Supporting Information

N-, Fe-Doped Carbon Spheres/Oriented Carbon Nanofibers Nanocomposite with Synergistically Enhanced Electrochemical Activities

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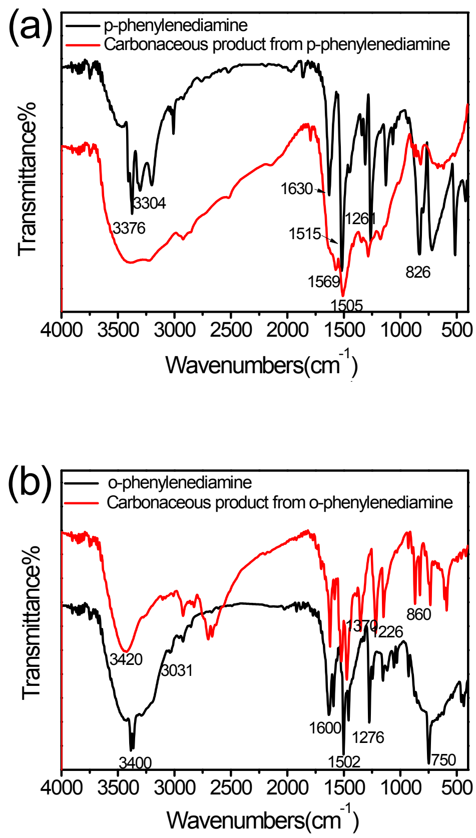


Figure S1(a) FTIR Data of p-phenylenediamine and carbonaceous product from p-phenylenediamine(P1); (b) FTIR data of o-phenylenediamine and carbonaceous product from o-phenylenediamine (P2)

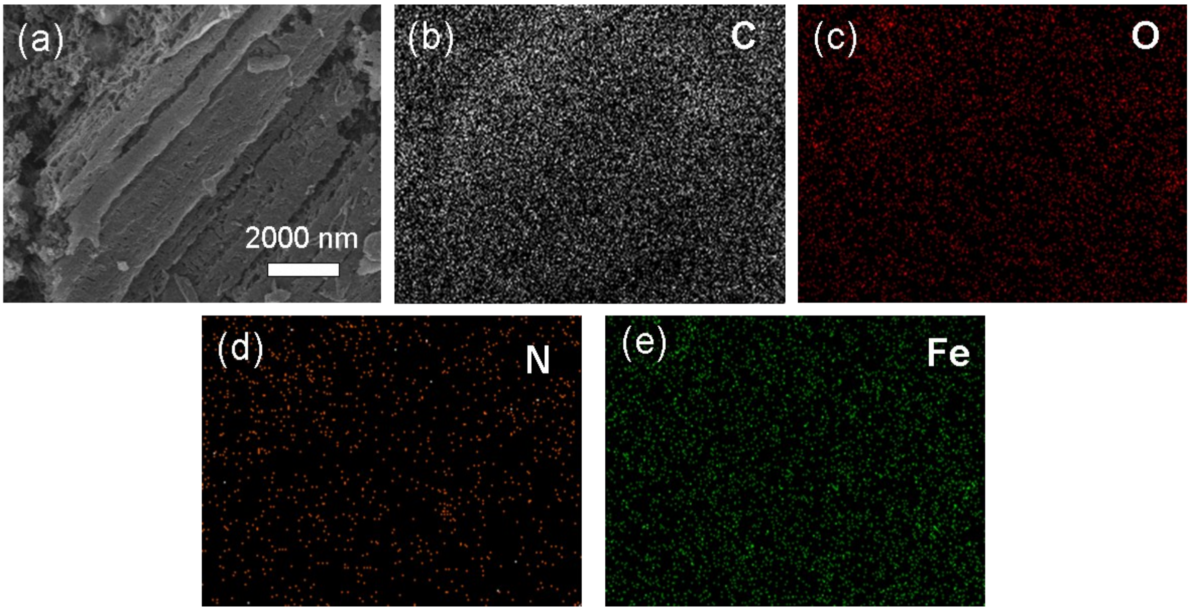


Figure S2. (a) SEM image of the NFe-CNF-400; (b-e) carbon, oxygen, nitrogen and ferrum element mappings of the NFe-CNF-400

