Electronic Supplementary Information

A Facile Synthesis of Porous N-Doped Carbon with Hybridization of Fe_3C Nanoparticle-Encased CNT for an Advanced Oxygen Reduction Reaction Electrocatalyst

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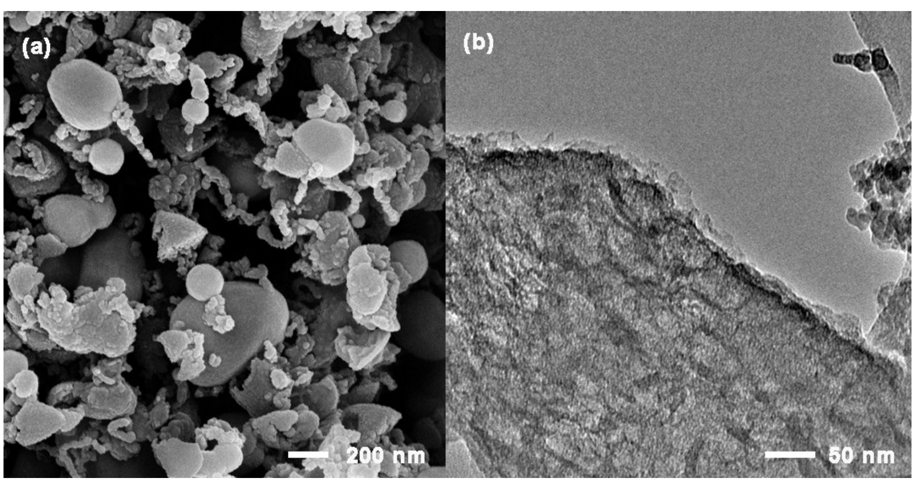

Figure. S1 SEM image (a) and TEM (b) image of the sample FeNC-700 obtained at the initial 0.5h.

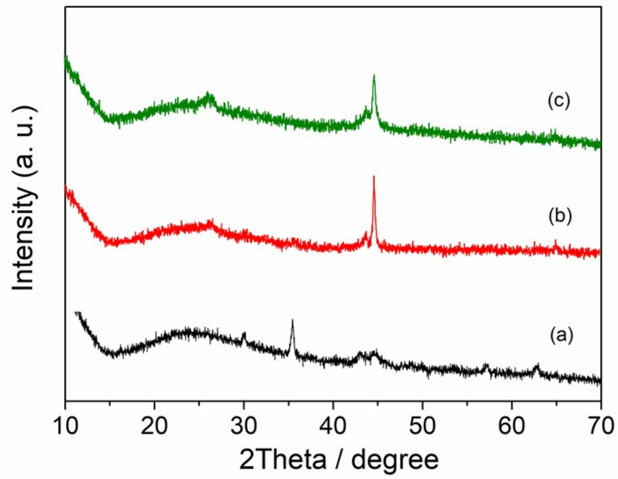

Figure S2. Powder X-ray diffraction pattern of FeNC-X samples: (a) FeNC-700; (b) FeNC-800; (c) FeNC-900.

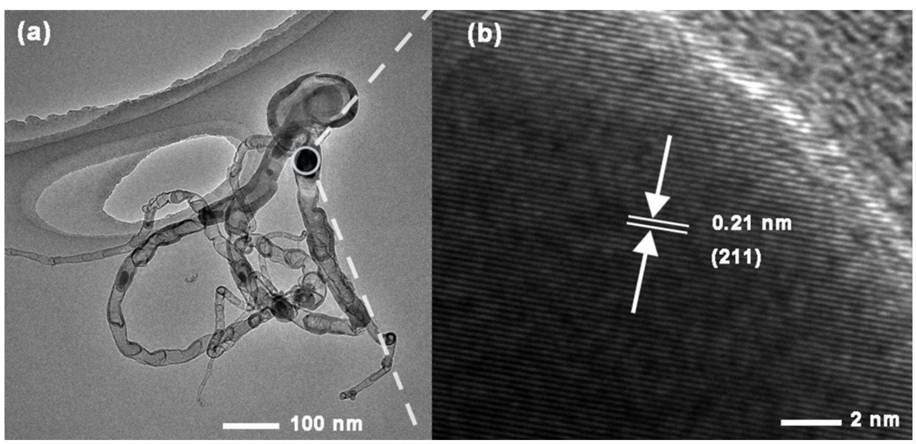

Figure S3. TEM image of FeNC-800.

