Electronic Supplementary Material

Pyrolysis transformation of ZIF-8 wrapped with polytriazine to nitrogen enriched core-shell polyhedrons carbon for supercapacitor

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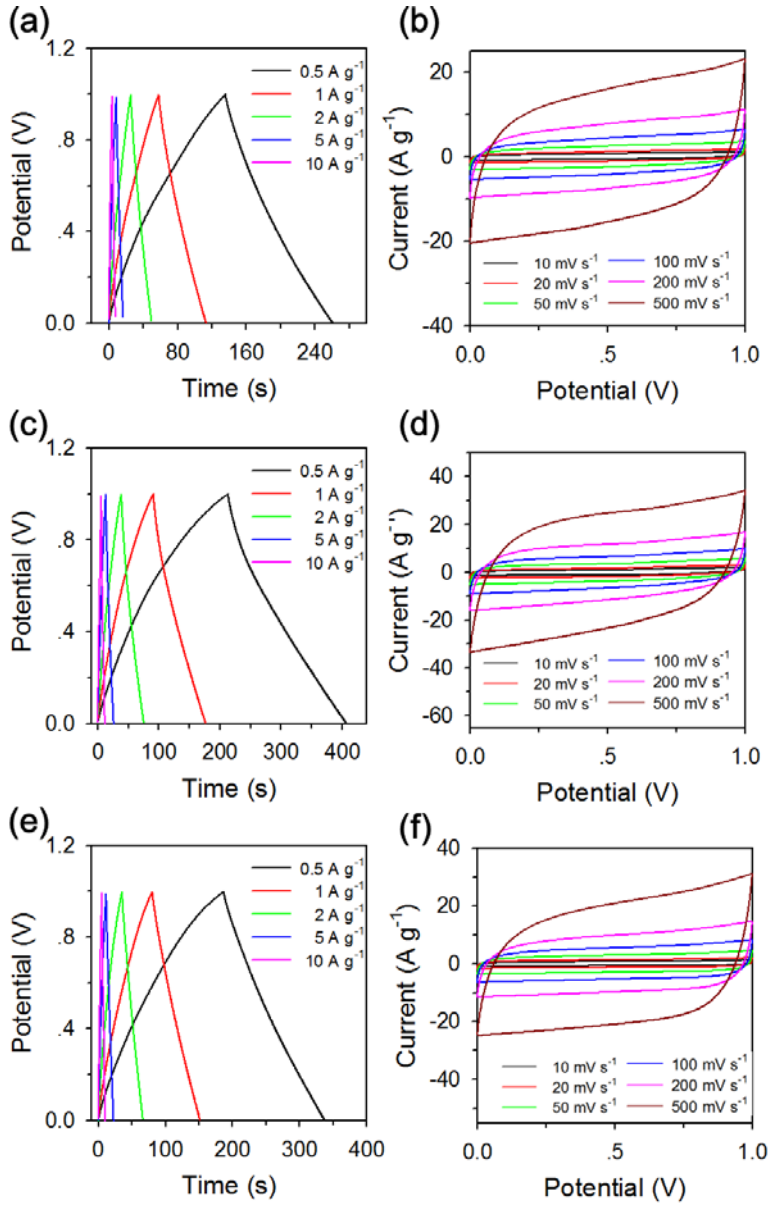

Fig. S1 (a), (c) and (f) were GCD curves of ZIF-8@C/N-1, ZIF-8@C/N-2, and ZIF-8@C/N-3 at different current densities, respectively; (b), (d), and (f) were CV curves of ZIF-8@C/N-1, ZIF-8@C/N-2, and ZIF-8@C/N-3 at different scan rates, respectively

