Electronic Supplementary Information

Designed formation of hollow particle-based nitrogen-doped carbon nanofibers for high-performance supercapacitors

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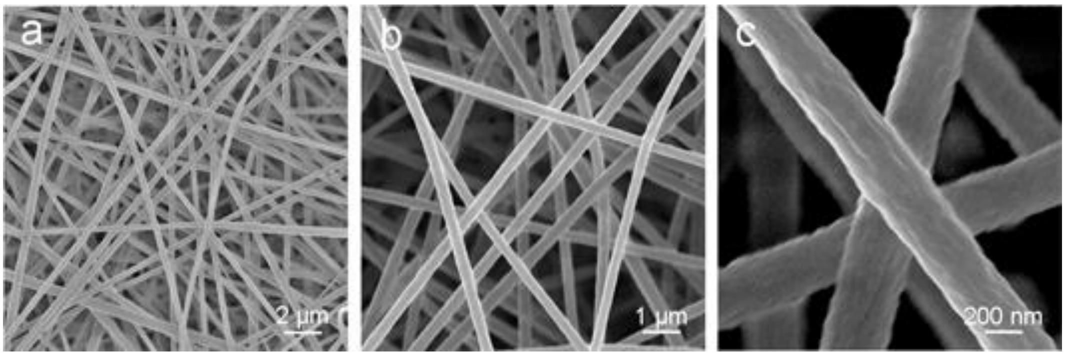

Fig. S1 FESEM characterizations of the PAN nanofibers without the addition of ZIF-8 particles.

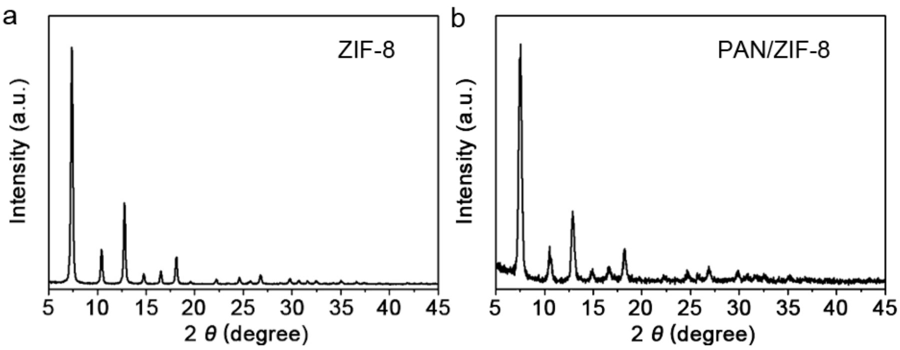

Fig. S2 XRD patterns of the ZIF-8 particles and PAN/ZIF-8 nanofibers.

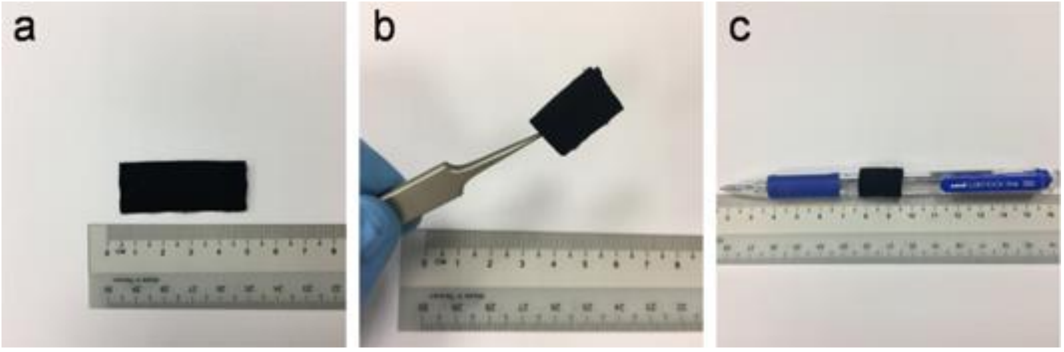

Fig. S3 Representative photographs showing the flexibility of the HPCNFs-N sample.

