Supplementary Information

Regulating defects and interfacial compatibility of porous carbon derived from oxygen contained composites to enhance oxygen reducing in aqueous electrolyte

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Supporting Experimental Details

Characterization of the materials: A field-emission scanning electron microscopy (FESEM, FEI Quanta-200) and a scanning transmission electron microscopy (STEM, MIRA3 TESCAN) were taken to run morphology tests. Expressions for chemical states of the carbon, nitrogen and sulfur in the material were performed by X-ray photoelectron spectroscopy (XPS, ESCA LAB 250Xi).

The Koutechy-Levich (K-L) equation: The average electron transfer number of made samples could be calculated from the slope of the K-L equation.

The K-L equation is given as follows:

$$\frac{1}{j} = \frac{1}{j_k} + \frac{1}{B\omega^{0.5}}$$

where j_k is the kinetic current and ω is the electrode rotating rate. B could be determined from the slope of the K-L plots based on the Levich equation as follows:

$$B = 0.2nF(DO_2)^{2/3}\nu^{-1/6}C_{O_2}$$

where n represents the number of electrons transferred per oxygen molecule, F is the Faraday constant (F = 96485 C mol^{-1}), D_{O2} is the diffusion coefficient of O_2 in0.1 M KOH (1.9×10^{-5} cm^2 s^{-1}), ν is the kinetic viscosity (0.01 cm^2 s^{-1}), and C_{O2} is the bulk concentration of O_2 (1.2×10^{-6} mol cm^{-3}). The constant 0.2 is adopted when the rotation speed is expressed in rpm.

Supporting Figures

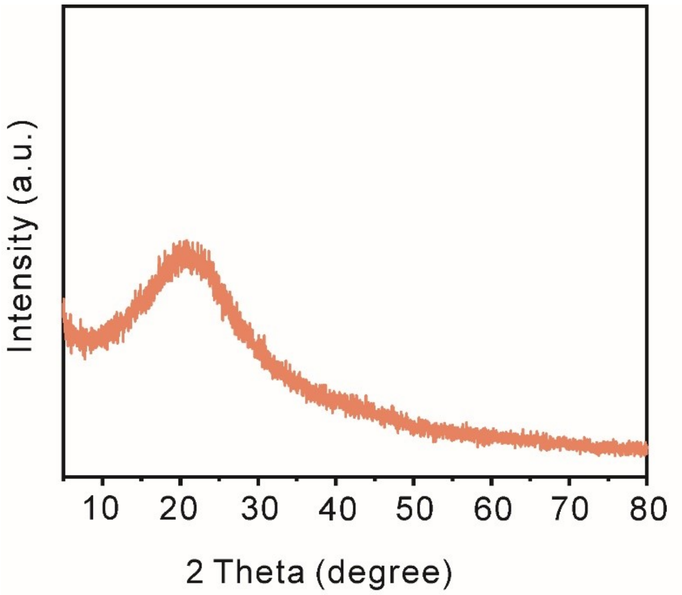

Fig. S1 XRD pattern of brown precursors.