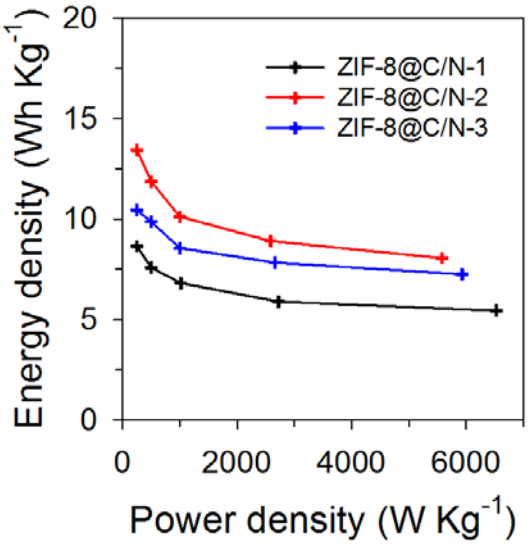

Fig. S2 Ragen plots of ZIF-8@C/N-x

Table S1 Specific capacitance of ZIF-8@C/N-x at different current densities

Samples / Current (A g^{-1})	ZIF-8@C/N-1	ZIF-8@C/N-2	ZIF-8@C/N-3
0.5	249.216 F g^{-1}	386.824 F g^{-1}	300.818 F g^{-1}
1	218.3968 F g^{-1}	341.6208 F g^{-1}	284.0092 F g^{-1}
2	195.9616 F g^{-1}	291.1952 F g^{-1}	246.396 F g^{-1}
5	169.872 F g^{-1}	256.468 F g^{-1}	220.33 F g^{-1}
10	156.644 F g^{-1}	231.992 F g^{-1}	204.512 F g^{-1}

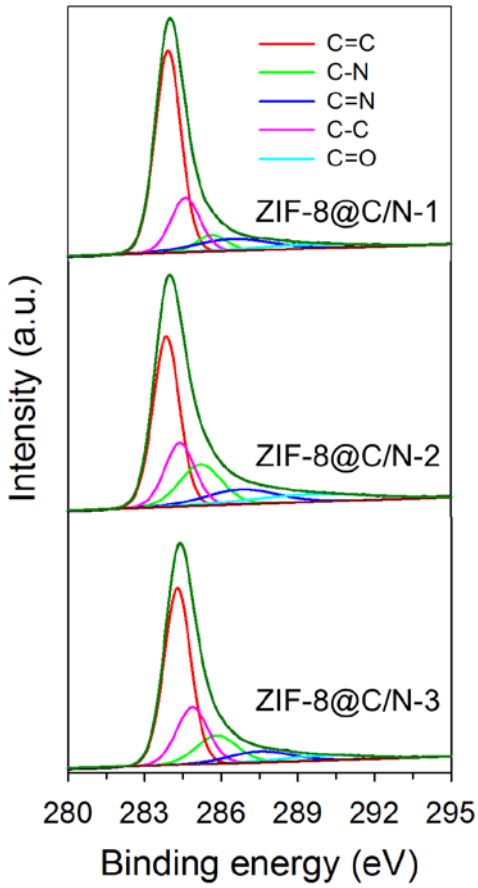

Fig. S3 High-resolution XPS spectra of C1s the ZIF-8@C/N-x samples.

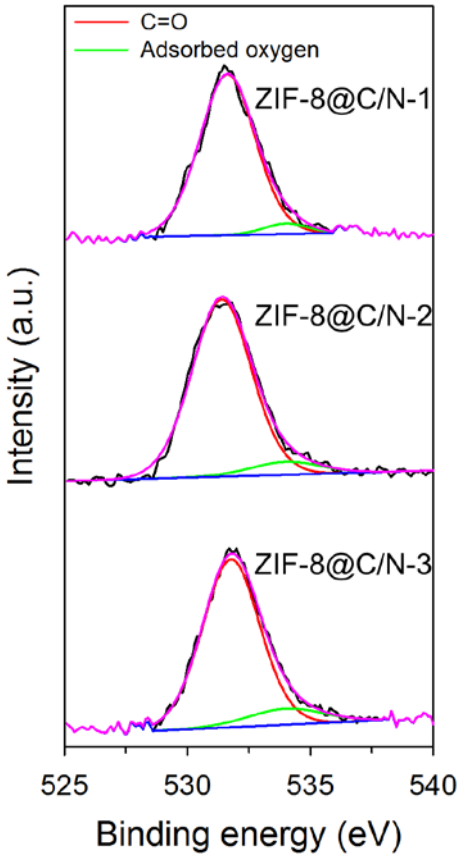

Fig. S4 High-resolution XPS spectra of O1s the ZIF-8@C/N-x samples

Table S2 Comparison of electrochemical performance: present work *vs.* literatures

