Electronic supplementary information

Template-free preparation of anthracite-based nitrogen-doped porous carbons for high-performance supercapacitors and efficient electrocatalysts for oxygen reduction reaction

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Table S1 Surface and pore properties of the ANPC-1 and ANPC-2 materials. [a]

Material	S_{BET} ($m^2\ g^{-1}$)	S_{micro} ($m^2\ g^{-1}$)	V_{pore} ($cm^3\ g^{-1}$)	V_{micro} ($cm^3\ g^{-1}$)
ANPC-1-800-0	2768.28	2512.76	1.363	1.128
ANPC-1-800-0.25	2271.05	1930.03	1.065	0.866
ANPC-1-800-1	1251.03	1142.19	0.568	0.456
ANPC-1-700-0.25	1990.55	1885.32	0.867	0.765
ANPC-1-900-0.25	2740.14	1404.37	1.666	0.605
ANPC-2-900-4	1654.08	1434.94	0.823	0.631
ANPC-2-900-6	2729.92	2344.92	1.318	1.005
ANPC-2-900-8	1911.54	1665.73	0.953	0.736
ANPC-2-800-6	2204.50	2004.56	1.086	0.861
ANPC-2-1000-6	2541.56	2054.74	1.328	0.896

[a] S_{BET}: BET specific surface area; S_{micro}: micropore surface area based on the t-plot method; V_{pore}: pore volume; V_{micro}: micropore volume based on the t-plot method.

Table S2 A comparison of BET specific surface area (S_{BET}) and specific capacitance (C_s) values of porous carbonaceous materials made from different carbon sources. [a]

Carbon source	S_{BET} ($m^2\ g^{-1}$)	C_s ($F\ g^{-1}$)	Current density ($A\ g^{-1}$)	Ref
Coal	902	230	1	S1
Coal	621.15	227	1	S2
Coal	1872	211	1	S3
Agarose	2666	214	0.2	S4
Wheat flour	995	178.5	0.5	S5
Corn straws	2790.4	327	0.2	S6
Anthracite	2271.05	346	0.5	This work

[a] All the C_s values in the table were obtained from the three-electrode system using 6 M KOH as the electrolyte.