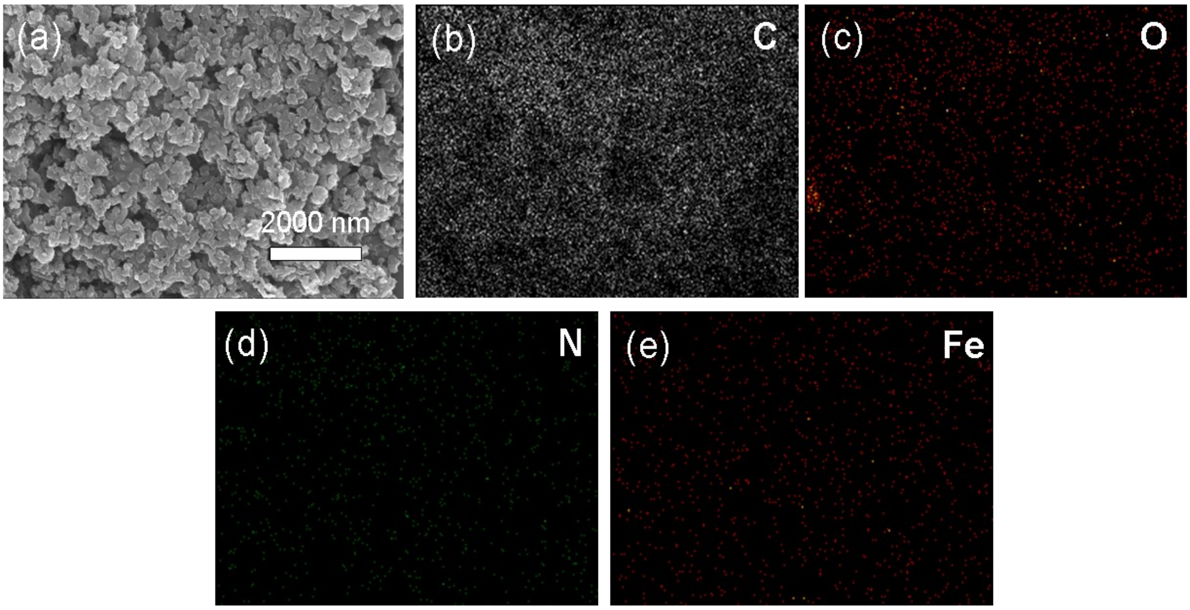


Figure S3. (a) SEM image of the NFe-CS-400; (b-e) carbon, oxygen, nitrogen and ferrum element mappings of the NFe-CS-400