Materials	Current density /A g^{-1}	Electrolyte	C[a] /F g^{-1}	E[b] /Wh kg^{-1}	P[c] /W kg^{-1}	References
ZIF-8@C/N-x	0.5	6 M KOH	386.8	13.4	250	This work
NC-HAP-700	1	1 M H_2SO_4	311	11.9	600	S4
C/U-2.0	1	6 M KOH	123	4.3	500	S5
NNCN-800	1	6 M KOH	316.8	10.56	500	S6
NPHC	0.5	6 M KOH	212	10.61	400	S7
CS-HPGC	0.5	6 M KOH	332	10.2	100	S8
NPCs	1	6 M KOH	341	9.6	350.15	S9
HPC-2	1	2 M KOH	171	4.2	250	S10
N-YDS-HPCDs	0.5	2 M KOH	346	11.64	250	S11

a) C: specific capacitance; b) E: Energy density; c) P: Power density

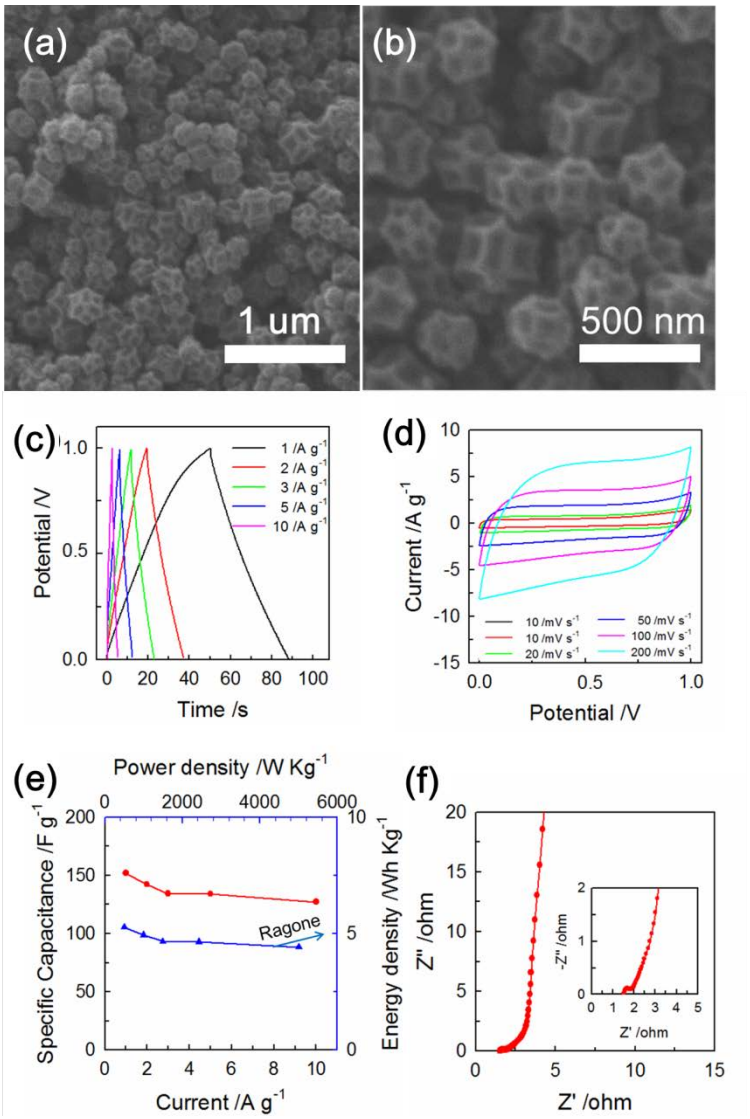

Fig. S5 (a) (b) SEM images of ZIF-8 derived carbon materials prepared under the same conditions; (c) GCD curves of ZIF-8 derived carbon materials at different current densities and (d) CV curves at different scan rates; (e) specific capacitances of the as-prepared samples at different current densities and Ragone plot (energy density vs. power density); (f) EIS of the as-prepared samples at the open circuit potential in the frequency range from 0.1 to 10^5 Hz.

References

S1 Feng L X, Wang K , Zhang X , Sun X Z, Li C, Ge X B, Ma Y W. Flexible solid-state supercapacitors with enhanced performance from hierarchically graphene nanocomposite electrodes and ionic liquid incorporated gel polymer electrolyte. Advanced Functional Materials, 2018, 28(4):1704463.1-1704463.9

S2 Bacal M, Perrière, J, Tanguy M, Vesselovzorov A N, Maslakov K I, Dementjev A P. Study of carbon nitride films deposited using a Hall-type ion source. Journal of Physics D Applied Physics, 2000, 33(19):2373-2378

S3 Yan L J, Li D, Yan T T, Chen G R, Shi L Y, An Z X, Zhang D S. Confining Redox Electrolytes in Functionalized Porous Carbon with Improved Energy Density for Supercapacitors. ACS Applied Materials & Interfaces, 2018, 10(49): 42494-42502

