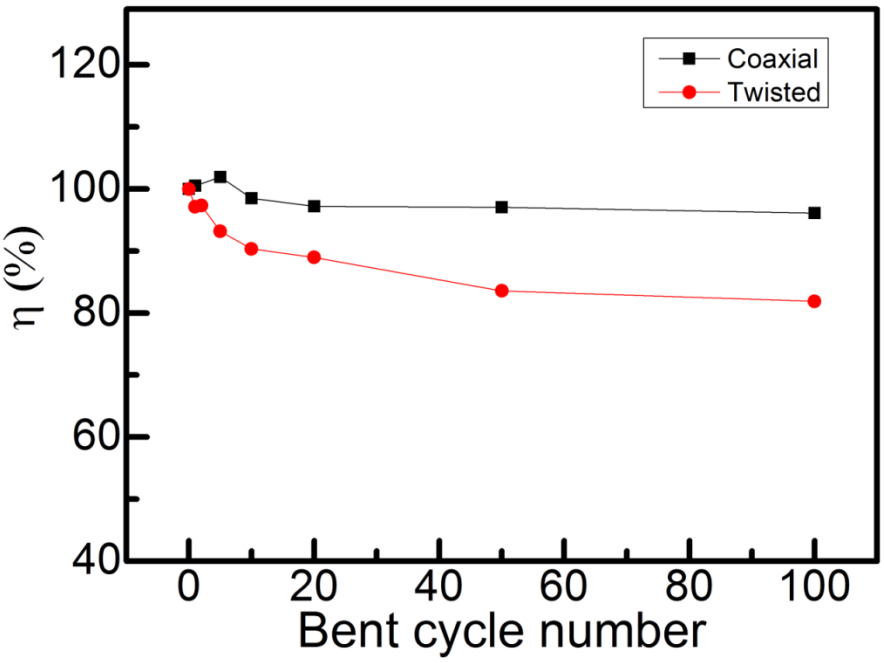

Figure S1. Dependence of photoelectric conversion efficiency on bent cycle number for the coaxial DSC fiber and twisted DSC wire based on the eutectic melts.

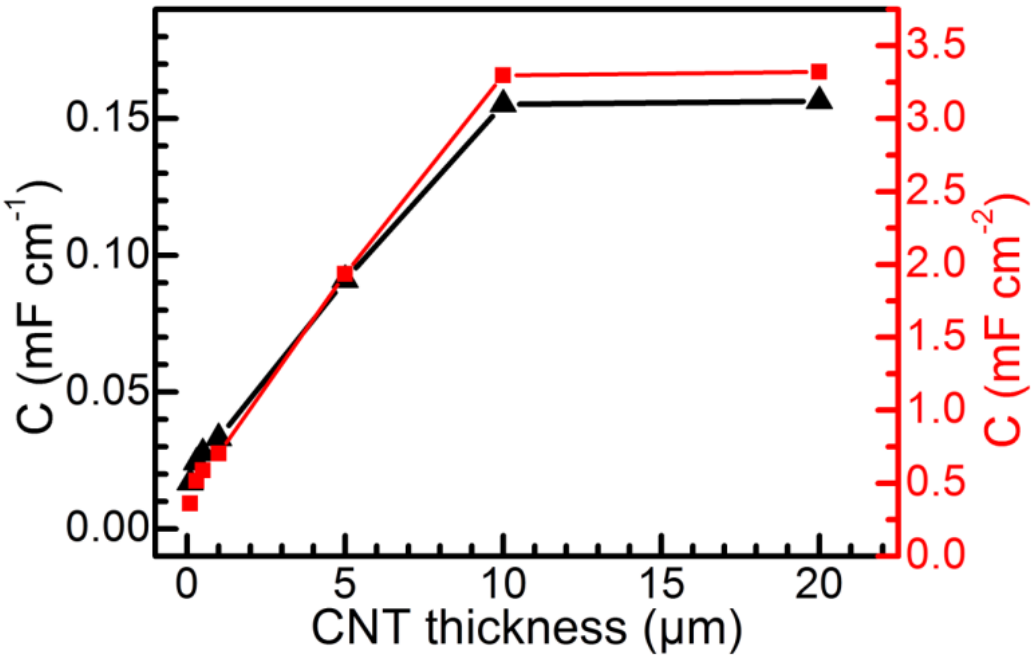

Figure S2. Dependence of specific capacitance on CNT thickness.

