Supporting Information

Enriched graphitic N-doped carbon-supported Fe_3O_4 nanoparticles as efficient electrocatalysts for oxygen reduction reaction

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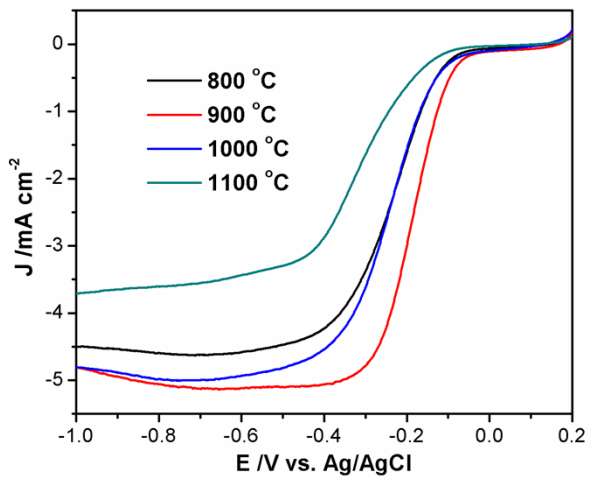


Figure S1. Linear sweep voltammograms at 1600 rpm for Fe_3O_4/N-C samples carbonized under different temperatures in O_2-saturated 0.1 M KOH.

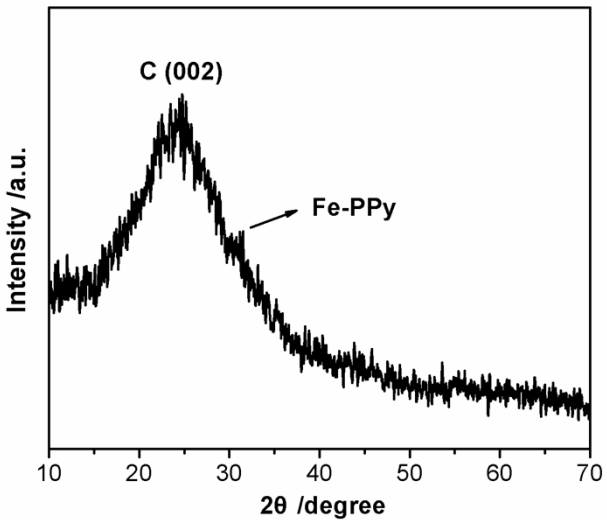


Figure S2. XRD patterns of Fe-PPy.

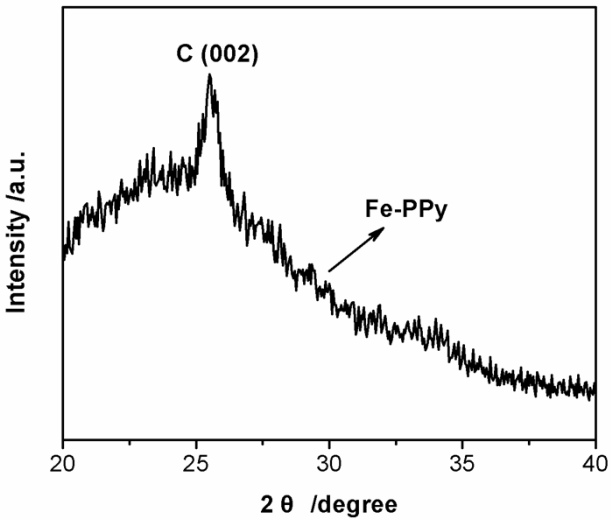


Figure S3. Step scanning XRD patterns of Fe-PPy at a very slow scan rate of 1 °C/min from 20 to 40 degree.