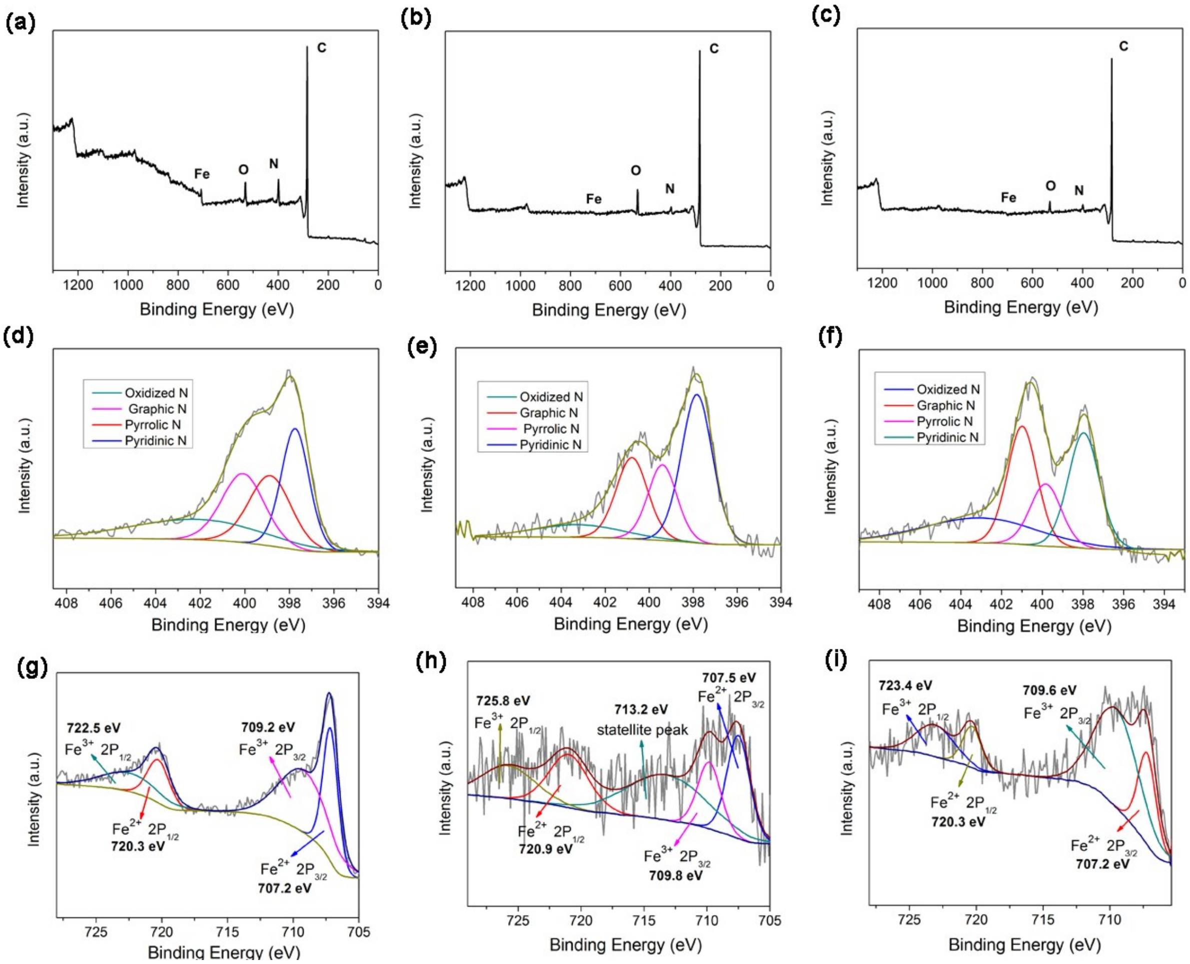

Figure S4. XPS spectrum of (left) FeNC-700; (middle) FeNC-800; (right) FeNC-900: (a-c) Survey pattern; (d-f) high-resolution spectrum of N; (g-i) high-resolution spectrum of Fe.