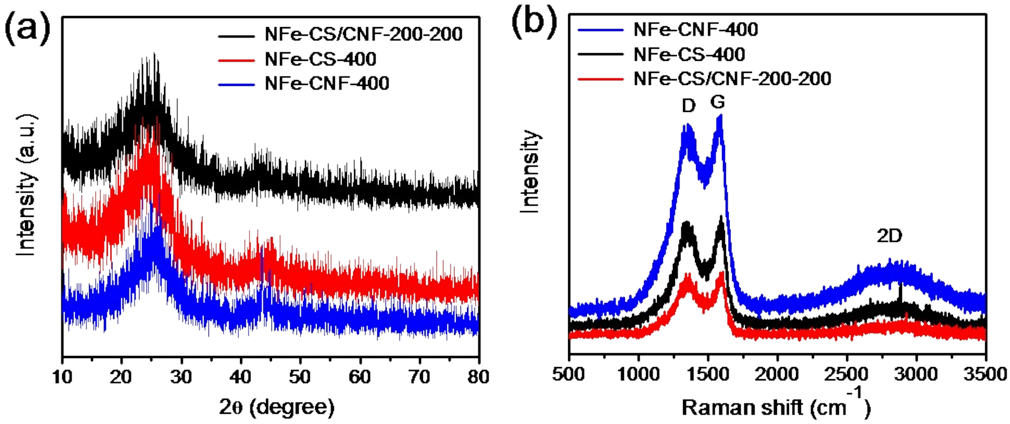


Figure S4(a)X-ray diffraction of the NFe-CS-400, NFe-CNF-400 andNFe-CS/CNF-200-200; (b)Raman spectra of the NFe-CS-400, NFe-CNF-400 andNFe-CS/CNF-200-200.

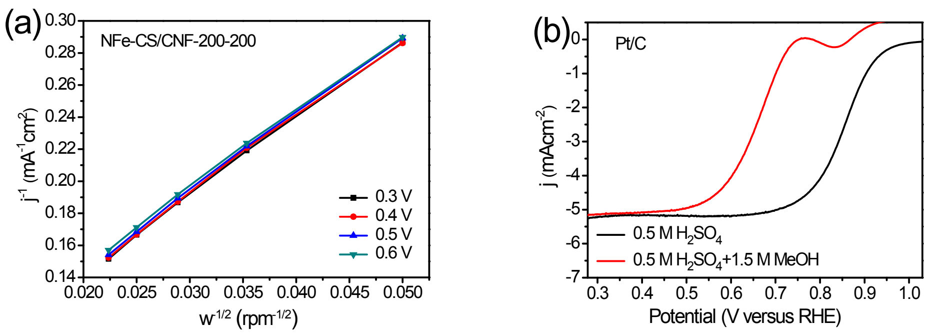
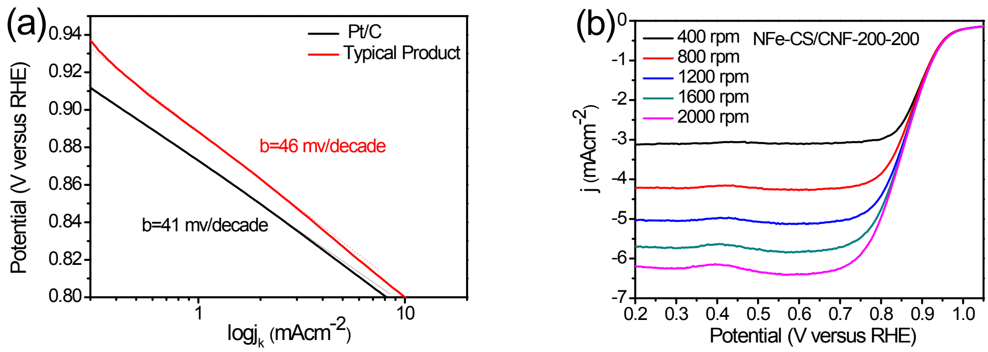


Figure S5 (a) K-L plots (i^{-1}vs. $\omega^{-1/2}$) at different electrode potentials at NFe-CS/CNF-200-200 electrode in 0.5 M H_2SO_4; (b) ORR polarization curves at Pt/C electrode with or without 1.5 M methanol



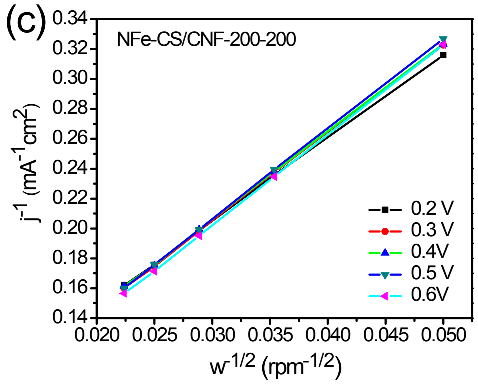
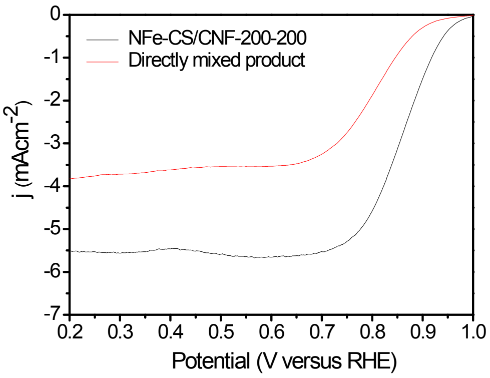


