Supplementary data

A green approach to prepare hierarchical porous carbon nanofibers from coal for high-performance supercapacitors

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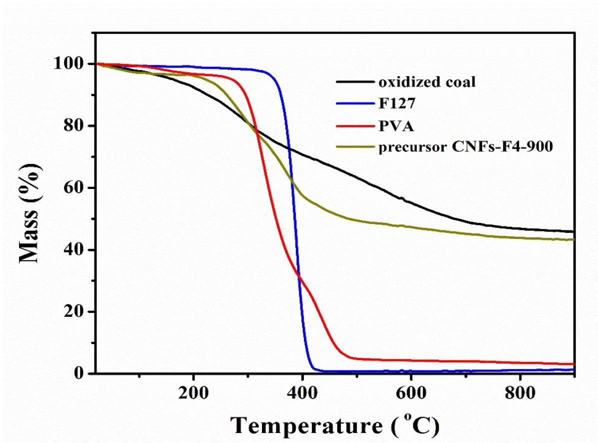


Figure S1. TG curves of oxidized coal, PVA, F127 and precursor CNFs-F4-900, respectively.

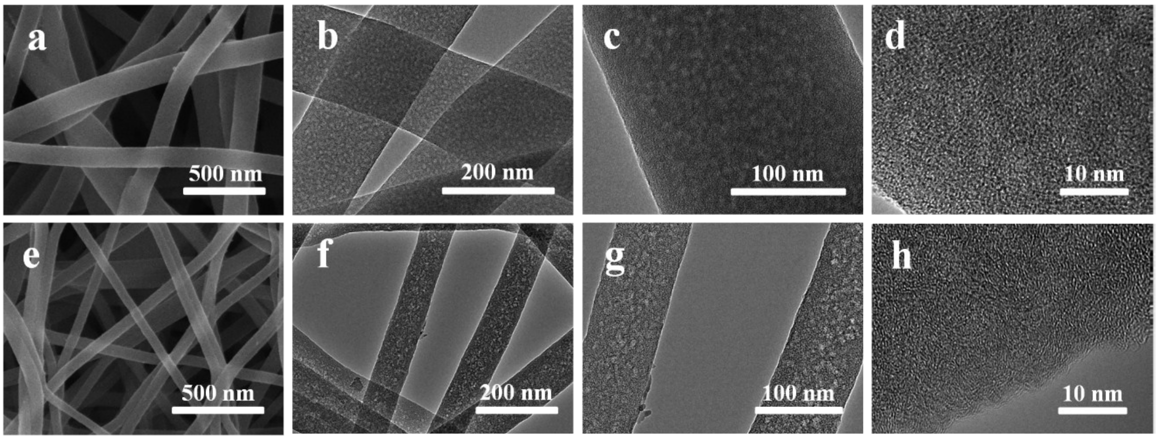


Figure S2. SEM images of HPCNFs (a) CNFs-F2-800; (e) CNFs-F2-1000; TEM images of HPCNFs (b, c) CNFs-F2-800; (f, g) CNFs-F2-1000; and HRTEM images of HPCNFs (d) CNFs-F2-800; (h) CNFs-F2-1000.

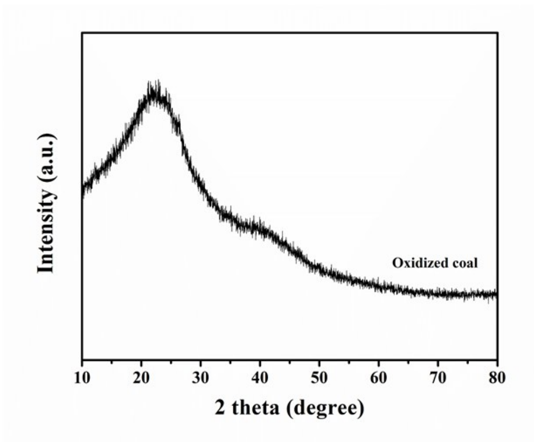


Figure S3. XRD patterns of oxidized coal.