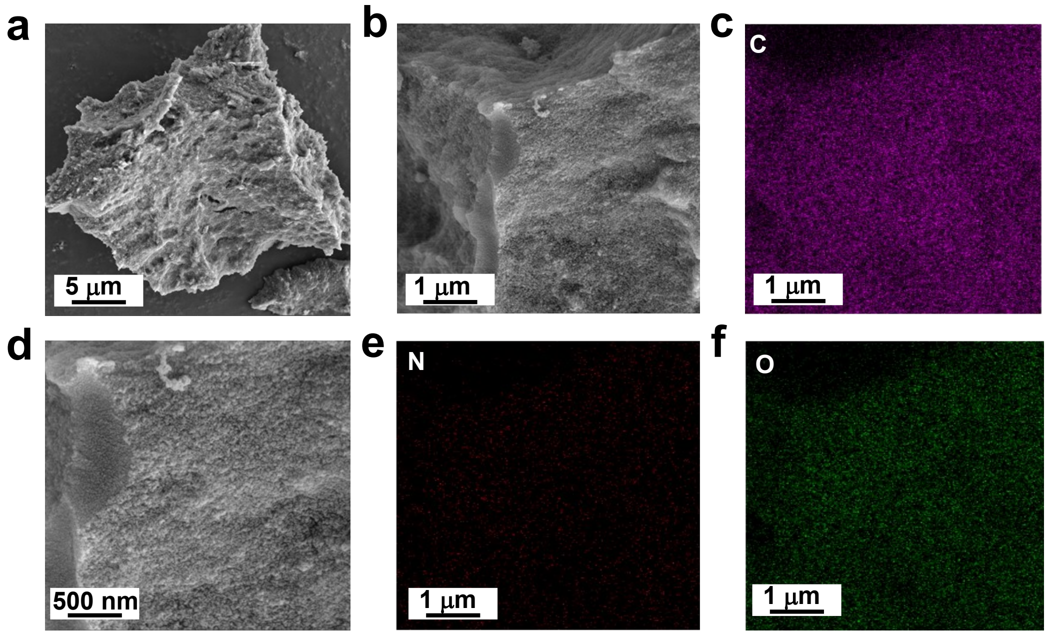

Fig. S2 a, d) SEM and b, c, e and f) elemental mapping images of precursor.

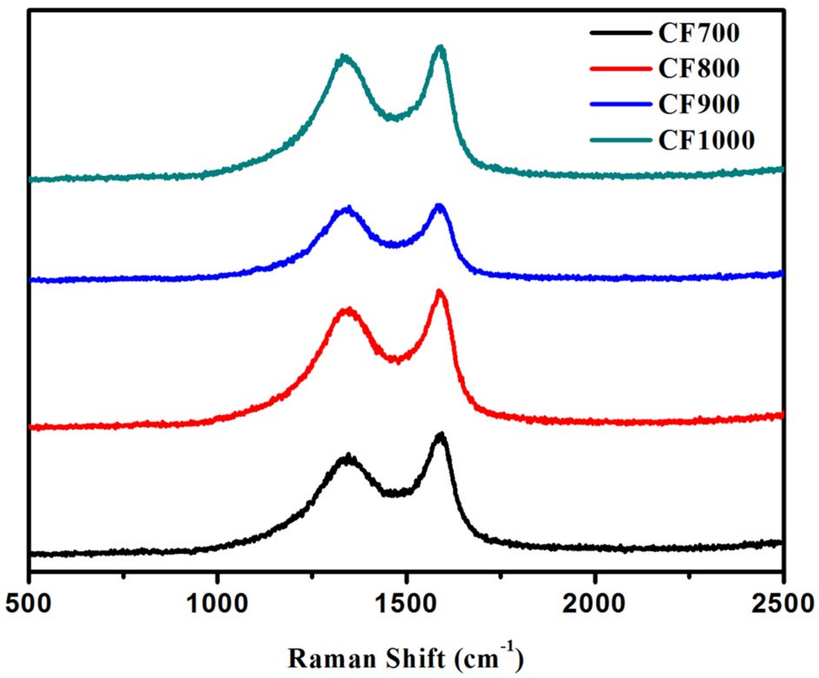

Fig. S3 Raman spectra of CF700, CF800, CF900 and CF1000.

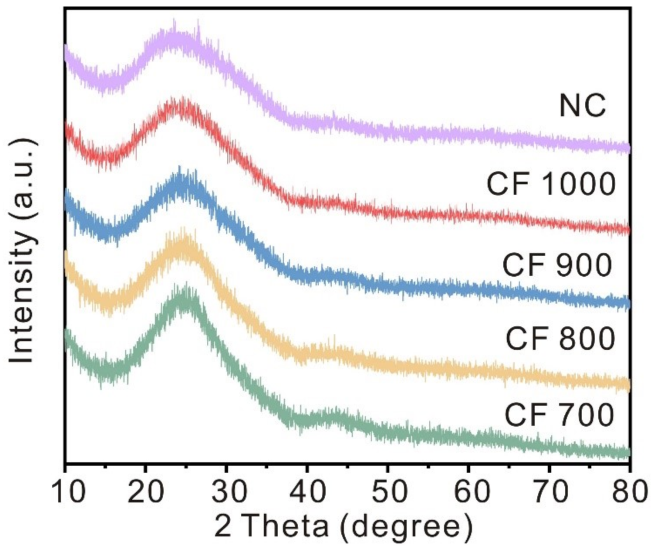

Fig. S4 XRD pattern of CF700, CF800, CF900, CF1000 and NC.