S4 Chu M Z, Zhai Y Y, Shang N Z, Guo P J, Wang C, Gao Y J. N-doped carbon derived from the monomer of chitin for high-performance supercapacitor. Applied Surface Science, 2020, 517: 146140

S5 Liu H, Zhai D D, Wang M, Liu J S, Chen X Y, Zhang Z J. Urea-modified phenol-formaldehyde resins for the template-assisted synthesis of nitrogen-doped carbon nanosheets as electrode material for supercapacitors. Chemelectrochem, 2019, 6(3): 885-891

S6 Guo W, Zhou Y S, Pang L, Chen Z, Dong Y H, Bi J J, Ming S J, Li T. One-Step Pyrolysis to Synthesize Non-Graphitic Nitrogen-Doped 2D Ultrathin Carbon Nanosheets and Their Application in Supercapacitors. ChemElectroChem, 2019, 6(10): 2689-2697

S7 Zhang Y, Sun Q, Xia K S, Han B, Zhou C G, Gao Q, Wang H Q, Pu S, Wu J P. Facile synthesis of hierarchically porous N/P codoped carbon with simultaneously high-level heteroatom-doping and moderate porosity for high-performance supercapacitor electrodes. ACS Sustainable Chemistry & Engineering, 2019, 7(6): 5717-5726

S8 Gong Y N, Li D L, Fu Q, Zhang Y P, Pan C X. Nitrogen self-doped porous carbon for high-performance supercapacitors. ACS Applied Energy Materials, 2020, 3(2): 1585-1592

S9 Yu J , Fu N , Zhao J , Liu R, Li F, Du Y C, Yang Z L. High specific capacitance electrode material for supercapacitors based on resin-derived nitrogen-doped porous carbons. ACS Omega, 2019, 4(14): 15904-15911

S10 Zhang H S, Xiao W, Zhou W J, Chen S Y, Zhang Y H. Hierarchical porous carbon derived from sichuan pepper for high-performance symmetric supercapacitor with decent rate capability and cycling stability. Nanomaterials, 2019, 9(4): 553

S11 Zhang J C, Liu L H, Qian G , Zhou Z J, Xiao K S, Cheng S, Wang Y, Liu Y F, Feng Y. Multi-layered zeolitic imidazolate framework based self-templated synthesis of nitrogen-doped hollow porous carbon dodecahedrons as robust substrates for supercapacitors. New Journal of Chemistry, 2019, 43(5): 2171-2178