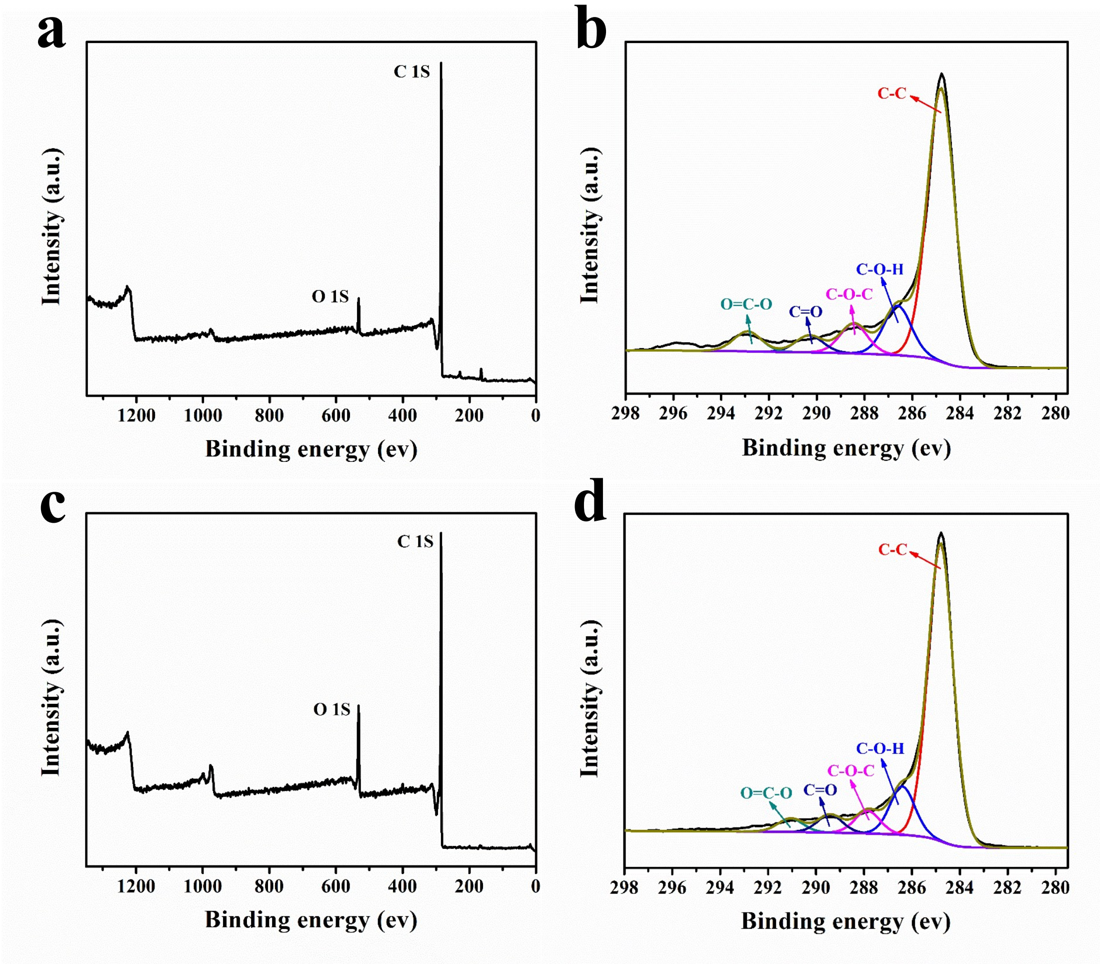
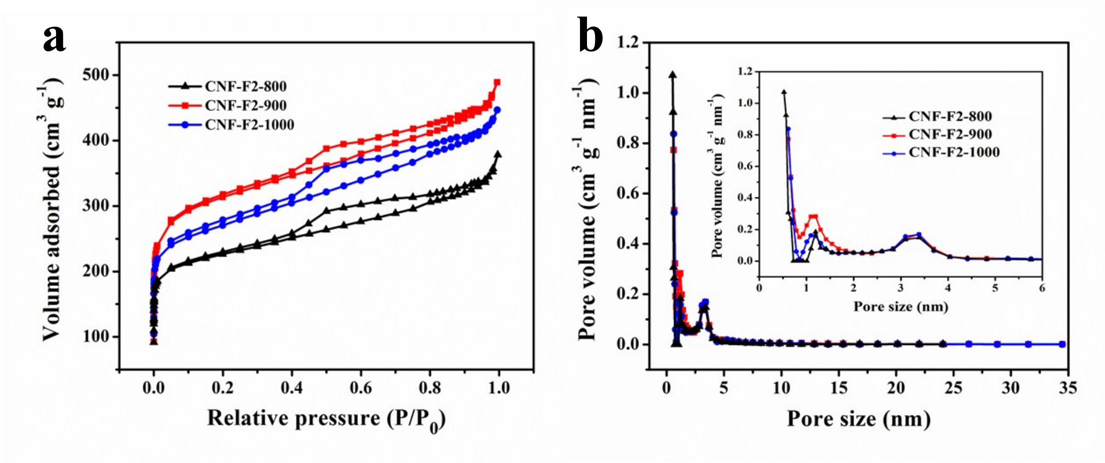