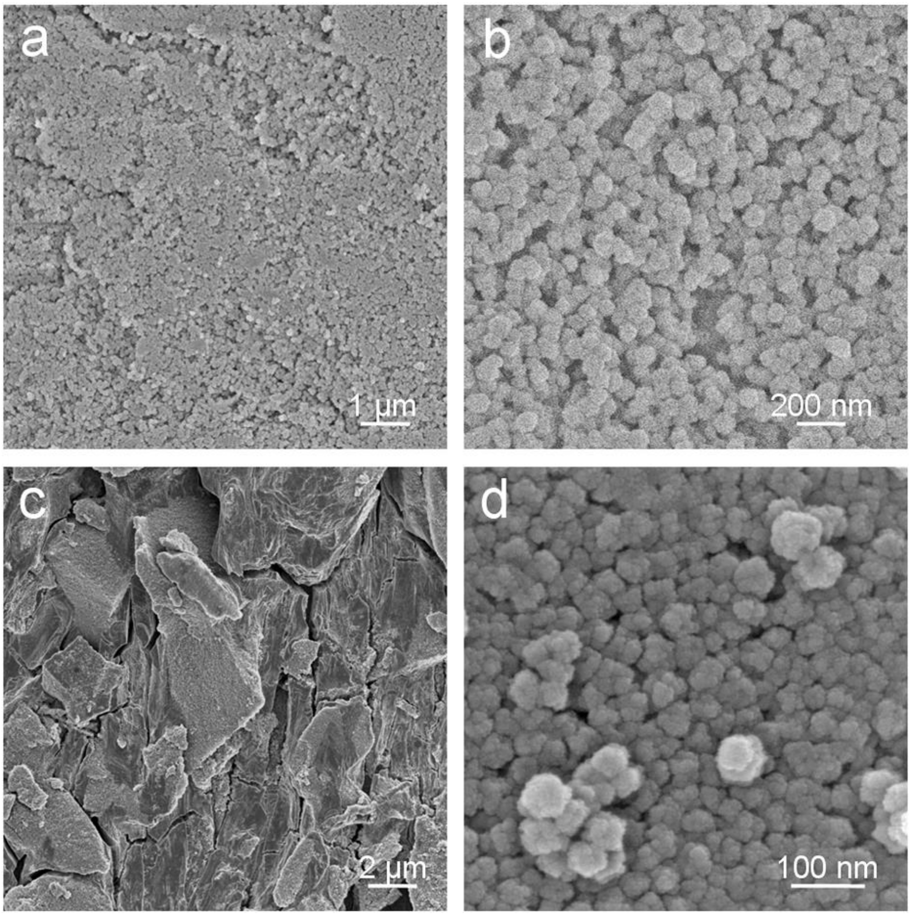

Fig. S4 FESEM characterizations. FESEM images of (a,b) ZIF-8 nanoparticles and (c,d) the resultant N-doped carbon (C-N) after carbonization process.

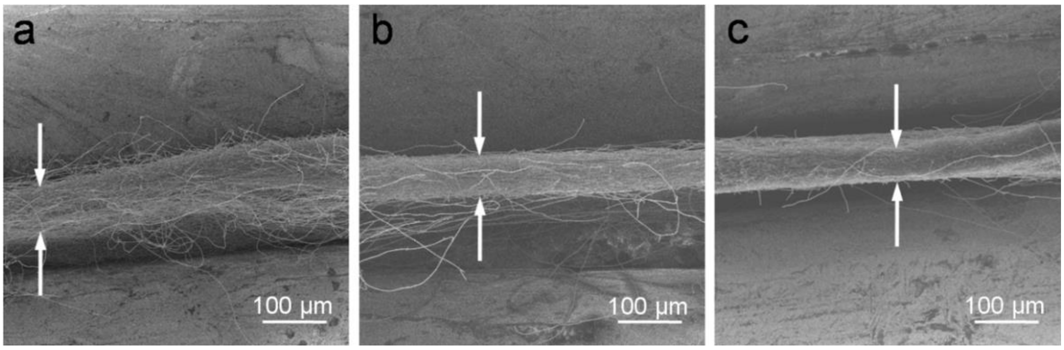

Fig. S5 FESEM characterizations. The cross-section FESEM images of (a) HPCNFs-N-800, (b) HPCNFs-N and (c) HPCNFs-N-1000.

