Supplementary information

A Bi-functional Catalyst for Oxygen Reduction and Oxygen Evolution Reactions from Used Baby Diapers: α-Fe_2O_3 Wrapped in P and S Dual Doped Graphitic Carbon

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The supporting information contains the following part:

Figure S1 A soiled baby diaper.

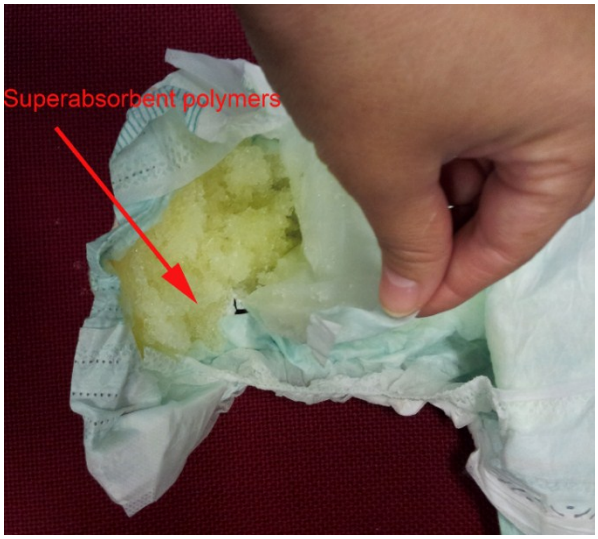
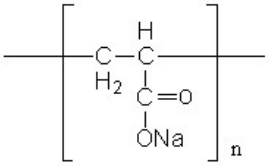


Figure S2 The superabsorbent polymers inside the absorbed layer of the soiled baby diaper.



Sodium polyacrylate

Figure S3 The chemical formula of superabsorbent polymers inside baby diapers.