Figure S4. (a) XPS survey spectra, (b) XPS of C1s region of the CNFs-F2-800 and (c) XPS survey spectra, (d) XPS of C1s region of the CNFs-F2-1000.

Table S1. C, O and H contents evaluated from XPS elemental analysis.

Samples	Elemental Analysis		
	C (wt. %)	O (wt. %)	H (wt. %)
CNFs-F2-800	85.01	12.70	2.29
CNFs-F2-900	88.51	10.33	1.16
CNFs-F2-1000	93.96	5.40	0.64



Figre S5. N_2 adsorption-desorption isotherms (a) and pore size distributions (b) of CNFs-F2-800, CNFs-F2-900 and CNFs-F2-1000.

Table S2. BET specific surface areas and porous structure of CNFs-F2-800, CNFs-F2-900 and CNFs-F2-1000.

Sample	S_{BET}[a] (m^2 g^{-1})	S_{meso}[b] (m^2 g^{-1})	S_{micro}[c] (m^2 g^{-1})	V_{total}[d] (m^3 g^{-1})	V_{meso}[e] (m^3 g^{-1})	V_{micro}[f] (m^3 g^{-1})	D_{ap}[g] (nm)
CNFs-F2-800	849	399	450	0.42	0.28	0.14	2.6
CNFs-F2-900	1161	429	733	0.76	0.45	0.31	2.7
CNFs-F2-1000	1007	403	604	0.69	0.44	0.25	2.7

[a] BET surface area.

[b] Micropore surface area calculated using the V-t plot method.

[c] Mesopore surface area calculated using the V-t plot method.

[d] The total pore volume calculated by single point adsorption at $P/P_0 = 0.99$.

[e] The mesopore volume calculated using the V-t plot method.

[f] The micropore volume calculated using the V-t plot method.

[g] Average pore size.

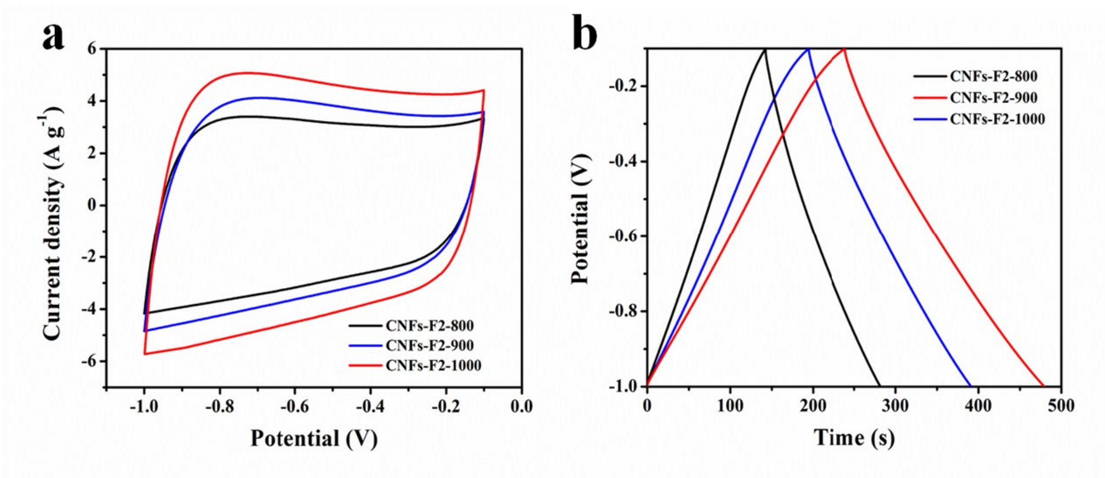


Figure S6. (a) CV curves of the samples at the scan rate of 100 mV s^{-1}; (b) galvanostatic charge-discharge curves of the samples at the same scan rate of 1.0 A g^{-1}.