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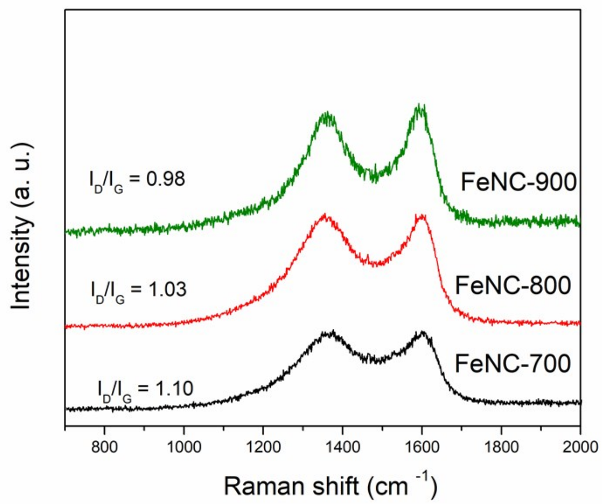

Figure S5. Impedance data for FeNC-X samples and FeNC-ZIF-800.

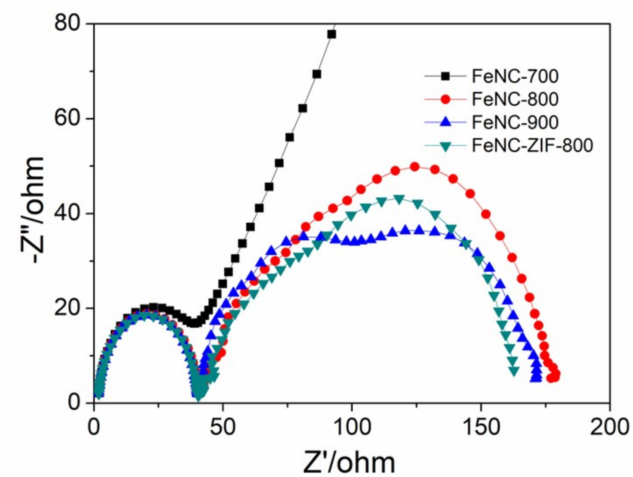

Figure S6. Impedance data for FeNC-X samples and FeNC-ZIF-800.

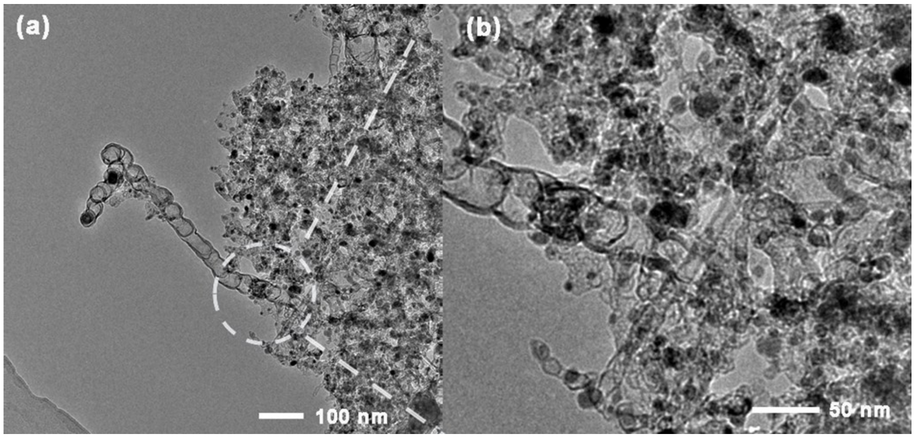

Figure S7. TEM image of the interface of N-doped carbon and carbon nanotubes in FeNC-ZIF-800.

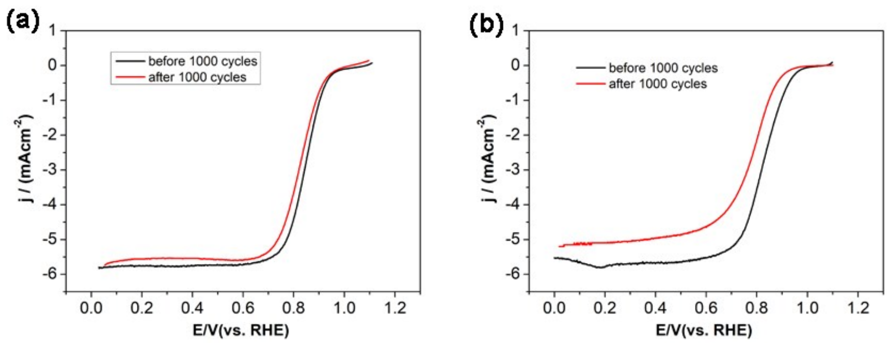

Figure S8. ORR polarization curves before and after 1000 cycles charge-discharge process of FeNC-ZIF-800 (a) and Pt/C (b) in O_2-saturated 0.1 M KOH solution.