Figure S6 (a) Tafel plots of the NFe-CS/CNF-200-200 and Pt/C in 0.1 M KOH; (b) ORR polarization curves at NFe-CS/CNF-200-200 electrode at various rotation speeds (sweep rate 10 mV s $^{-1}$) in O_2-saturated 0.1 M KOH; (c) K-L plots at different electrode potentials at NFe-CS/CNF-200-200 electrode in 0.1 M KOH



FigureS7 ORR polarization curves at NFe-CS/CNF-200-200 and directly mixed product of NFe-CS-400 and NFe-CNF-400 electrodes in O_2-saturated 0.1 M KOH

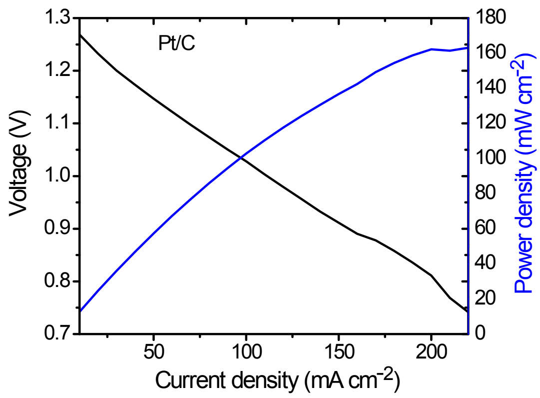


Figure S8 Polarization curves (V-i) and corresponding power density plots of the batteries using Pt/C at different current density

Table S1. Element percentage (C, O, N and Fe), BET surface area, total pore volume and micropore volume of the NFe-CS/CNF-200-200, NFe-CS-400 and NFe-CNF-400.

Products	C at.%	O at.%	N at.%	Fe at.%	BET surface area (m^2/g)	Total pore volume (cm^3/g)	Micropore volume (cm^3/g)
NFe-CS/CNF-200-200	91.73	3.99	3.89	0.38	625.00	0.44	0.28
NFe-CS-400	91.09	5.08	3.54	0.28	417.78	0.43	0.17
NFe-CNF-400	90.18	4.78	4.32	0.72	182.64	0.22	0.06
NFe-CS/CNF-150-250	91.1	3.83	4.53	0.54	350.60	0.30	0.09
NFe-CS/CNF-180-220	90.13	4.80	4.59	0.49	444.58	0.31	0.21
NFe-CS/CNF-220-180	91.65	4.38	3.52	0.45	532.5	0.39	0.25
NFe-CS/CNF-250-150	90.91	4.84	3.79	0.46	466.83	0.36	0.22
P1	74.69	14.01	11.09	0.20	----	----	----
P2	78.17	5.19	16.07	0.57	----	----	----

The data about element percentage (C, O, N and Fe) were obtained from the XPS results.