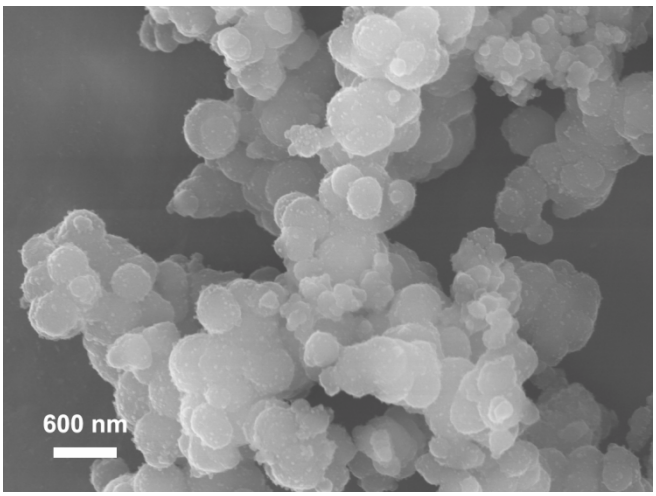


Figure S4. SEM image of Fe-PPy.

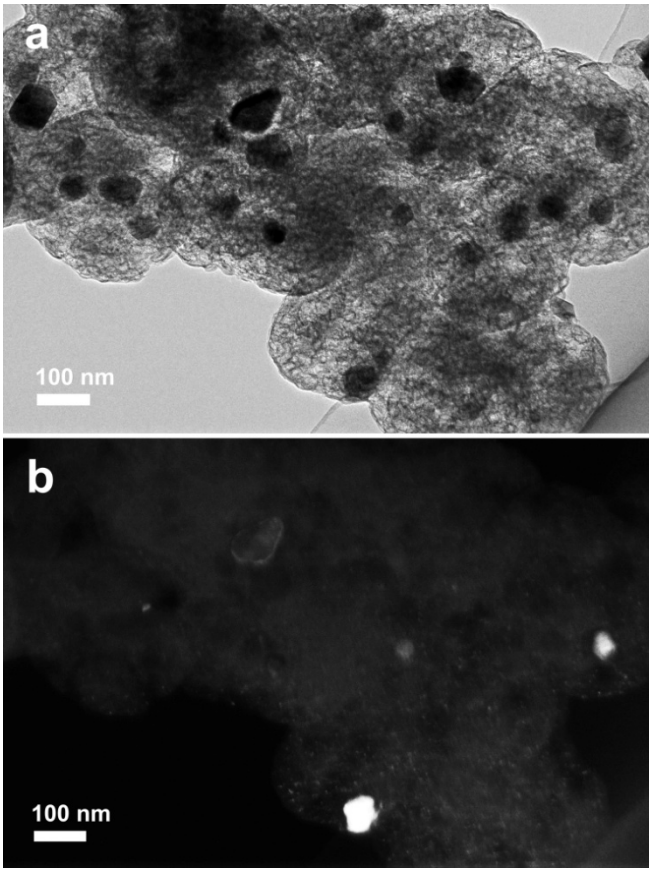


Figure S5. (a) TEM and (b) the corresponding dark-field TEM images of Fe_3O_4/N-C-900.

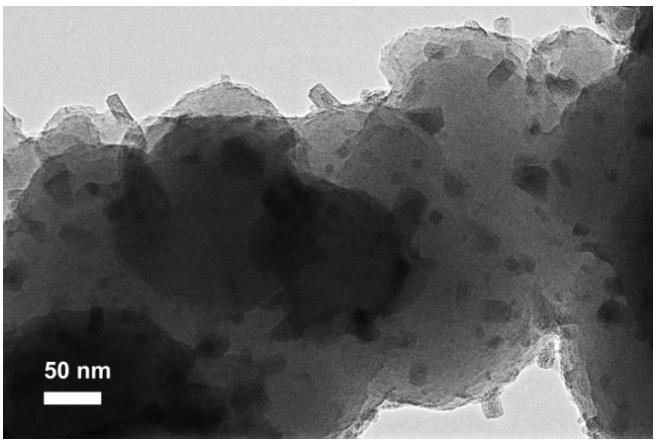


Figure S6. TEM image of Fe-PPy.