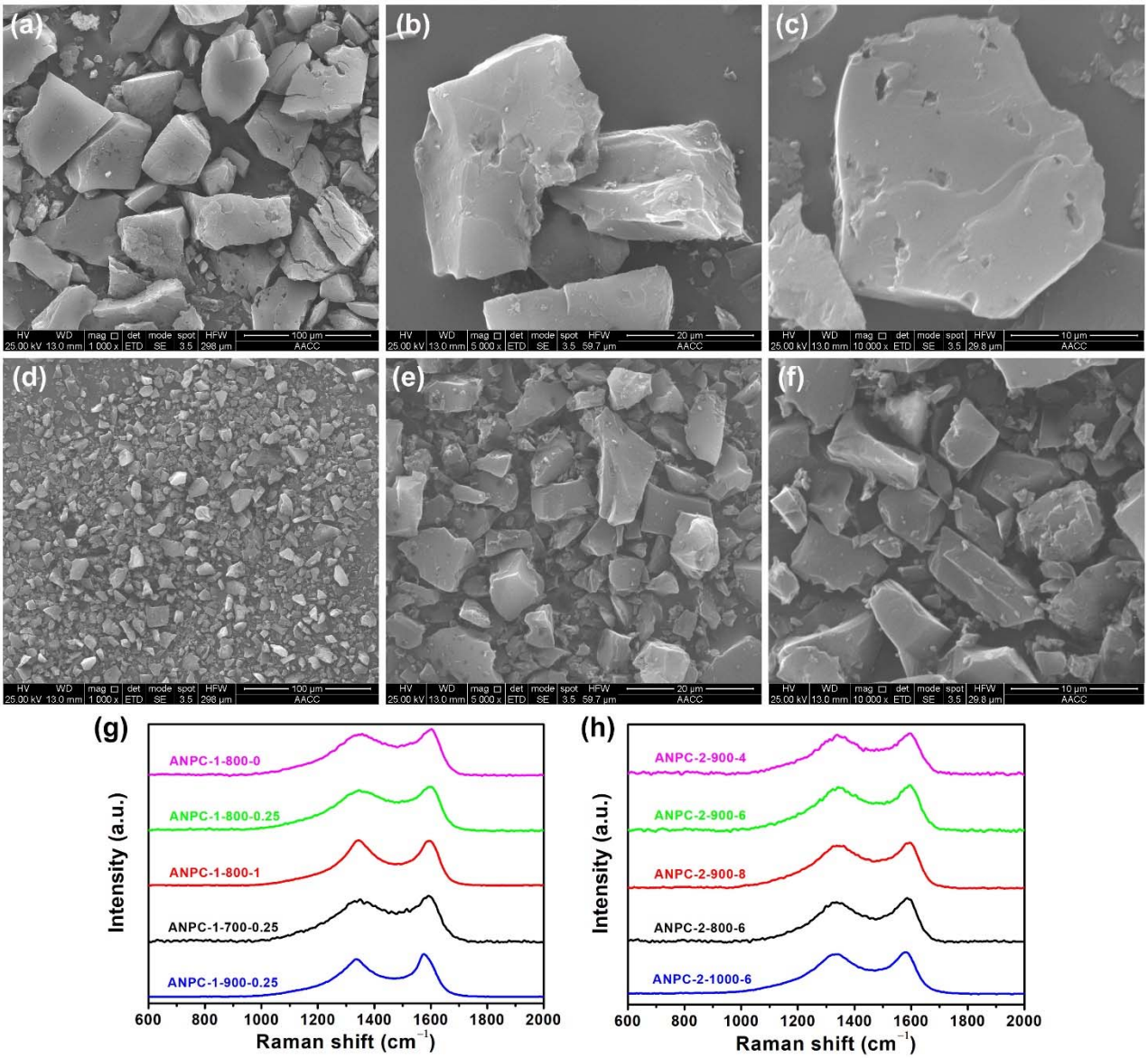

Fig. S1 SEM images of (a-c) ANPC-1-800-0.25 and (d-f) ANPC-2-900-6 with different magnifications (1k: a, d; 5k: b, e; 10k: c, f). Raman spectra of (g) the ANPC-1 materials and (h) the ANPC-2 materials.