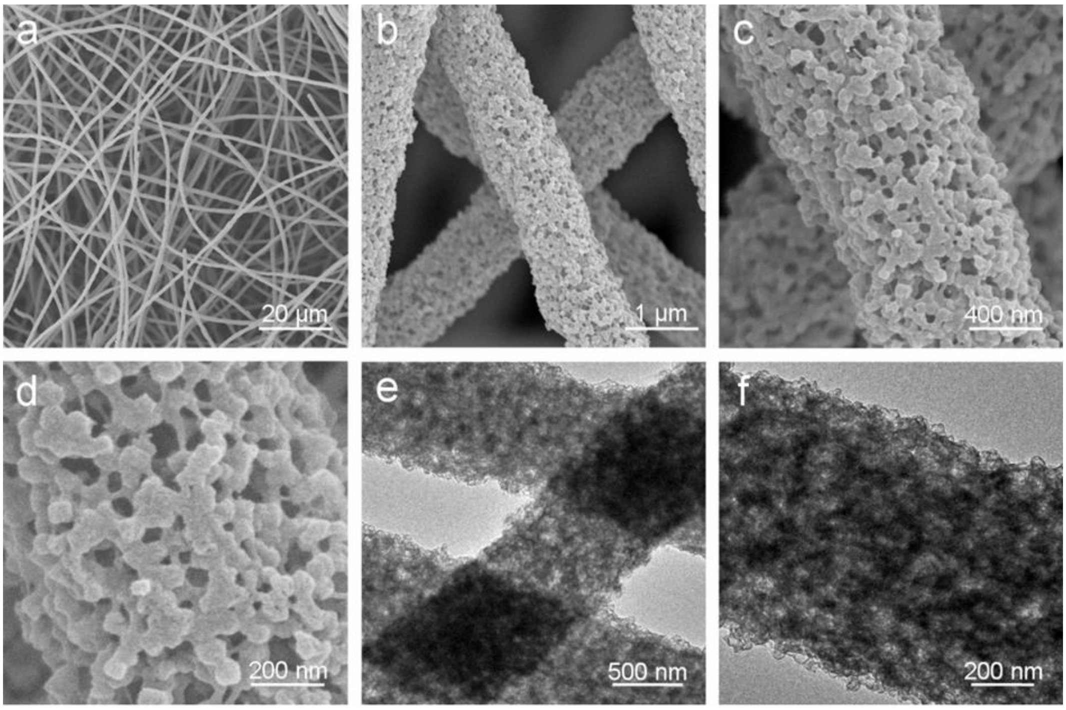

Fig. S6 FESEM and TEM characterizations of HPCNFs-N-800.