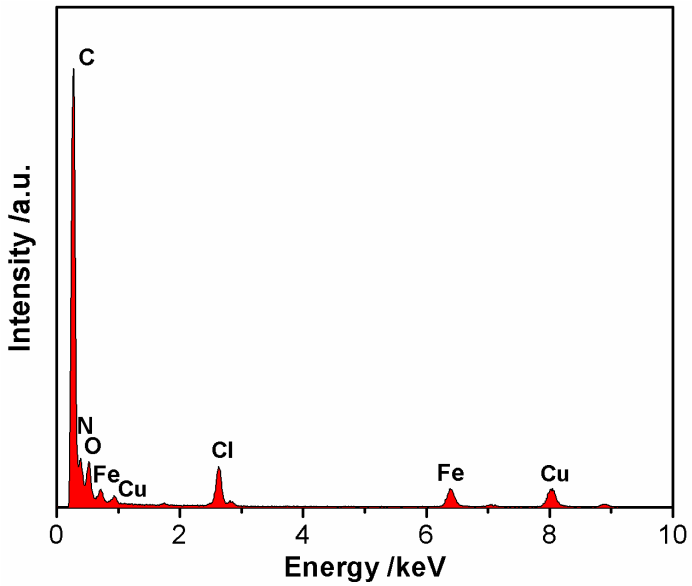
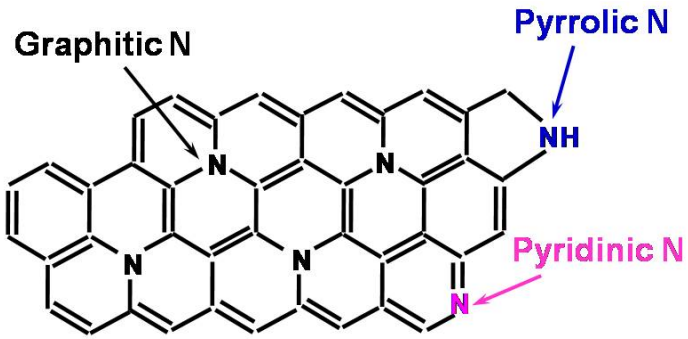


Figure S7. EDX spectroscopy of Fe-PPy.



Scheme S1. Schematic structure of the bonding configurations of N atoms in N-doped carbon.

Table S1. Elemental composition by XPS (at %).

Sample	C 1s	N 1s	O 1s	Fe 2p
Fe_3O_4/N-C-900	89.3	2.4	7.5	0.8

Table S2. C 1s composition from XPS (at %).

Peak	Component	BE (eV)	Atomic %
C=C	C 1s	284.6	68.6
C=N & C-O	C 1s	285.6	14.3
C-N & C=O	C 1s	287	10.1
O-C=O	C 1s	290	7.0

Table S3. N 1s composition from XPS (at %).

Peak	Component	BE (eV)	Atomic %
Pyridinic N	N 1s	398.3	14.2
Pyrrolic N	N 1s	400.1	3.5
Graphitic N	N 1s	401.2	78.0
Oxidized N	N 1s	403.5	4.3

Table S4. Fe 2p composition from XPS (at %).

Peak	Component	BE (eV)	Atomic %
Fe^{2+}, Fe^{3+}, 2p 1/2	Fe 2p	725.2	19
Fe^{2+}, 2p 1/2	Fe 2p	723	10.1
Satellite Peak	Fe 2p	718.7	8.7
Fe^{2+}, 2p 3/2	Fe 2p	713.6	19.9
Fe^{3+}, 2p 3/2	Fe 2p	710.9	42.3

Table S5. O 1s composition from XPS (at %).