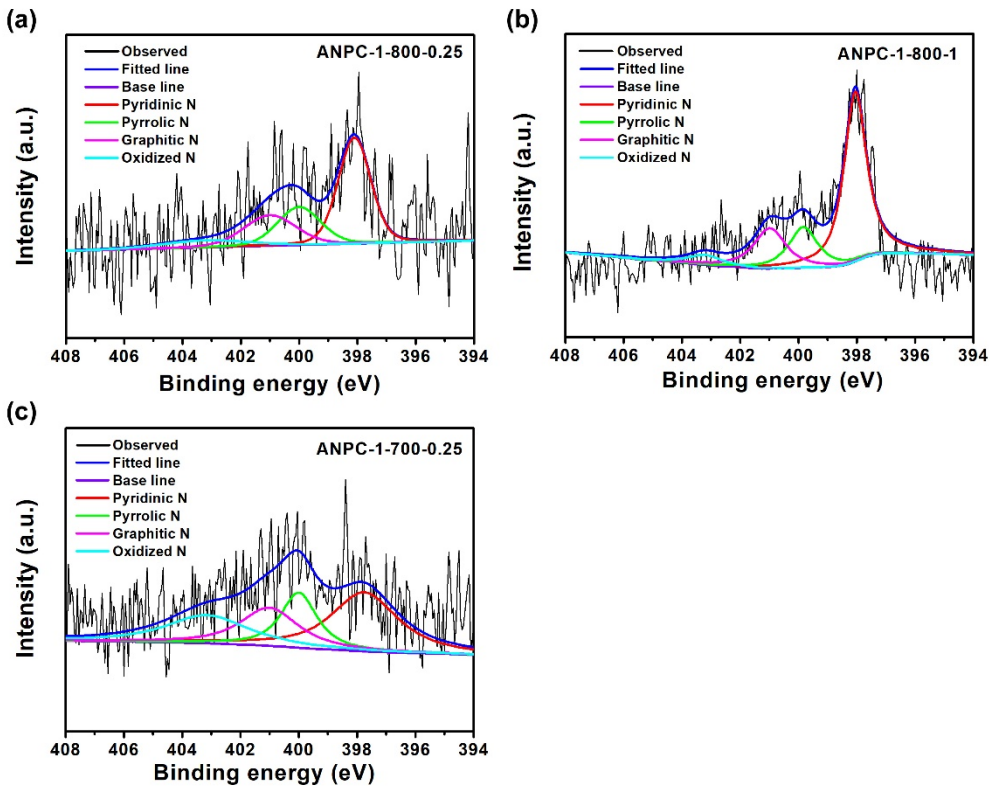

Fig. S2 High-resolution XPS N 1s spectra of (a) ANPC-1-800-0.25, (b) ANPC-1-800-1 and (c) ANPC-1-700-0.25.