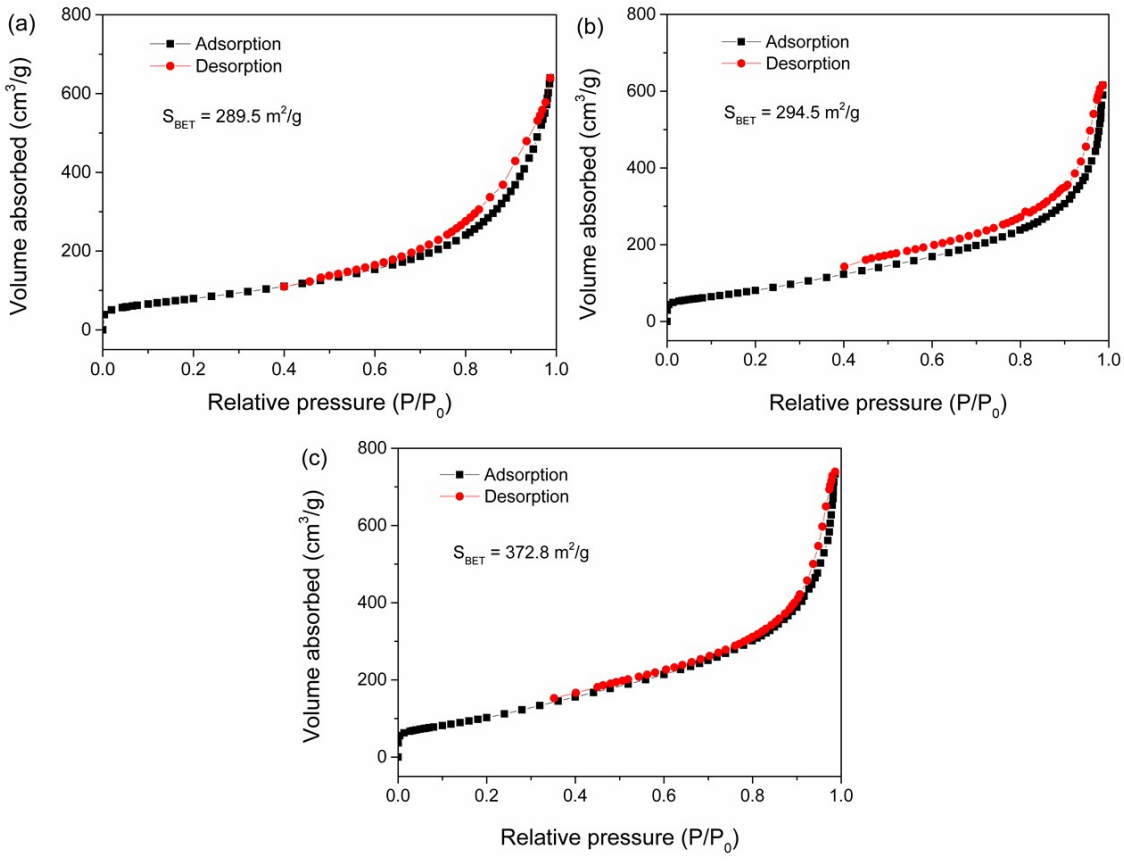


Figure S4 N_2 adsorption-desorption isotherm curve for (a) Fe_2O_3/P-S-GC; (b) Fe_2O_3/GC; and (c) P-S-GC.

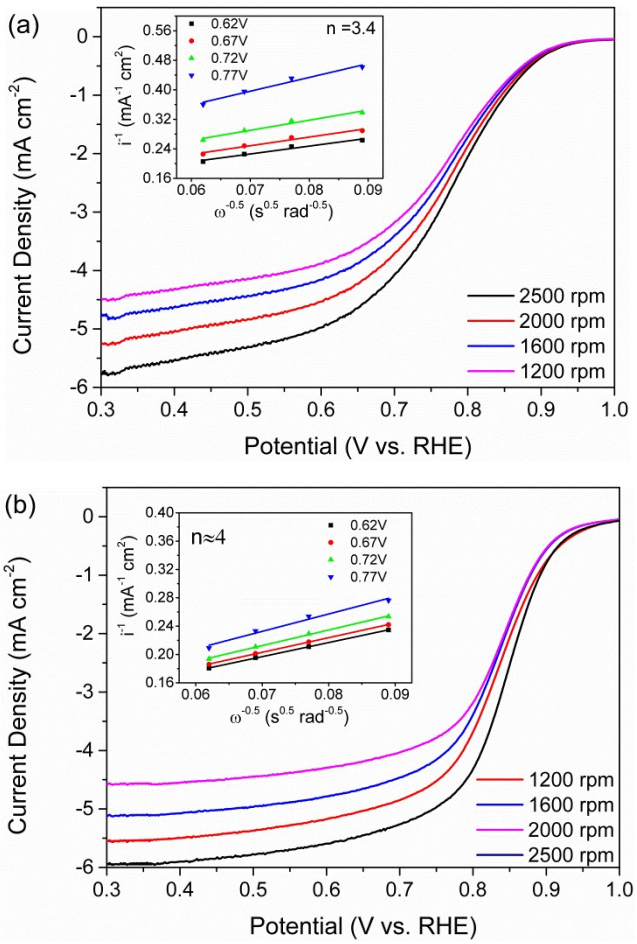


Figure S5 RDE test at different rotating rates for (a) P-S-GC and (b) commercial Pt/C. The sweeping rate was set at 5 mV s^{-1} and the electrolyte was 0.1M KOH; The Koutecky-Levich plots at different potentials are shown in the corresponding insets.

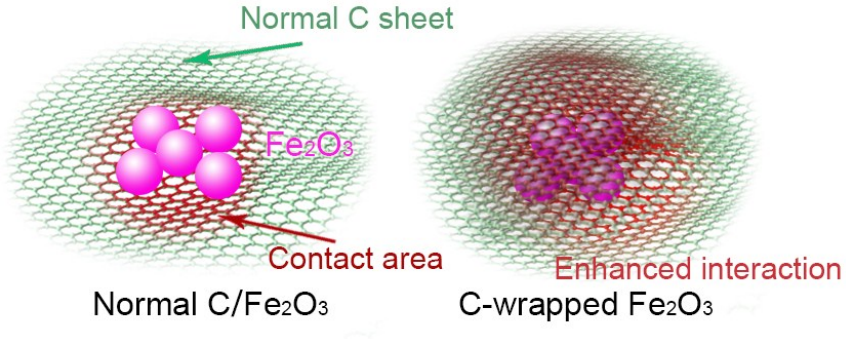


Figure S6 The structural comparison between normal C/Fe_2O_3 and carbon-wrapped Fe_2O_3.

