Electronic Supplementary Information

Flexible Wire-like All-Carbon Supercapacitors Based on Porous Core-shell Carbon Fibers

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Calculations

Specific capacitance C_m (F/g) was calculated from the CV and charge-discharge curves by the equations (1) and (2), respectively, where I_1 (A) is the response current, ΔV (V) is the voltage window, ν (V/s) is the scan rate, I_2 (A) is the constant discharge current, Δt (s) is the discharging time and m (g) is the weight used for the capacitance calculations. For three-electrode cell, m is the weight of electrode, which is about 0.06 g. For the two-electrode cell, it is the weight of the entire device, which is about 0.2 g.

$$C_m = \frac{\int I_1 dV}{vm\Delta V} \qquad (1)$$

$$C_m = \frac{I_2 \Delta t}{m\Delta V} \qquad (2)$$

Length capacitance C_L (F/cm) was calculated from CV and charge-discharge curves by the equations (3) and (4), respectively. Compared with Specific capacitance C_m (F/g), m (g) was replaced into L (cm).

$$C_L = \frac{\int I_1 dV}{vL\Delta V} \qquad (3)$$

$$C_L = \frac{I_2 \Delta t}{L\Delta V} \qquad (4)$$

Energy density (E) and Power density (P) were calculated by equations (5) and (6), respectively.

$$E = \tfrac{1}{2} C_m (\Delta V)^2 \qquad (5)$$

$$P = E/\Delta t \qquad (6)$$

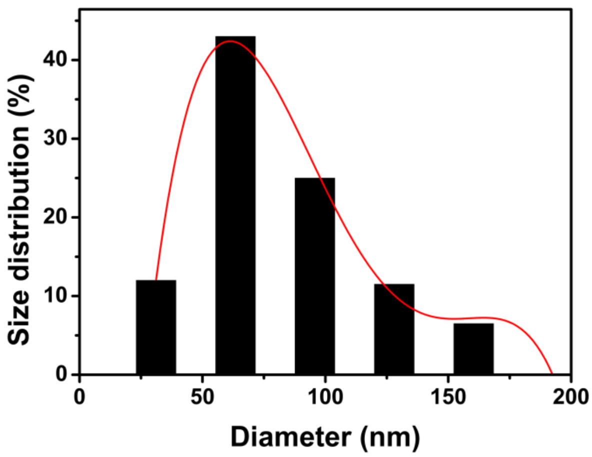

Figure S1. Size distribution of carbon nanoparticles from carbon shell.

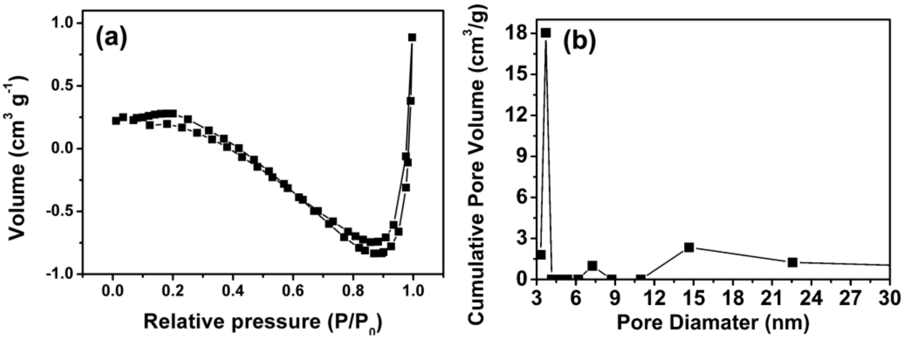

Figure S2. (a) specific surface area and (b) pore size distribution of the porous core-shell carbon fibers.