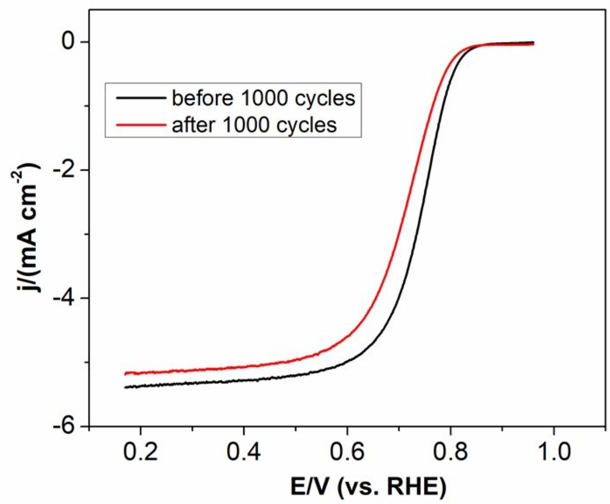

Figure S9. ORR polarization curves before and after 1000 cycles charge-discharge process of FeNC-ZIF-800 in O_2-saturated 0.5 M H_2SO_4 solution.

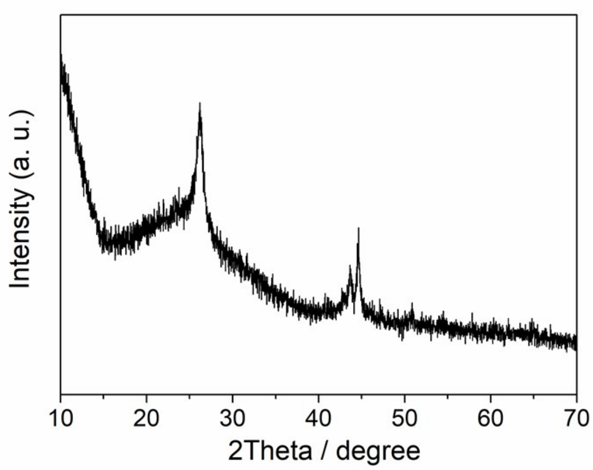

Figure S10. XRD pattern of FeNC-1000.

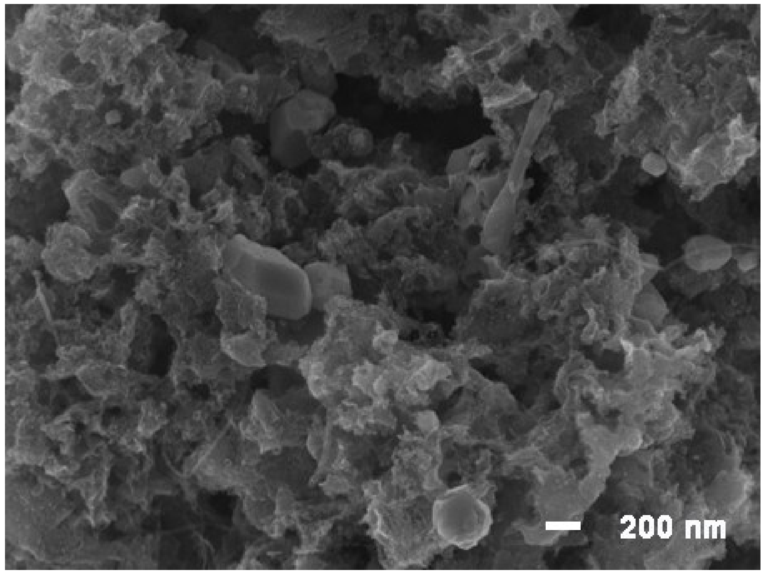

Figure S11. SEM image of FeNC-1000.