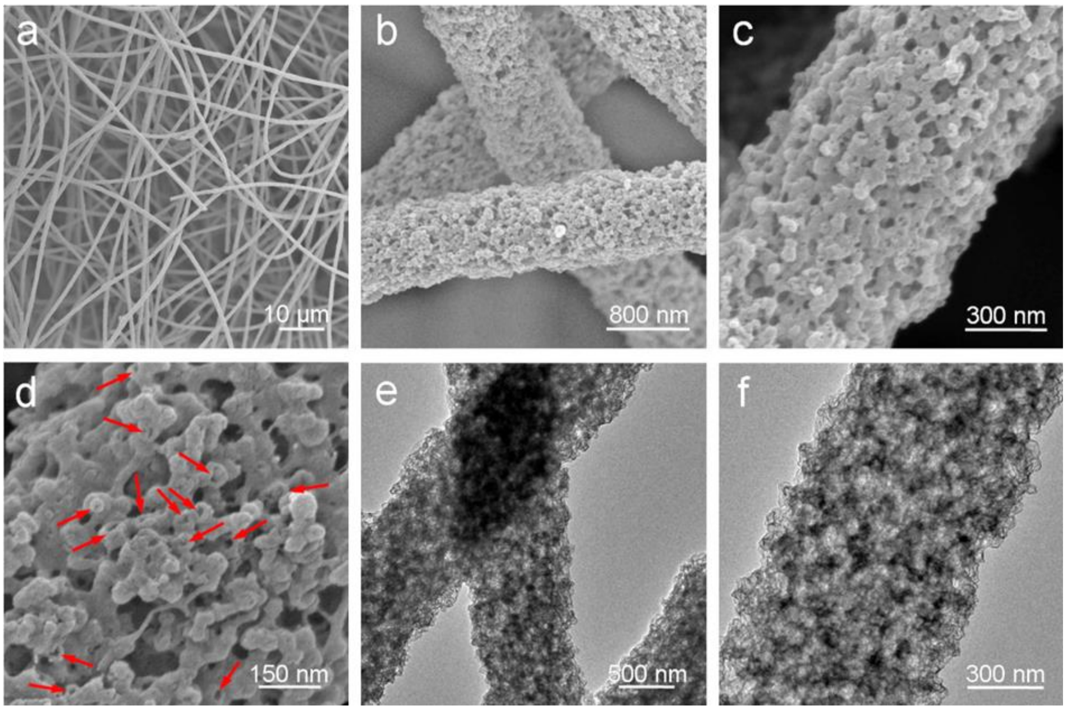

Fig. S7 FESEM and TEM characterizations of HPCNFs-N-1000.

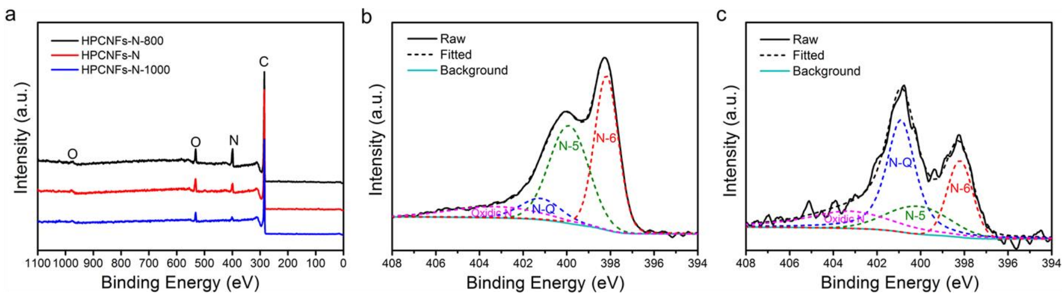

Fig. S8 (a) XPS survey spectra of HPCNFs-N and the control samples. High resolution spectra of N 1s for (b) HPCNFs-N-800 and (c) HPCNFs-N-1000.

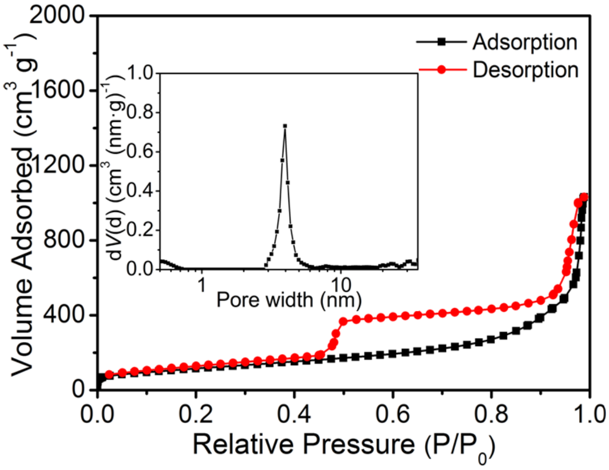

Fig. S9 N_2 adsorption/desorption isotherms and the corresponding pore-size-distribution curve of HPCNFs-N.