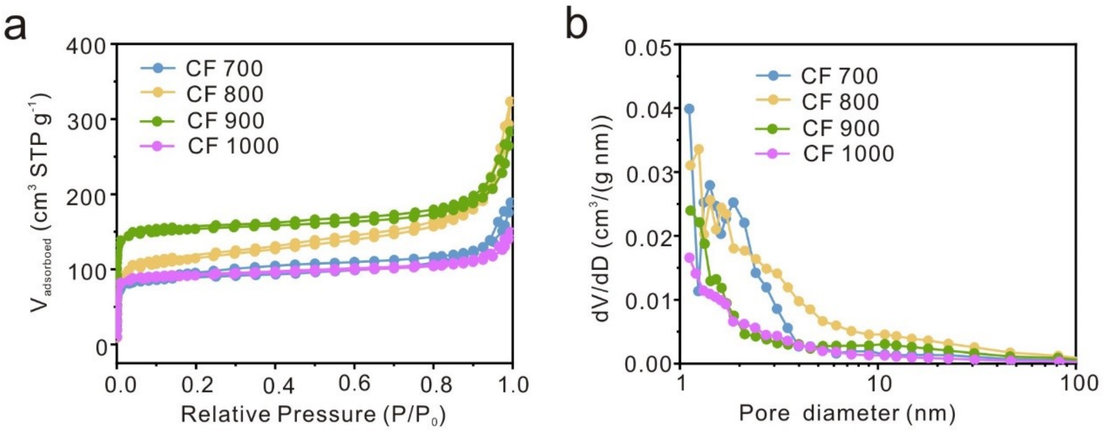

Fig.S5 a) N_2 adsorption-desorption isotherms with the corresponding; b) PSD curves of CF700, CF800, CF900 and CF1000.

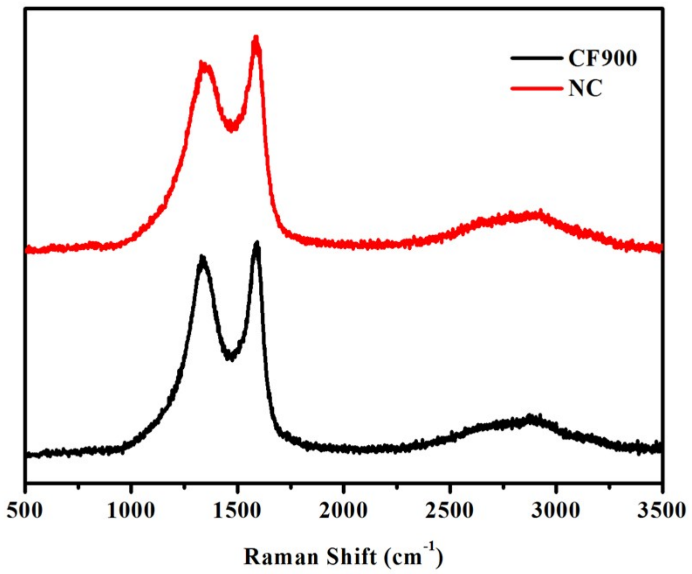

Fig. S6 Raman spectra of CF900 and NC.

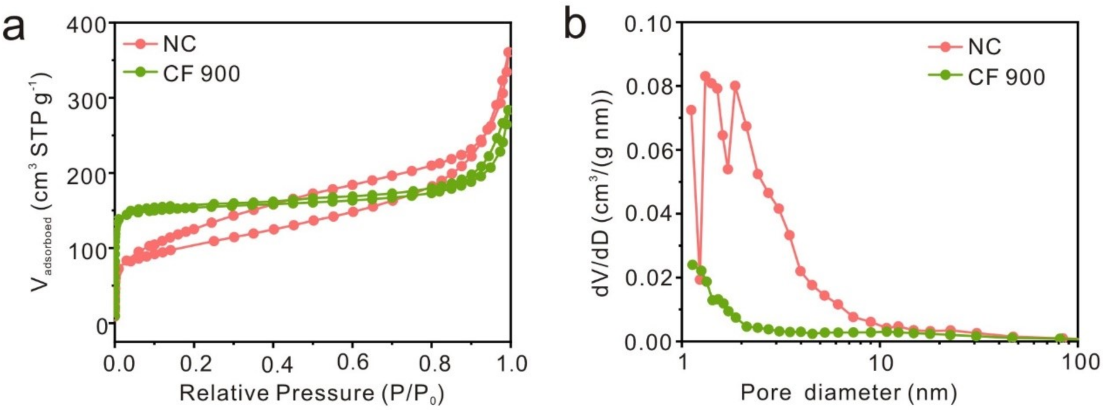

Fig. S7 a) N_2 adsorption-desorption isotherms with the corresponding; b) PSD curves of CF900 and NC.