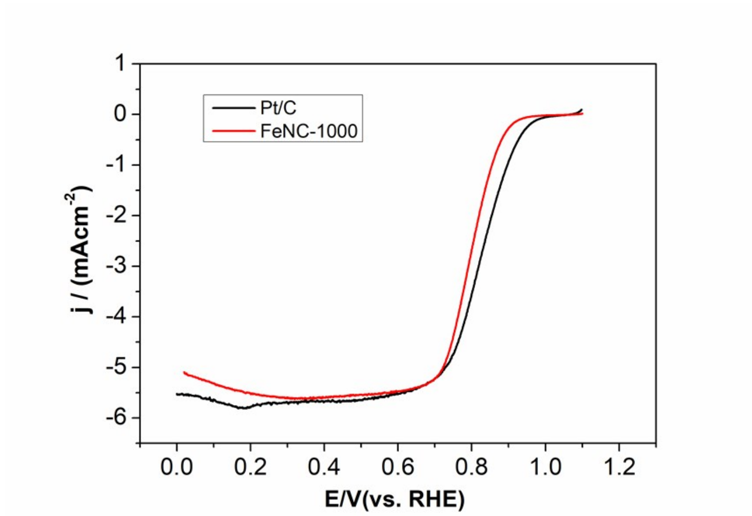

Figure S12. ORR polarization curve of FeNC-1000 in O_2-saturated 0.1 M KOH solution.

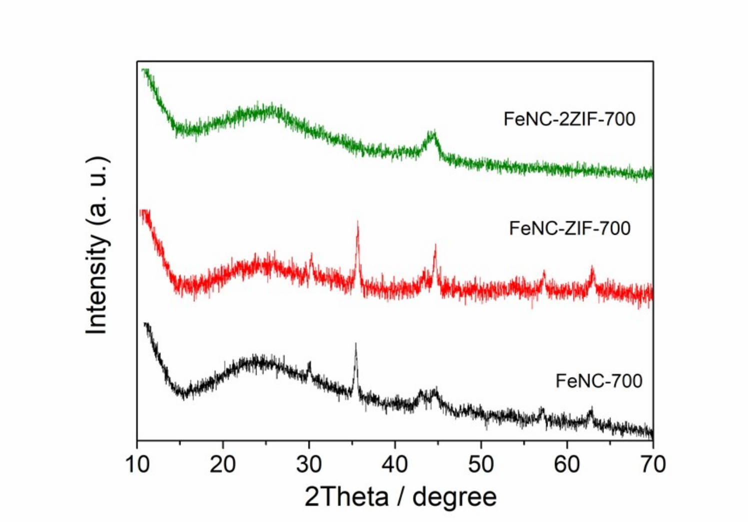

Figure S13. XRD pattern of samples obtained at 700 °C. (FeNC-2ZIF-800 means the amount of ZIF in the precursors are 200% of that in FeNC-ZIF-700).

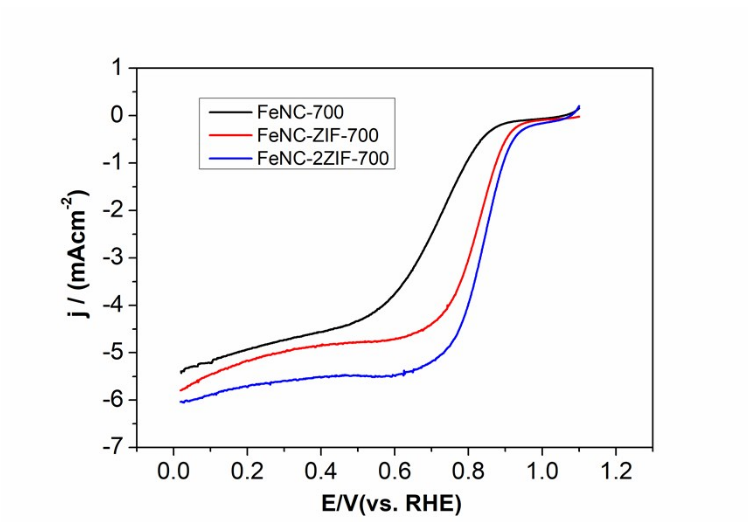

Figure S14. ORR polarization curves of samples obtained at 700 °C in O_2-saturated 0.1 M KOH solution.

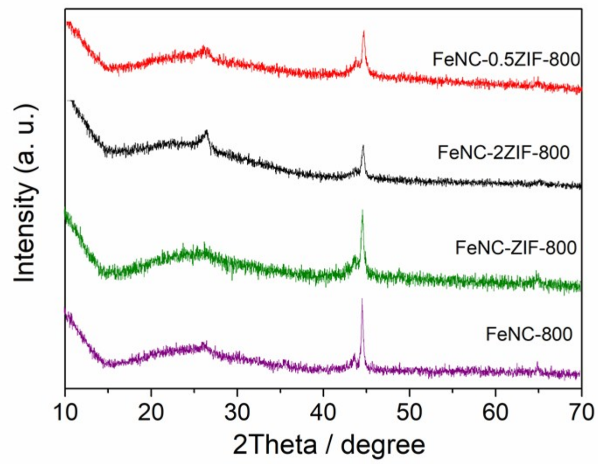

Figure S15. XRD pattern of samples obtained at 800 ^{o}C. (FeNC-2ZIF-800 and FeNC-0.5ZIF-800 mean the amount of ZIF in the precursors are 200% or 50% of that in FeNC-ZIF-800)