Table S2 Summary of reported ORR performance for nitrogen-doped carbon catalysts in alkaline media

Sample	Electrolyte	Mass loading (mg cm^{-2})	Onset Potential (mv vs. RHE)	Half-Wave Potential(mv vs. RHE)	Limiting current density(mAcm $^{-2}$)	Ref.
PtC	0.1M KOH	0.2	932	845	5.62	this work
NFe-CS/CNF-200-200	0.1M KOH	0.2	950	863	5.73	this work
Fe-N-CC	0.1M KOH	0.1	940	830	-	1
FePPc/CNT-1.5	0.1M KOH	0.65	1050	930	~5.7	2
Meso/micro-PoPD	0.1M KOH	0.5	900	850	5.8	3
N-doped mesoporous nanosheets	0.1M KOH	0.6	970	830	5.45	4
N-doped carbon spheres	0.1M KOH	0.25	880	-	~5.7	5
BP-NFe	0.1M KOH	0.4	1060	-	-	6
N-Fe-co-doped CNTs	0.1M KOH	0.485	930	870	5.5	7
Fe-N-CNFs	0.1M KOH	0.6	0.93	-	~5.4	8
Fe3C@NCNF-900	0.1M KOH	0.15	980	-	~4.5	9

Table S3 Summary of reported ORR performance for nitrogen-doped carbon catalysts in acidic media

Sample	Electrolyte	Mass loading (mg cm^{-2})	Onset Potential (mv vs. RHE)	Half-Wave Potential(mv vs. RHE)	Limiting current density(mAcm^{-2})	Ref.
PtC	0.5M H_2SO_4	0.2	930	850	5.2	this work
NFe-CS/CNF-200-200	0.5M H_2SO_4	0.2	860	782	5.48	this work
Fe-N-CC	0.5M H_2SO_4	0.1	800	520	-	1
FePPc/CNT-1.5	0.5M H_2SO_4	0.65	920	800	~4.8	2
N-doped Carbon Spheres	0.5 M H2SO4	0.25	650	-	~5.6	5
N-Fe-codoped CNTs	0.1 M HClO4	0.49	870	730	~5.75	7
Fe3C@NCNF-900	0.1 M HClO4	0.15	780	-	-	9
Fe-N-HCMS	0.5 M H2SO4	0.25	800	~640	7	10
MWCNT/Co-porphyrin	0.5M H_2SO_4	0.155	790	660	~3.78	11
Fe-SPc/KJ300	0.1 M HClO4	0.612	850	610	~5.5	12
Co-TPFc/MWCNT	0.5M H_2SO_4	0.845	840	560	-	13

Table S4. Summary of reported performance of Zn-air batteries

Catalyst	Volatage 10mA cm^{-2}(V)	Volatage 100 mA cm^{-2}(V)	Peak power density (mW cm^{-2})	Specific Capacity	Reference
NFe-CS/CNF-200-200	**1.29**	**1.04**	**163.3**	**717 $mAhg^{-1}$($10mAcm^{-2}$) 656 $mAhg^{-1}$($100mAcm^{-2}$)**	**This work**
N/P co-doped mesoporous nanocarbon	~1.17	----	55	735 $mAhg^{-1}$($5mAcm^{-2}$) 689$mAhg^{-1}$ ($25mAcm^{-2}$)	Nature nanotechnology,2015,10(5),444-452
Meso/micro-PoPD	1.28	1.01	----	630 $mAhg^{-1}$($100mAcm^{-2}$)	Nature Commnication, 2014,5 4973
Carbon-Coated Core Shell Fe CuNanoparticles	~1.28	~1.1	212	----	Acs Nano 2015, 9, 6493-6501
CoO/N-CNT	1.3	~1.11	265	570 $mAhg^{-1}$($100mAcm^{-2}$)	Nature Commnication 2013,4 1805
MnOx NWs on KB	1.24	1.04	190	295 $mAhg^{-1}$($200mAcm^{-2}$)	Nano Lett. 2011, 11,5362-5366
N-carbon nanofiber aerogel	1.25	----	----	615 $mAhg^{-1}$ ($10mAcm^{-2}$)	Nano Energy. 2015, 11, 366-376
MnOx electrodeposited on stainless steel	0.81	----	27	----	Energy Environ. Sci. 2014 , 7 , 2017
Mn_3O_4/graphene	1.23	0.92	120	----	Energy Environ. Sci. 2011, 4, 4148

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