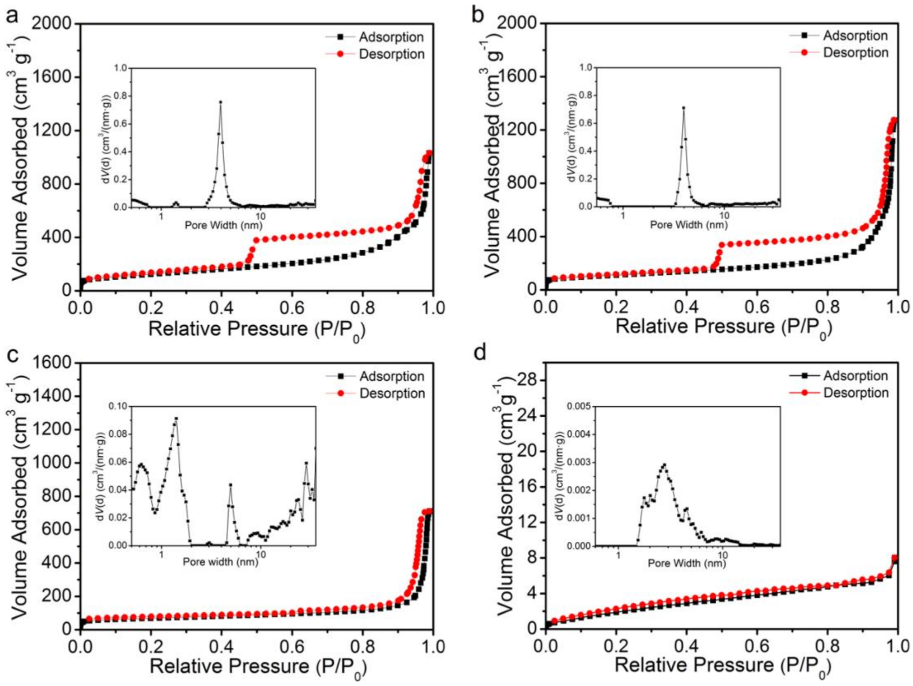

Fig. S10 N_2 adsorption/desorption isotherms and the corresponding pore-size-distribution curves of the control samples. (a) HPCNFs-N-800, (b) HPCNFs-N-1000, (c) C-N and (d) N-CNFs.

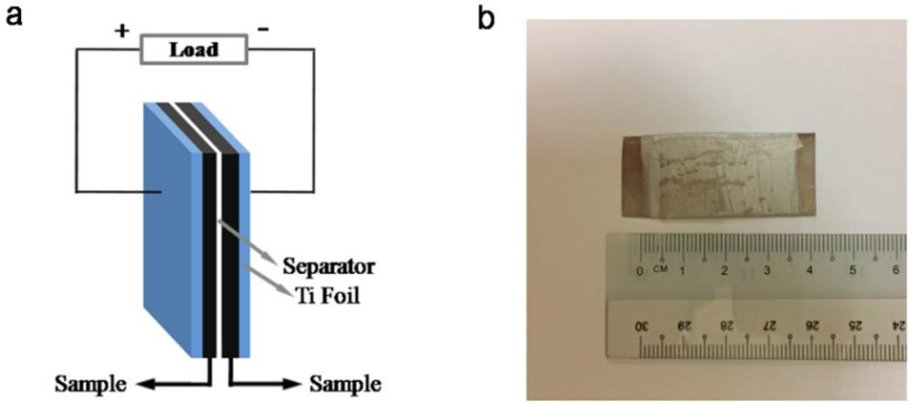

Fig. S11 Two-electrode system for measuring supercapacitive performance. (a) Schematic diagram of the two-electrode configuration. (b) Photograph of a supercapacitor with as-synthesized samples as the electrodes.