Table S1. Assessment of catalytic bi-functionality for some reported catalysts

Sample	E [V] ORR at -3mA cm^{-2}	E [V] OER at 10 mA cm^{-2}	ΔE value [V]
Pt/C[1]	0.83 vs. RHE	1.85 vs. RHE	1.02
Ir/C[2]	0.69 vs. RHE	1.61 vs. RHE	0.92
Ru/C[2]	0.61 vs. RHE	1.62 vs. RHE	1.01
Mn oxide[2]	0.73 vs. RHE	1.77 vs. RHE	1.0
$NiCo_2S_4$@N/S-rGO[3]	0.76 vs. RHE	1.70 vs. RHE	1.04
$Co_3O_4/2.7Co_2MnO_4$[4]	0.68 vs. RHE	1.77 vs. RHE	0.94
LN-800[5]	-0.32vs. Ag/AgCl	0.70 vs. Ag/AgCl	1.09
H-Pt/$CaMO_3$[6]	n.a.	n.a.	1.01
Fe_2O_3/P-S-GC	0.75 vs. RHE	1.61 vs. RHE	0.86

Table S2. The atomic contents of various samples for Fe_2O_3/P-S-GC, determined by XPS

	Content					
Sample	C at. %	Fe at.%	O at. %	P at.%	S at.%	others at.%
1#	31.22	22.08	36.10	0.77	2.57	7.26
2#	35.59	20.78	35.23	0.47	1.59	6.34
3#	36.20	20.24	30.52	1.26	3.06	8.72
4#	39.68	19.73	28.69	1.37	4.15	6.38
5#	30.81	21.92	36.17	0.62	2.41	8.07
Average	34.70	20.95	33.34	0.90	2.76	7.35

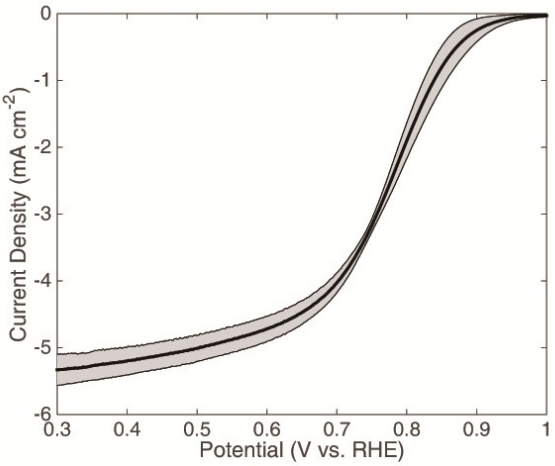


Figure S7 The comparison of ORR performance for different samples of Fe_2O_3/P-S-GC, the atomic content of which are shown in **Table S2**. The black line represents the average activity of the five samples, and the grey domain is the deviation region.

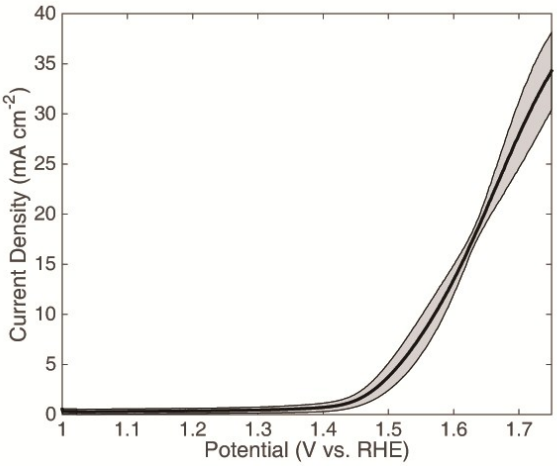


Figure S8 The comparison of OER performance for different samples of Fe_2O_3/P-S-GC, the atomic content of which are shown in **Table S2**. The black line represents the average activity of the five samples, and the grey domain is the deviation region.

References

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