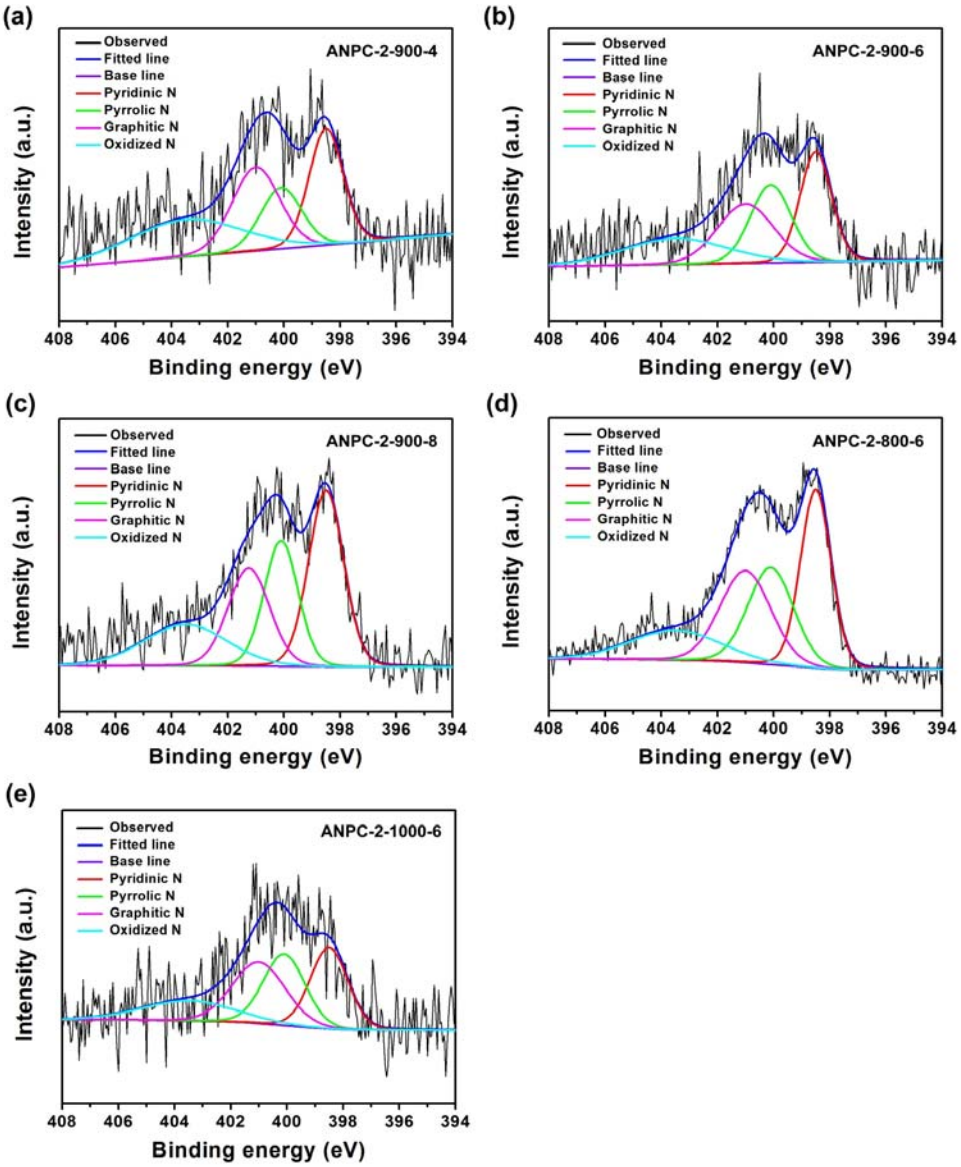

Fig. S3 High-resolution XPS N 1s spectra of (a) ANPC-2-900-4, (b) ANPC-2-900-6, (c) ANPC-2-900-8, (d) ANPC-2-800-6 and (e) ANPC-2-1000-6.