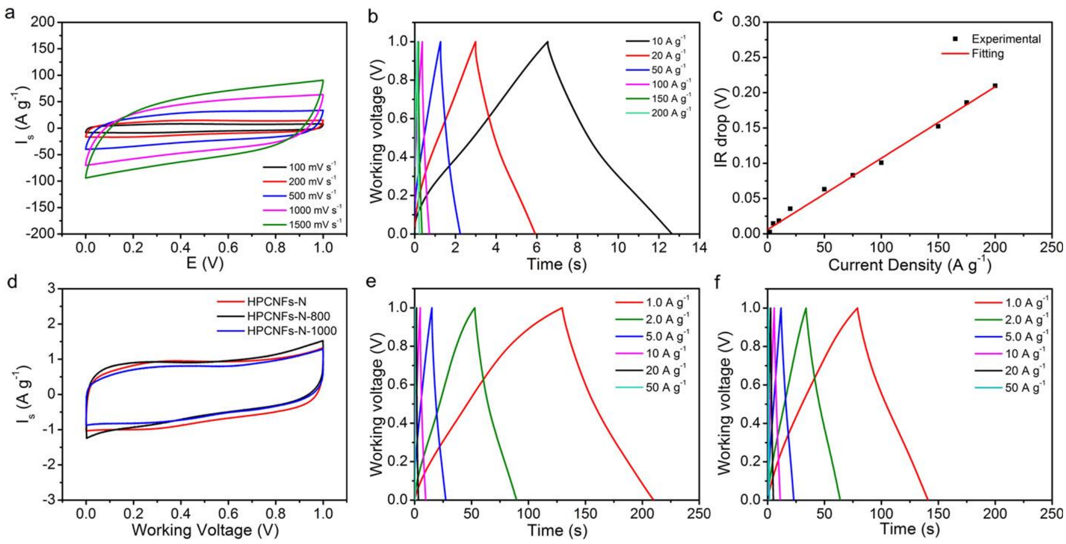

Fig. S12 (a) CV curves at different scan rates, (b) galvanostatic charge-discharge curves at different current densities and (c) *IR* drop at different current densities of HPCNFs-N. (d) CV curves of different samples at a current density of 10.0 mV s^{-1}. Galvanostatic charge-discharge curves at different current densities of (e) HPCNFs-N-800 and (f) HPCNFs-N-1000.

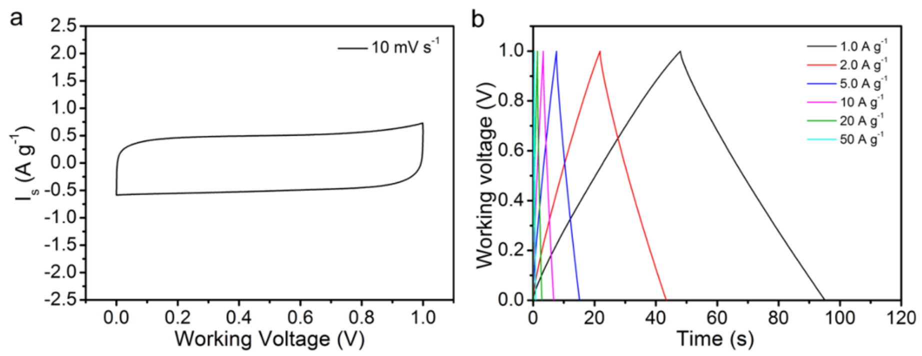

Fig. S13 Supercapacitive performance of C-N. (a) CV curve at the scan rate of 10.0 mV s^{-1}. (b) Galvanostatic charge-discharge curves at different current densities.

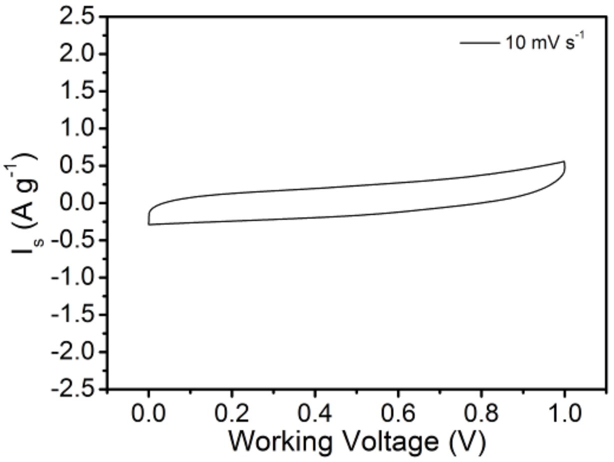

Fig. S14 CV curve of N-CNFs at the scan rate of 10.0 mV s^{-1}.