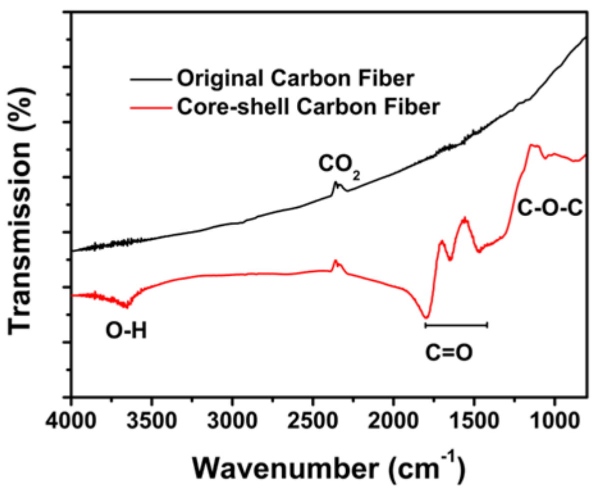

Figure S3. FT-IR spectra of the original carbon fibers and porous core-shell carbon fibers.

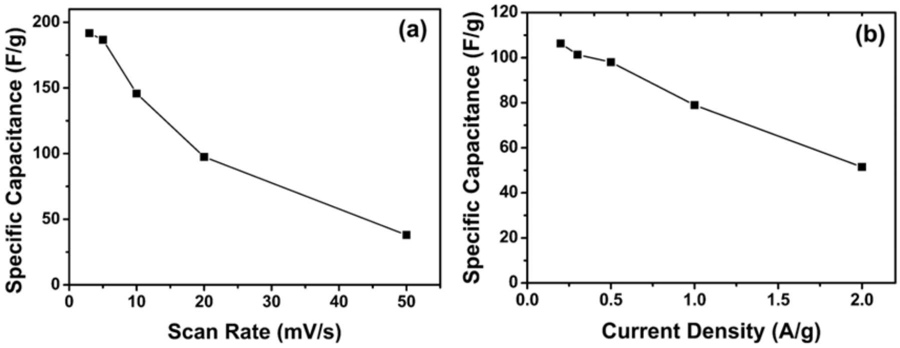

Figure S4. Calculated specific capacitance as a function of (a) scan rate and (b) current density for porous core-shell carbon fibers electrode.

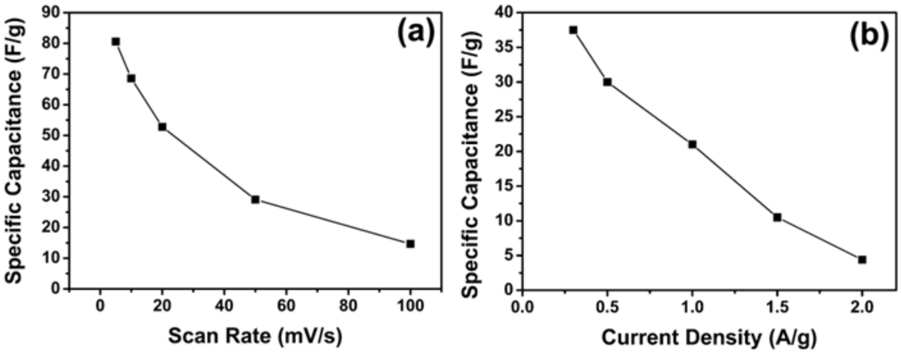

Figure S5. Calculated specific capacitance as a function of (a) scan rate and (b) current density for the wire-like all-carbon supercapacitor.

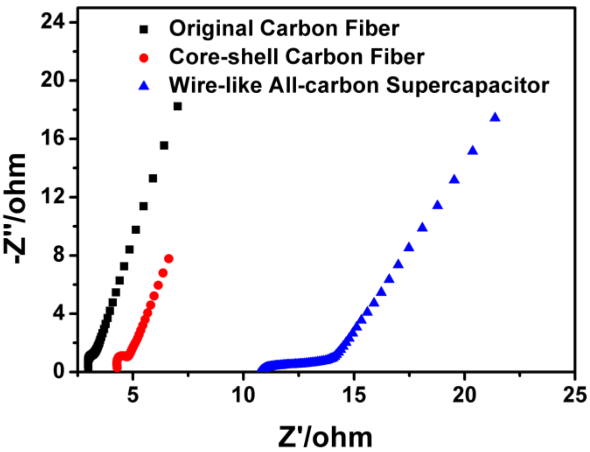

Figure S6. Impedance comparison curves for the original carbon fibers, porous core-shell carbon fibers and wire-like all-carbon supercapacitor.