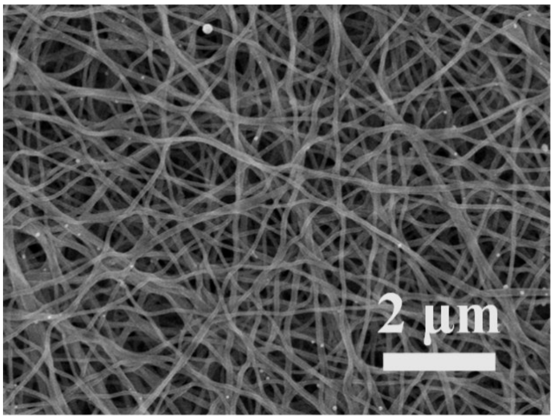


Figure S7. SEM characterizations of the CNFs-F2-900 electrode after 20000 discharge/charge cycles at 10.0 A g^{-1}.

Table S3. Maximum capacitances and cycling stability of porous carbon nanofiber materials.

Electrode Material	Specific Capacitance	Electrolyte	cycling stability	Reference
water etching-assisted templating activated mesoporous carbon nanofibers	195 F g^{-1} at 1.0A g^{-1}	6 M KOH	91% 1 A g^{-1} 3000 cycles	[18]
porous carbon nanofibers	144 F g^{-1} at 0.1 A g^{-1}	6 M KOH	90% 0.5 A g^{-1} 1000 cycles	[21]
hierarchical porous carbon nanofibers	251F g^{-1} at 1.0 A g^{-1}	6 M KOH	97% 2 A g^{-1} 1000 cycles	[24]
steam activated carbon nanofibers	230 F g^{-1} at 1.0 A g^{-1}	6 M KOH	88% 1 A g^{-1} 5000 cycles	[13]
coal derived porous carbon fibers	170 F g^{-1} at 1.0 A g^{-1}	6 M KOH	100% 1 A g^{-1} 20000 cycles	[31]
coal based porous carbon nanofibers	265.2 F g^{-1} at 1.0 A g^{-1}	6 M KOH	105% 10 A g^{-1} 20000 cycles	This work

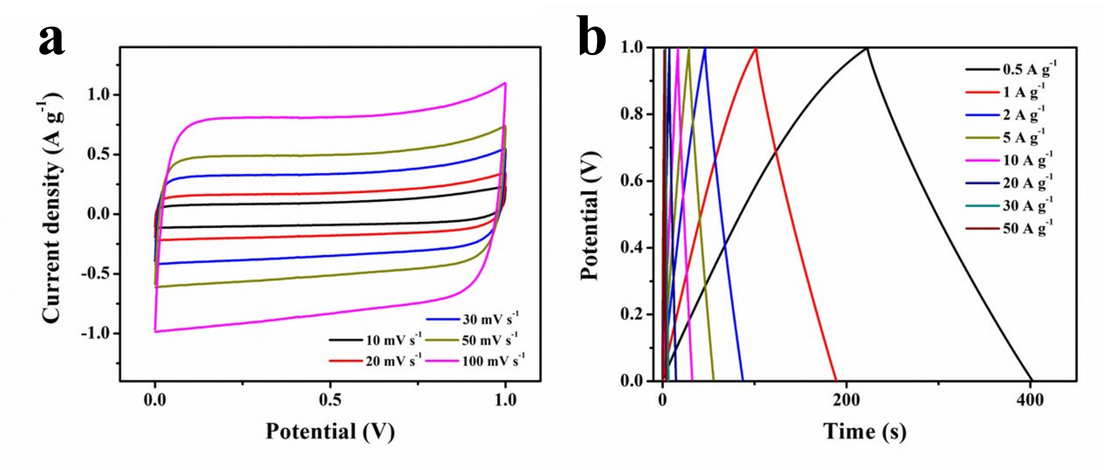


Figure S8. (a) CV curves and (b) CP cures of the CNFs-F2-900 sample at different current densities.