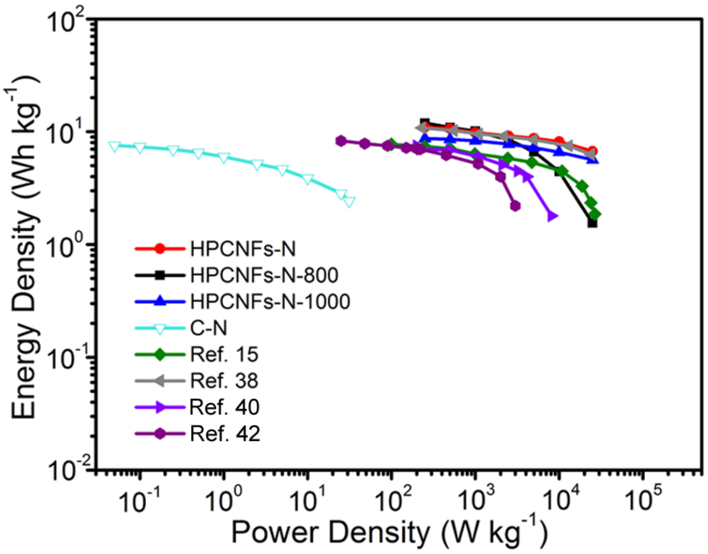

Fig. S15 Ragone plots of HPCNFs-N, the control samples and other carbon-based devices.

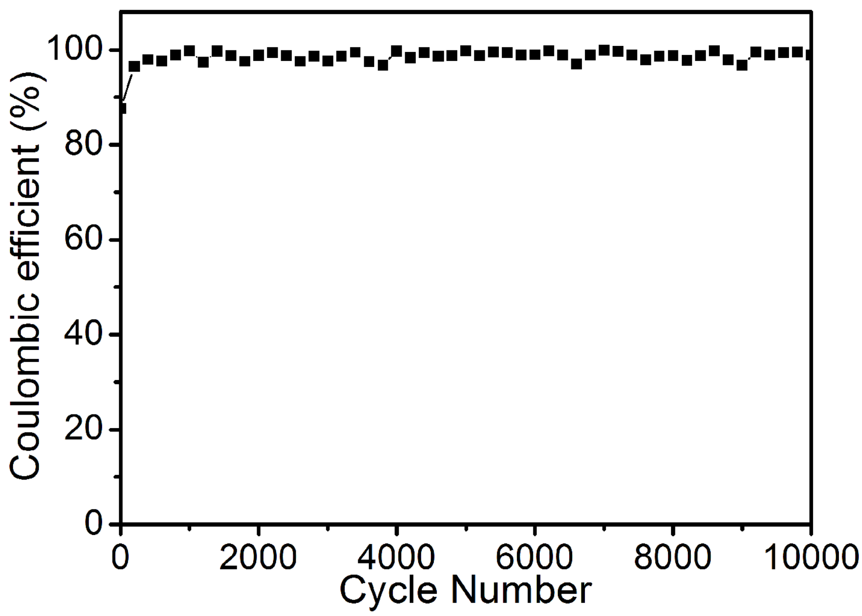

Fig. S16 The Coulombic efficiency of HPCNFs-N during the cycling test at a current density of 5.0 A g^{-1}.