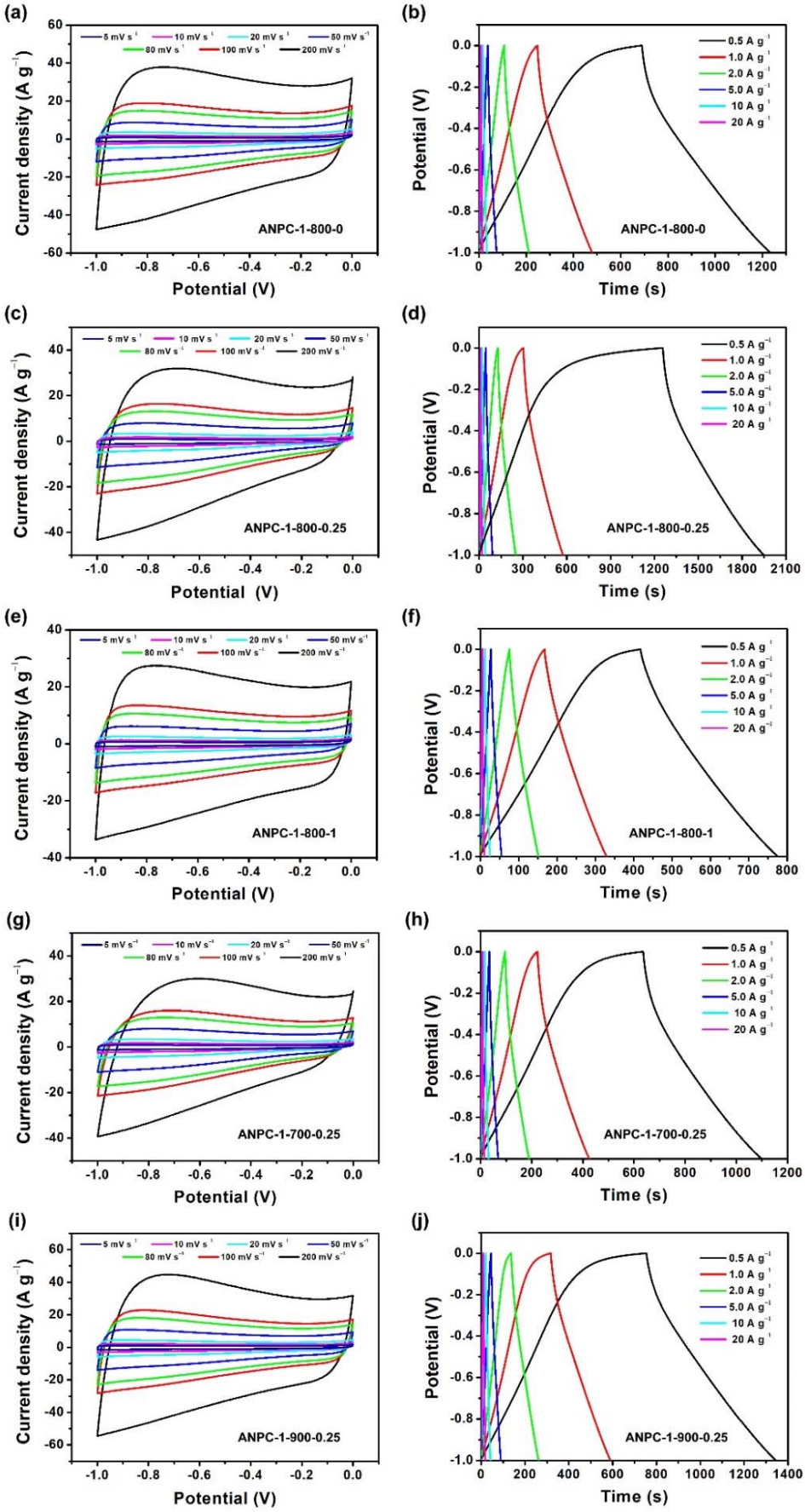

Fig. S4 CV curves of (a) ANPC-1-800-0, (c) ANPC-1-800-0.25, (e) ANPC-1-800-1, (g) ANPC-1-700-0.25 and (i) ANPC-1-900-0.25 at different scan rates; GCD curves of (b) ANPC-1-800-0, (d) ANPC-1-800-0.25, (f) ANPC-1-800-1, (h) ANPC-1-700-0.25 and (j) ANPC-1-900-0.25 at different charge/discharge current densities. All the measurements were taken in 6 M KOH.

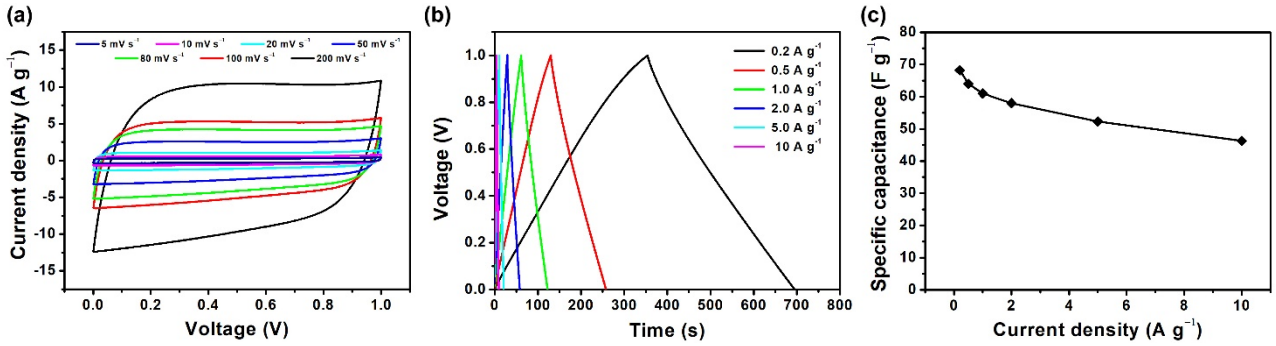

Fig. S5 (a) CV curves of the ANPC-1-800-0.25//ANPC-1-800-0.25 supercapacitor at different scan rates; (b) GCD curves of the ANPC-1-800-0.25//ANPC-1-800-0.25 supercapacitor at different charge/discharge current densities; (c) specific capacitances of the ANPC-1-800-0.25//ANPC-1-800-0.25 supercapacitor at different current densities. All the measurements were taken in 6 M KOH.