Peak	Component	BE (eV)	Atomic %
Hydroxyls	O 1s	533.1	39.2
Carboxyls	O 1s	532.0	33.2
O-physically absorbed/carbonates	O 1s	530.8	12.1
O related to Fe_3O_4	O 1s	530.2	15.5

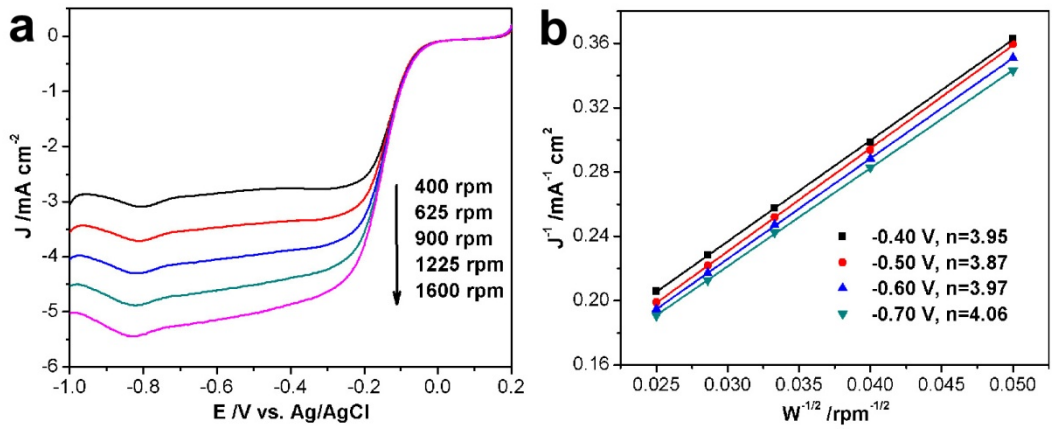


Figure S8. (a) Linear sweep voltammograms and (b) K-L plots at different potential for Pt/C catalyst in O_2-saturated 0.1 M KOH solution.

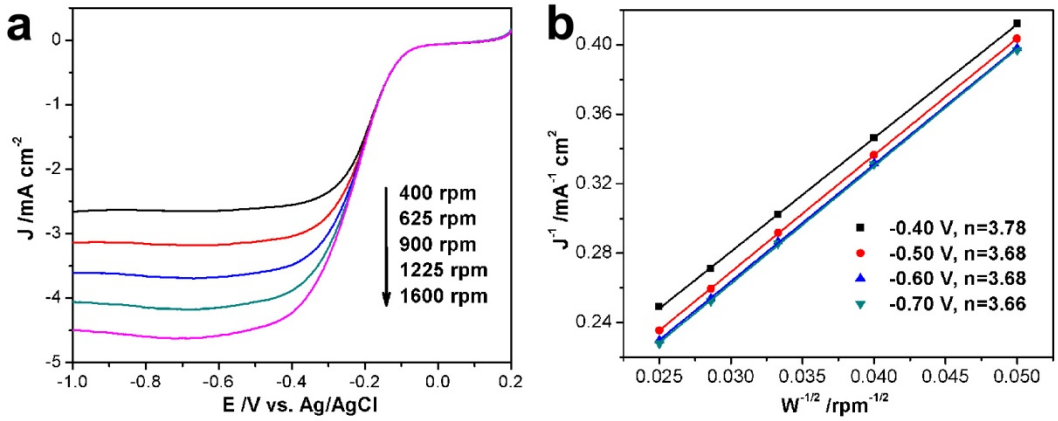


Figure S9. (a) Linear sweep voltammograms and (b) K-L plots at different potential for Fe_3O_4/N-C-800 in O_2-saturated 0.1 M KOH solution.