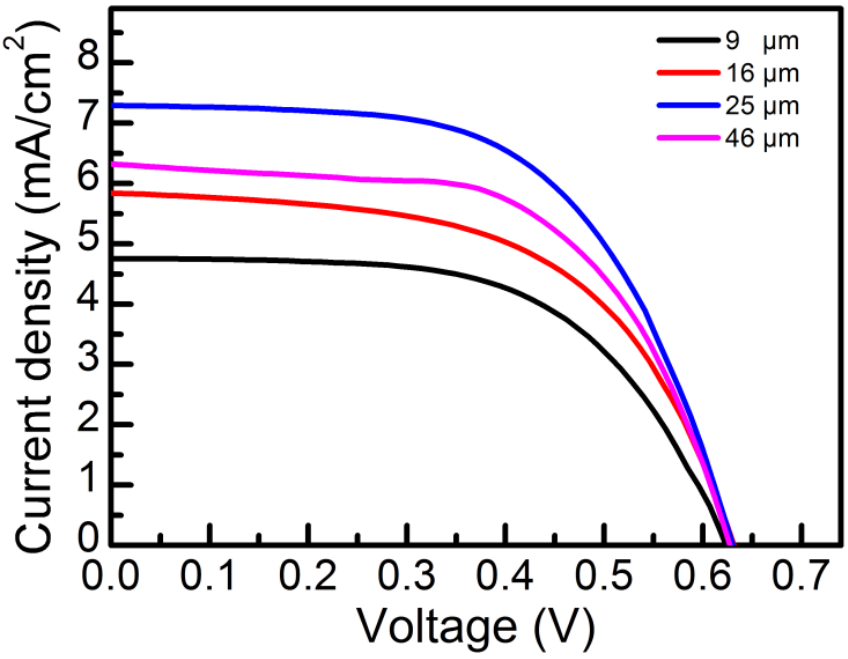

Figure S3. *J-V* curves of the PC part with different TiO_2 lengths under AM 1.5 illumination.

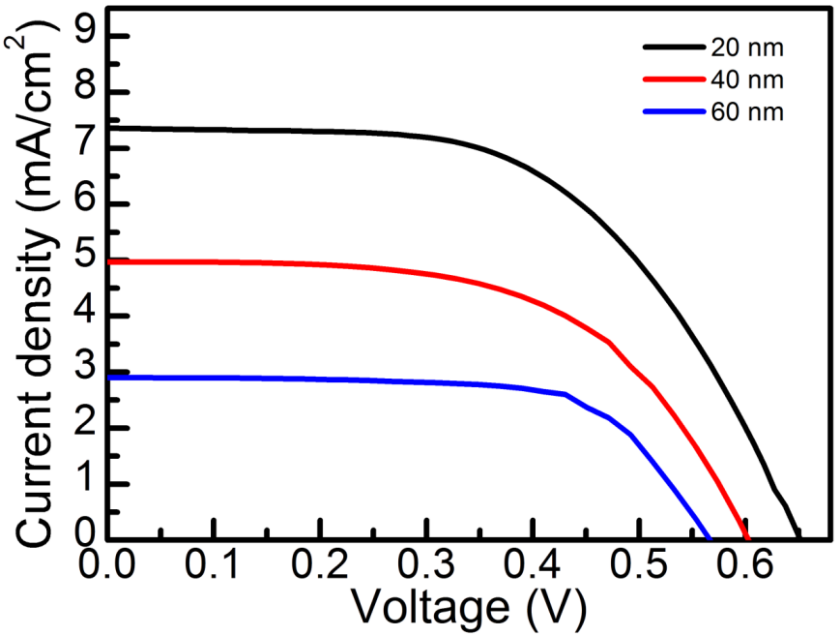

Figure S4. *J-V* curves of the PC part with different CNT thicknesses under the illumination of AM 1.5.