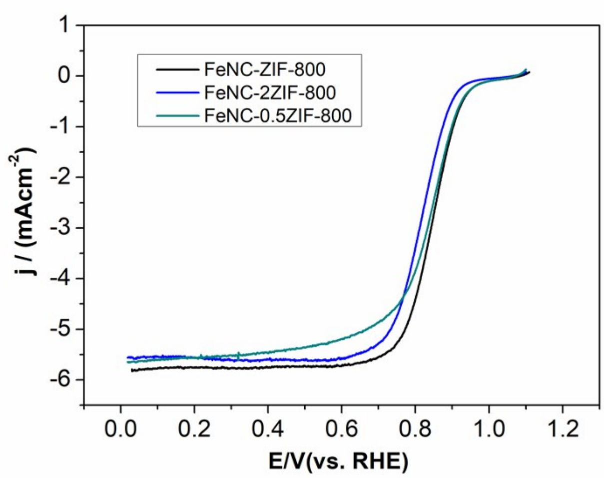

Figure S16. ORR polarization curves of samples obtained at 800 ^{o}C in O_2-saturated 0.1 M KOH solution.

Table S1. Comparison of ORR catalytic performances in 0.1 M KOH solution between FeNC-ZIF-800 and other non-precious metal-based catalysts reported previously.

Catalyst	Onset potential (V vs. RHE)	Half-wave potential (V vs. RHE)	Ref.
FeNC-ZIF-800	1.0	0.86	This work
Fe-N/C-800	0.923	0.809	1
Fe_3C/NG-800	1.03	0.86	2
Fe-N/C-800	0.98	/	3
Co_3O_4@CMWCNT	0.89	0.81	4
Co-N-HPC	0.91	0.83	5
GNPCSs-800	0.957	0.82	6
Fe/N/CNT	1.04	0.86	7
Fe−N−GC-900	1.01	0.86	8
Fe_3C/C-800	1.05	0.83	9
GFe-800a	-0.087 (vs. Ag/AgCl)	-0.29 (vs. Ag/AgCl)	10
Fe-N/G	0.87	0.78	11
ZIF-67-900	0.95	0.85	12
FePhen@MOF-$ArNH_3$	1.03	0.86	13
N–Fe–CNT/CNP	/	0.87	14
NCNT/CoO-NiO-NiCo	1.0	0.83	15
N-CNT/N-G	/	0.85	16
Fe−N_4/C	-	0.87	17
Fe-N-CNS	0.98	0.85	18
Fe_3C/C-800	1.03	0.86	19

Table S2. Comparison of ORR catalytic performances in acid solution between FeNC-ZIF-800 and other non-precious metal-based catalysts reported previously.

Catalyst	Onset potential (V vs. RHE)	Half-wave potential (V vs. RHE)	Electrolyte	Ref.
FeNC-ZIF-800	0.85	0.74	H_2SO_4	This work
pPMF-800	0.89	0.71	$HClO_4$	20
CPANIFe-NaCl	0.91	0.74	$HClO_4$	21
PpPD-Fe-C	0.83	0.72	H_2SO_4	22
Fe-N-GC-900	/	0.74	$HClO_4$	8
Fe-AAPyr	0.9	0.75	H_2SO_4	23
H–Fe@N–C/RGO	0.89	0.67	$HClO_4$	24
Fe-N/C-800	0.80	0.68	$HClO_4$	1
Fe–g-C_3N_4@C	/	0.75	$HClO_4$	25
Fe-N-HCMS	0.81	0.60	H_2SO_4	26
FeNC-70	0.8	/	$HClO_4$	27
PANI-Fe	0.85	/	H_2SO_4	28
ZIF-67-900	0.85	0.71	H_2SO_4	12
Fe_3C/NG-800	0.92	0.77	$HClO_4$	2
Fe_3C/C-700	0.90	0.73	$HClO_4$	9
Fe-N-CNFs	0.55 (vs. Ag/AgCl)	0.37 (vs. Ag/AgCl)	H_2SO_4	29

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