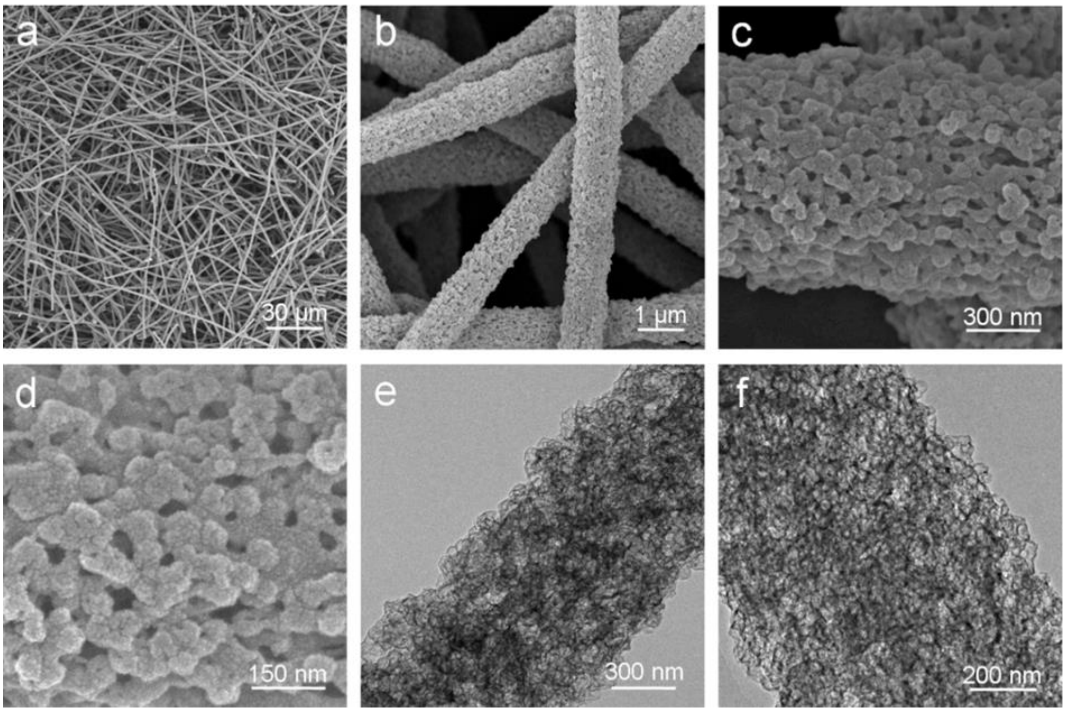

Fig. S17 FESEM and TEM characterizations of the HPCNFs-N electrode after 10000 discharge/charge cycles at 5.0 A g^{-1}.

Table S1. Pore parameters of HPCNFs-N and the control samples.

Sample	S_{BET} ($m^2\ g^{-1}$) [a)]	V_T ($cm^3\ g^{-1}$) [b)]
HPCNFs-N	417.9	0.68
HPCNFs-N-800	443.5	1.60
HPCNFs-N-1000	380.6	1.97
C-N	223.1	0.38
N-CNFs	8.7	0.01

[a)] S_{BET}: Calculated specific surface area; [b)] V_T: pore volume.

Table S2. Comparison of electrochemical performance of HPCNFs-N with some representative carbon-based electrodes for supercapacitors.

Carbon-based electrodes	Specific capacitance (F g^{-1})	Energy density (Wh kg^{-1})	Power density (kW kg^{-1})	Ref.
HPCNFs-N	307.2 (1 A g^{-1})	10.96	25	This work
N,P-co-doped CNFs	204.9 (1 A g^{-1})	7.76	26.61	15
Heteroatom-doped carbon	~265 (1 A g^{-1})	Not reported	Not reported	19
N-doped carbon@graphitic carbon	270 (1 A g^{-1})	Not reported	Not reported	34
Porous N-doped carbon	~200 (0.25 A g^{-1})	Not reported	Not reported	35
Two-dimensional $CoS_{1.097}$/N-doped carbon nanocomposites	360.1 (1.5 A g^{-1})	Not reported	Not reported	36
N-doped activated carbons	185 (0.4 A g^{-1})	Not reported	Not reported	37
Hierarchical N-doped carbon nanocages	313 (1 A g^{-1})	10.90	22.22	38
N-enriched porous carbon spheres	388 (1 A g^{-1})	Not reported	Not reported	39
Cross-linked N-doped CNF network	~200 (1 A g^{-1})	5.9	10	40
N-doped hierarchical CNFs	332 (1 A g^{-1})	Not reported	Not reported	41
Pine needle-derived N-doped carbon frameworks	236 (1 A g^{-1})	8.2	2.0	42
Hydrophilic N-doped carbon foams	52 (1 mA cm^{-2})	Not reported	Not reported	43