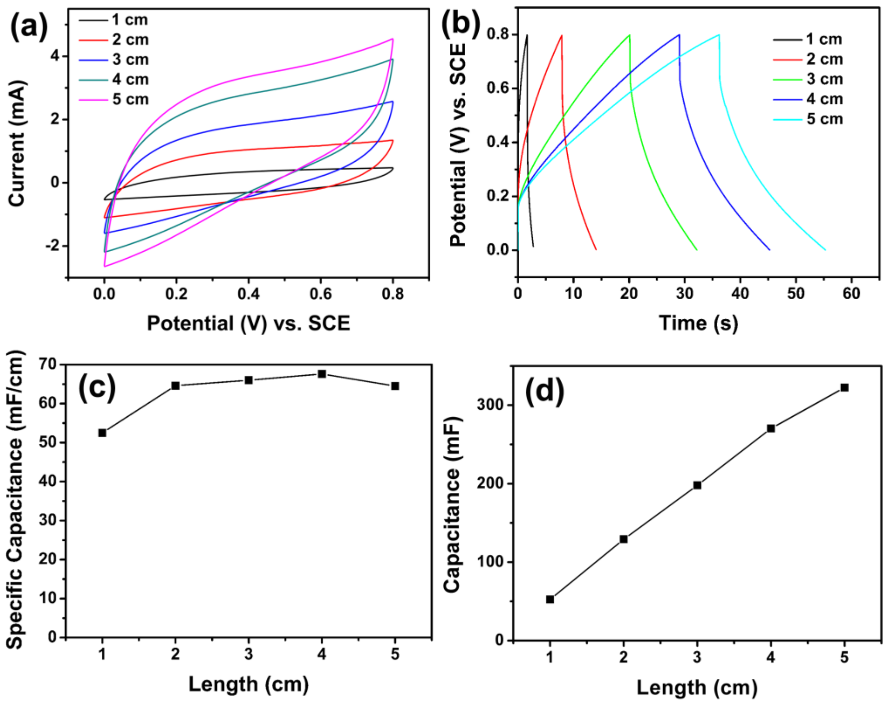

Figure S7. Length capacitance of wire-like all-carbon supercapacitor obtained from CV curves at a scan rate of 10 mV/s (a), galvanostatic charge/discharge curves at a constant current of 5 mA (b), and specific capacitance as a function of the length based on CV results (c,d). The diameters of wire-like all-carbon supercapacitor are about 0.53 mm, H_3PO_4/PVA as solid-state electrolyte. The supercapacitor fiber was cut off 1 cm every time to test the corresponding CV and galvanostatic charge/discharge result.

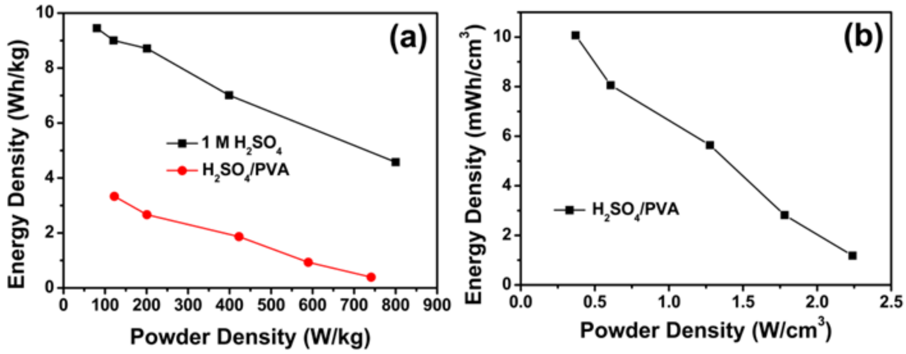

Figure S8. Ragone plot for the porous core-shell carbon fiber electrode in 1 M H_2SO_4 aqueous electrolyte and H_2SO_4/PVA solid electrolyte, respectively. The data were calculated by (a) the weight and (b) volume of the supercapacitor.