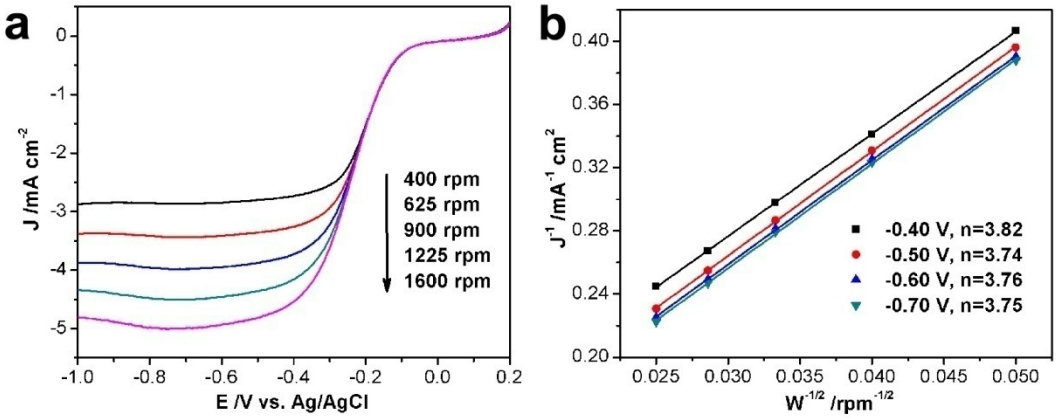


Figure S10. (a) Linear sweep voltammograms and (b) K-L plots at different potential for Fe_3O_4/N-C-1000 in O_2-saturated 0.1 M KOH solution.

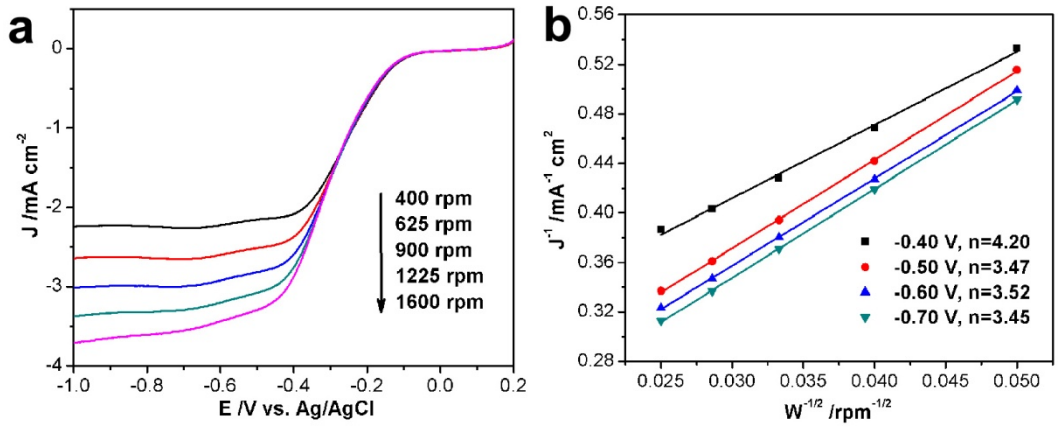


Figure S11. (a) Linear sweep voltammograms and (b) K-L plots at different potential for Fe_3O_4/N-C-1100 in O_2-saturated 0.1 M KOH solution.

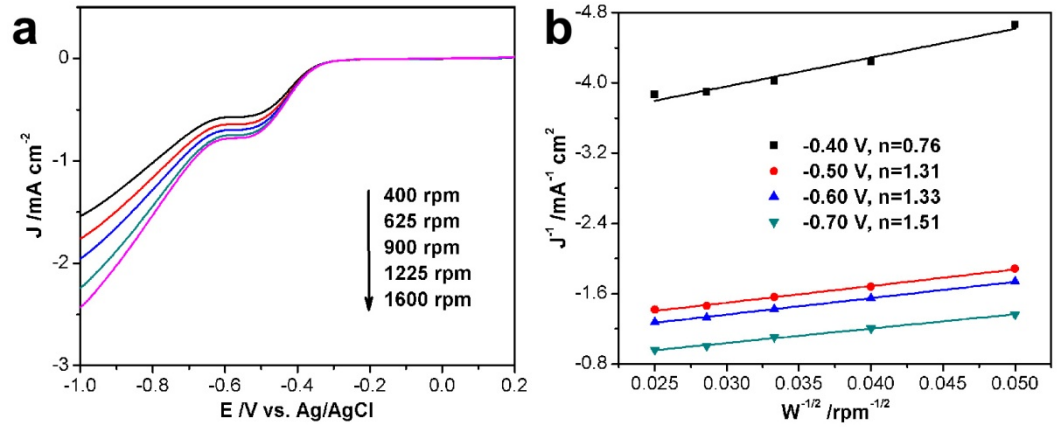


Figure S12. (a) Linear sweep voltammograms and (b) K-L plots at different potential for pristine Fe_3O_4 nanoparticles in O_2-saturated 0.1 M KOH solution.