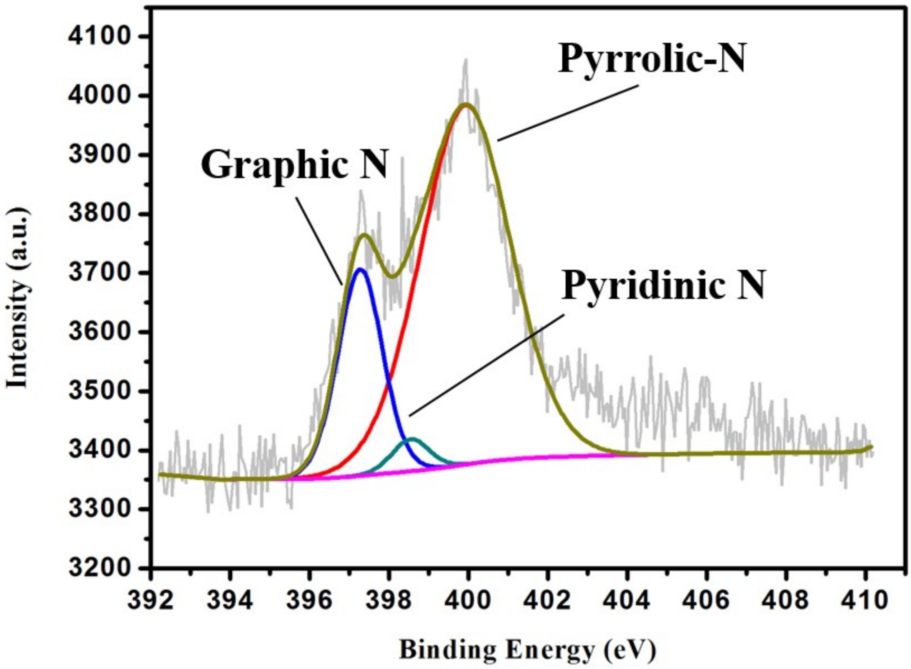

Fig. S8 XPS survey spectrum of NC with the N 1s spectra.

Table S1. Textural properties of carbon materials.

Sample	BET surface area[a] / m^2 g^{-1}	Total pore volume[b] / cm^3 g^{-1}	Micropore volume[c] / cm^3 g^{-1}
CF700	353.4	0.292	0.129
CF800	422.8	0.500	0.128
CF900	612.8	0.439	0.217
CF1000	362.1	0.231	0.127
NC	453.6	0.558	0.091

[a] Determined by multipoint BET method within the relative pressure (P/P_0) range of 0.01 to 0.2. [b] Obtained at the relative pressure (P/P_0) range of 0.98. [c] Determined by t-plot method within the relative pressure (P/P_0) range of 0.2 to 0.5.

Table S2. Comparison of the AAB performances of different carbon-based catalyst.

Catalysts	Cell Type/Electrolyte	Discharge Voltage /V	Current Densities /mA cm^{-2}	Ref
NC	Flow/ Liquid 6 M KOH + 0.01 M Na_2SnO_3 + 0.0005 M $In(OH)_3$+ 0.0075 M ZnO	1.36	50	This work
Commercial	Flow/Liquid	0.9	100	1

manganese	4 M NaOH + 0.05M Na_2SnO_3			
20% Pt/C	Flow/ Liquid 6 M KOH + 0.01 M Na_2SnO_3 + 0.0005 M $In(OH)_3$+ 0.0075 M ZnO	1.32	50	This work
SMNP	Flow/Liquid 6 M KOH	0.9	100	2
Co SANC-850	Static/Liquid 6 M KOH + 0.01 M Na_2SnO_3 + 0.0005 M $In(OH)_3$+ 0.0075 M ZnO	1.3	200	3
Cu-Fe-N-C	Flow/ Liquid 6 M KOH + 0.01 M Na_2SnO_3 + 0.0005 M $In(OH)_3$+ 0.0075 M ZnO	1.5	40	4

Supporting References

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