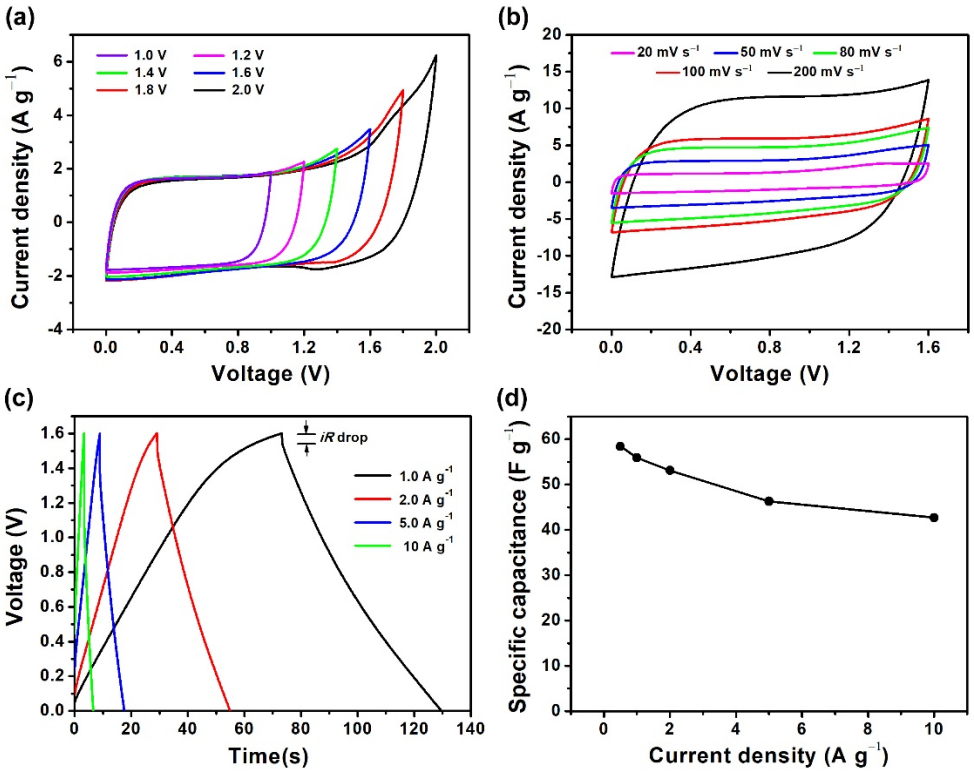

Fig. S6 (a) CV curves of the ANPC-1-800-0.25//ANPC-1-800-0.25 supercapacitor with different voltage windows at a scan rate of 50 mV s^{-1}; (b) CV curves of the ANPC-1-800-0.25//ANPC-1-800-0.25 supercapacitor at different scan rates; (c) GCD curves of the ANPC-1-800-0.25//ANPC-1-800-0.25 supercapacitor at different charge/ discharge current densities; (d) specific capacitances of the ANPC-1-800-0.25//ANPC-1-800-0.25 supercapacitor at different current densities. All the measurements were taken in 1 M Na_2SO_4.

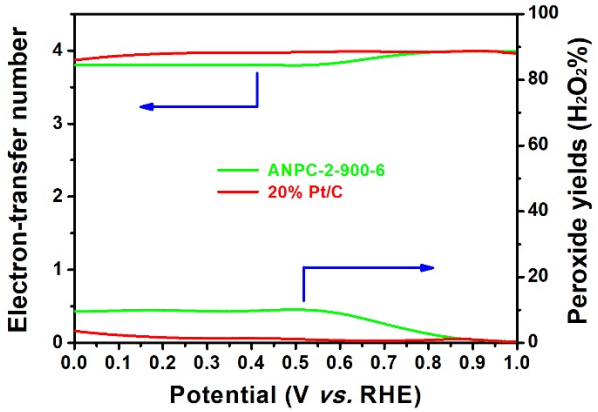

Fig. S7 RRDE measurements in 0.1 M KOH at 1600 rpm: the electron-transfer numbers and peroxide yield of ANPC-2-900-6 and 20% Pt/C across the potentials ranging from 0 to 1.0 V *vs.* RHE.

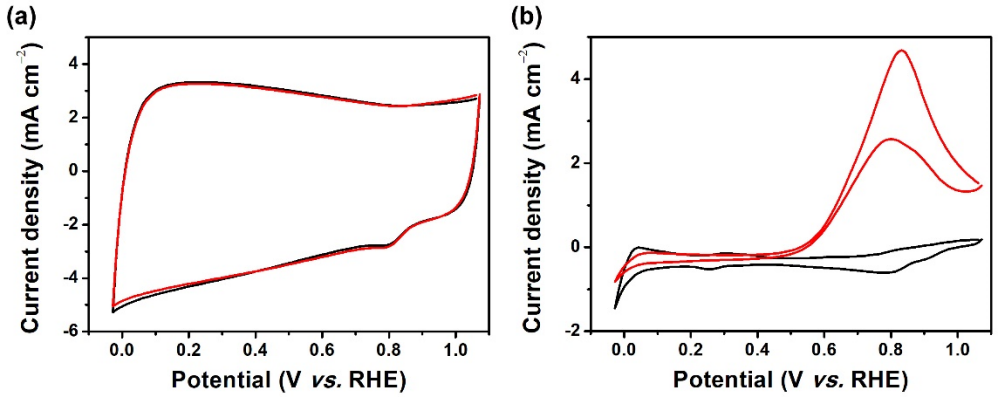

Fig. S8 CV curves of (a) ANPC-2-900-6 and (b) 20% Pt/C at the scan rate of 50 mV s^{-1} in O_2 saturated 0.1 M KOH solution at 25 ℃ before (black) and after (red) the addition of 1 M methanol.

References

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