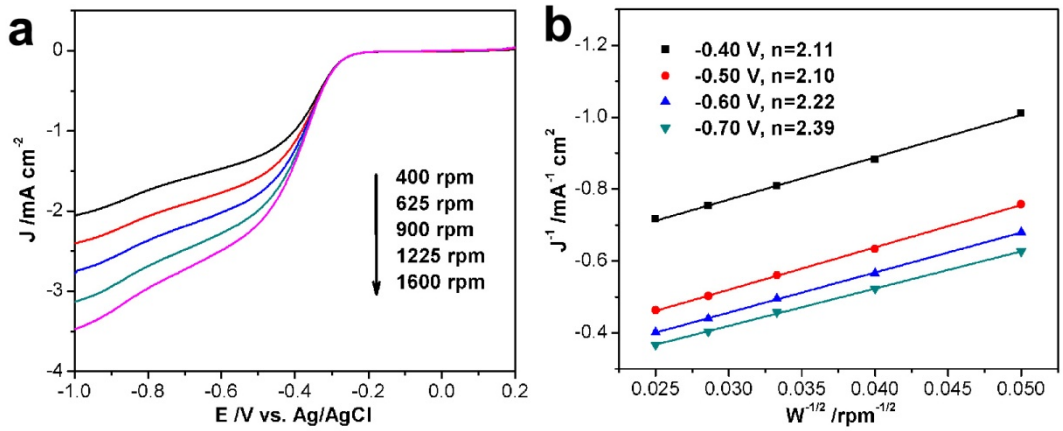


Figure S13. (a) Linear sweep voltammograms and (b) K-L plots at different potential for N-doped carbon in O_2-saturated 0.1 M KOH solution.

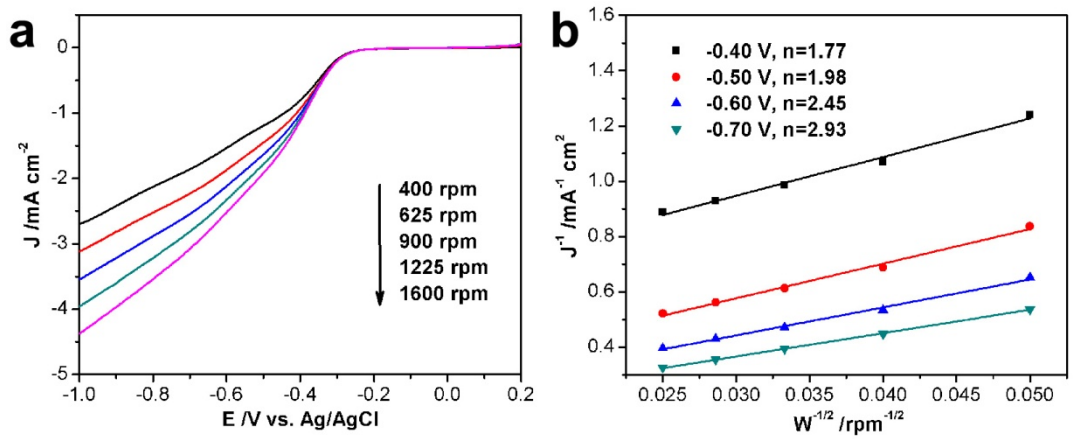


Figure S14. (a) Linear sweep voltammograms and (b) K-L plots at different potential for physical mixture of N-doped carbon and Fe_3O_4 nanoparticles in O_2-saturated 0.1 M KOH solution.