Supporting Information

N-doped Hierarchical Continuous Hollow Thin Porous Carbon Nanostructure for High Performance Flexible Gel-Type Supercapacitors

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Figure S1. (a) Zoom-in SEM image of carbon cloth and (b) SEM image of MSS@CC with inset showing zoom-in morphology of assembled MSS.



Figure S2 SEM image of NCN@CC with inset showing large scale image.



Figure S3. EDX spectrum of NHPCN@CC.



Figure S4. Pore size distribution of NHPCN.



Figure S5. Full XPS survey of NHPCN@CC. (O KLL= oxygen Auger peak)



Figure S6. Illustration of various N-doping in graphitic carbon.



Figure S7. High resolution XPS spectrum of O1s of NHPCN.



Figure S8. Specific capacitances vs. scan rates for both NHPCN@CC and NCN@CC in (a) positive (0-1 V) and (b) negative (-1-0 V) potential windows.



Figure S9. Galvanostatic charging/discharging curves of (a) NCN@CC and (b) NHPCN@CC at increasing current densities.



Figure S10. Specific capacitances vs. current densities curves for NHPCN@CC and NCN@CC.



Figure S11. Specific capacitances vs. current densities curves for NHPCN@CC//NHPCN@CC and NCN@CC//NCN@CC cells.



Figure S12. Demonstration of two NHPCN@CC//NHPCN@CC cells connected in series to light up a red light LED.



Figure S13. Photographs illustrate flexible NHPCN@CC//NHPCN@CC cell under increasing bending angles.



Figure S14. Leakage current of NHPCN@CC//NHPCN@CC charged at 2 mA to 2 V and kept at 2 V for 2 h.

Element	atomic %
C1s	76.5
N1s	4.5
O1s	19.0

 Stable S1. Composition of NHPCN@CC determined from XPS spectrum.

Sample	potential window (V)	2	10	10	25	50	100
NHPCN@CC	0-1	235	208	188	170	145	126
NHPCN@CC	-1-0	206	181	170	158	143	136
NCN@CC	0-1	100	73	57	42	27	27
NCN@CC	-1-0	108	94	84	72	59	45

Table S2. Specific capacitances (in unit of F g⁻¹) achieved by NHPCN@CC and HCH@CC electrodes at increasing scan rates (in unit of mV s⁻¹).

cell	potential window (V)	2	25	100 mV s ⁻¹	
NHPCN@CC//NHPCN@CC	0-2	41	35	34	
NCN@CC//NCN@CC	0-2	20	13	11	

Table S3. Specific capacitances (in unit of F g⁻¹) of NHPCN@CC//NHPCN@CC andNCN@CC//NCN@CC cells.

Table S4. Specific capacitances and energy and power densities of and

 NCN@CC//NCN@CC cells at increasing current densities.

	potential window (V)		0.5 A g ⁻¹	1 A g ⁻¹	5 A g ⁻¹	10 A g ⁻¹
NHPCN@CC//NHPCN@CC	0-2	Specific capacitance (F g ⁻¹)	44	40	28	19
		Energy density (Wh kg ⁻¹)	24.3	22.1	15.6	10.3
		Power density (kW kg ⁻¹)	0.5	1	5	10
NCN@CC//NCN@CC	0-2	Specific capacitance (F g ⁻¹)	13.4	11.4	5.2	2.5
		Energy density (Wh kg ⁻¹)	7.5	6.3	2.9	1.4
		Power density (kW kg ⁻¹)	0.5	1	5	10

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	Flat	Bending at	Bending at	Bending at	Return to	
		72°	102°	135°	flat	
Energy	18.7	18.3	18.3	16.1	16.7	
density						
(Wh kg ⁻¹)						
Power density	3.4	3.3	3.3	2.9	3	
(kW kg ⁻¹)						

 Table S5. Energy and power densities of NHPCN@CC//NHPCN@CC cells at

increasing bending angles at scan rate of 100 mV s⁻¹.

Year	Type of electrode	Electrolyte	Specific capacitance	Rate capability	Energy density	Power density	Cycle stability	Ref.
2013	3D graphene hydrogel	H ₂ SO ₄ /PVA	118 F g ⁻¹ (10 mV s ⁻¹)	45% retention (10-100 mV s ⁻¹)	0.61 W h kg ⁻¹	0.67 kW kg ⁻¹	10000 / 91.6%	58
2015	CNF / RGO / CNT//CNF / RGO / CNT	H ₂ SO ₄ /PVA	252 F g ⁻¹ (0.5 A g ⁻¹)	62% retention (5-50 mV s ⁻¹)	8.2 W h kg ⁻¹	2.7 kW kg ⁻¹	1000 / 99.5%	65
2016	PEDOT nanofibers/carb on cloth	0.5 M Na ₂ SO ₄	201.4 mF cm ⁻² (1 mA cm ⁻²)	_	4 W h kg ⁻¹	3.2 kW kg ⁻¹	1000 / 92.4%	66
2017	starch/RGO// starch/RGO	LiCl/PVA	36 F g ⁻¹ (2 mV s ⁻¹)	47% retention (2-1000 mV s ⁻¹)	19.8 - 9.6 W h kg ⁻¹	0.5 - 9.9 kW kg ⁻¹	8000 / 80%	23
2017	FSC	H ₂ SO ₄ /PVA	80 F g ⁻¹ (5 mV s ⁻¹)	_	8.8 W h kg ⁻¹	0.18 kW kg ⁻¹	10000 / 112%	67
2018	Cellulose Nanofibril/RG O/Carbon Nanotube Hybrid Aerogels	H ₂ SO ₄ /PVA	147 F g ⁻¹ (0.5 A g ⁻¹)	70 % retention (0.5-10 A g ⁻¹)	8.3 W h kg ⁻¹	10 kW kg ⁻¹	3000 / 94%	68
2019	PBC-5//PBC-5	3 М КОН	45 F g ⁻¹ (0.5 A g ⁻¹)	78 % retention (0.5-5 A g ⁻¹)	14 W h kg ⁻¹	0.44 kW $ ext{kg}^{-1}$	8000 / 95.7%	69
This work	NHPCN@CC// NHPCN@CC	LiCl/PVA	43 F g ⁻¹ (0.5 A g ⁻¹)	83 % retention (2-100 mV s ⁻¹)	24.3-10.3 W h kg ⁻¹	0.5-10 kW kg ⁻¹	8000 / 85%	

 Table S6. Comparison of specific capacitance, rate capability, energy density, and

power density of present work with past work.