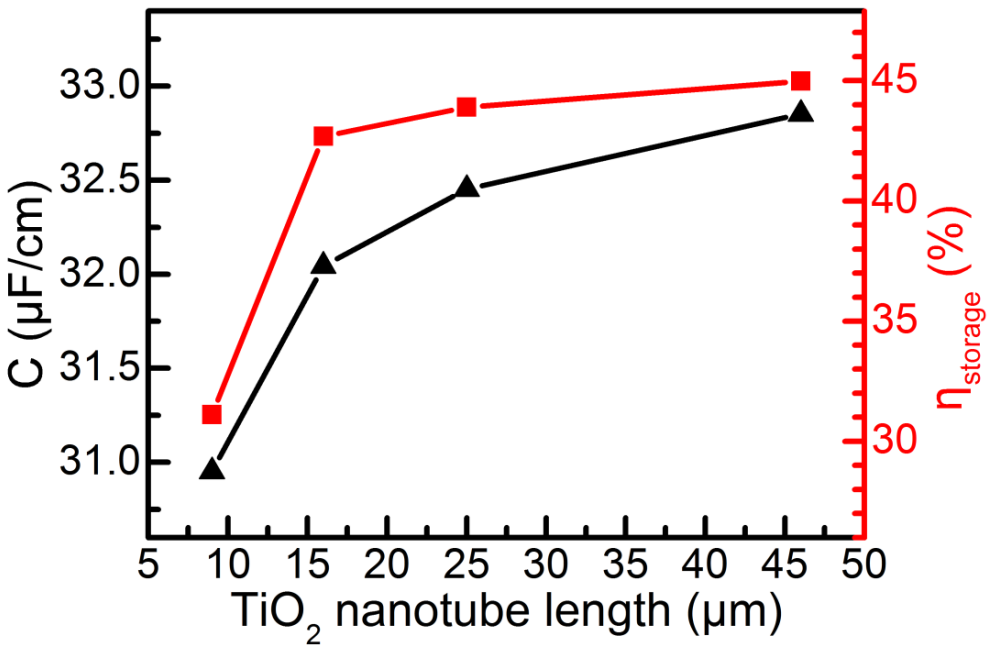

Figure S5. Dependence of specific capacitance and energy storage efficiency on TiO_2 length in the ES part.

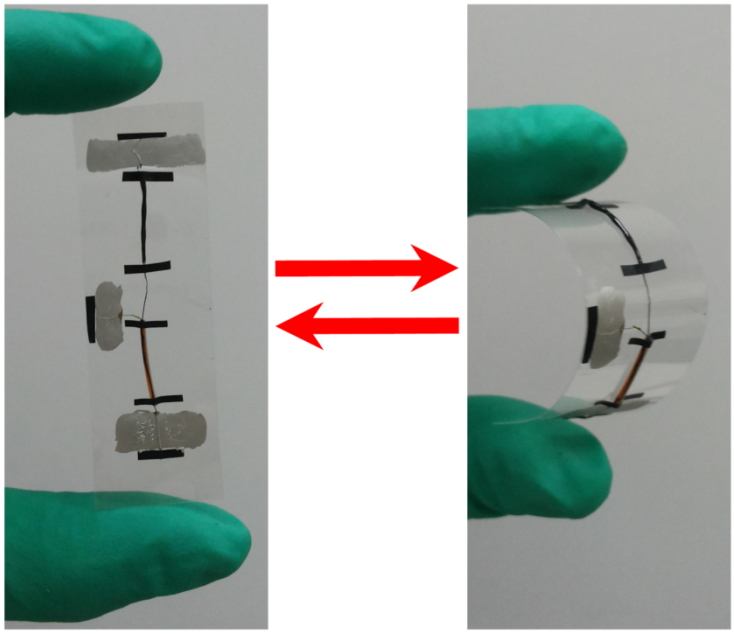

Figure S6. Photographs of an "energy fiber" during a reversible bending process.