Electronic Supplementary Information

A Green One-arrow-two-hawks Strategy for Nitrogen-Doped Carbon Dots as Fluorescent Ink and Oxygen Reduction Electrocatalyst

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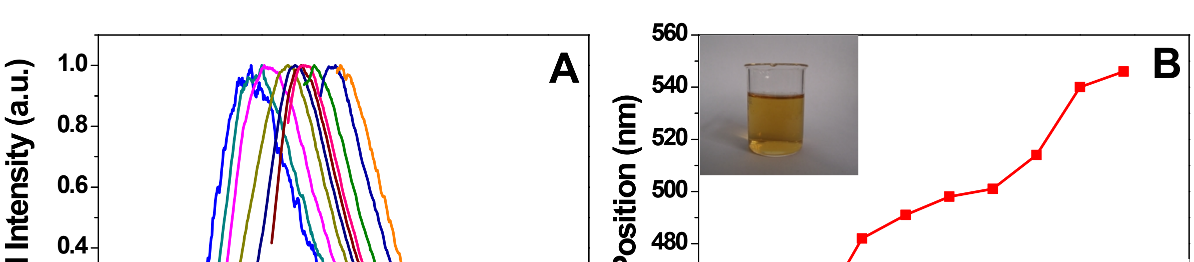


Figure S1. (A) The normalized PL spectra of SP1 with different excitation wavelengths, progressively increasing from 300 nm to 520 nm in 20 nm increments. (B) Relationship between excitation and emission wavelength of PL spectra. The inset is the digital photograph of the product (up) and Tyndall effect (down) exhibited by product passed through with red laser light.

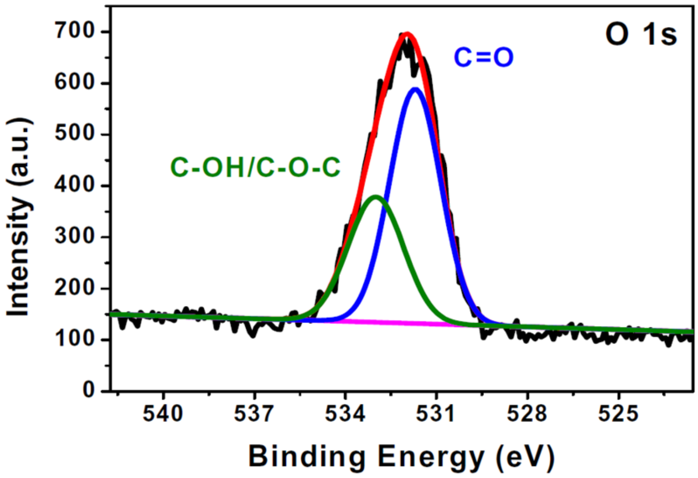


Figure S2. High-resolution O 1s XPS spectrum of N-CDs in SP1.

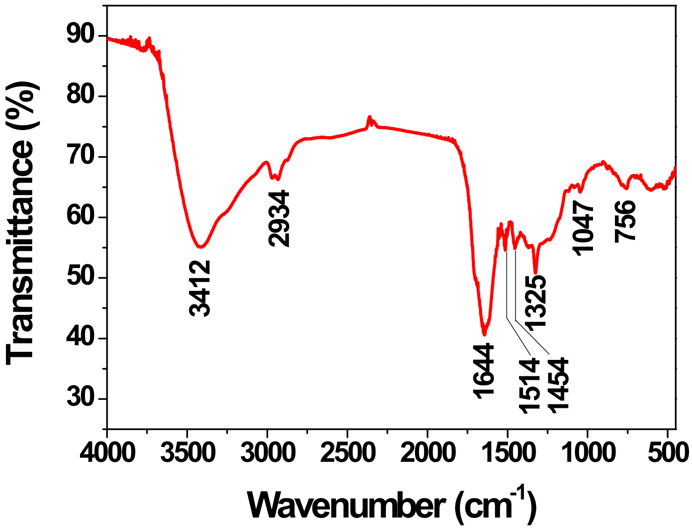


Figure S3. FTIR spectrum of SP1.

The apparent absorption peaks at about 3412 and 1047 cm^{-1} corresponded to the characteristic absorption bands of the −OH stretching vibration mode.[s1] The other two characteristic peaks at about 1644 cm^{-1} and 1514 cm^{-1} indicated the existence of COO−.[s1] Moreover, a peak at 1325 cm^{-1} arising from the C−OH stretching vibration is also observed, and the peak at 2934 and 756 cm^{-1} are in agreement with the C−H stretching mode and C−H out-of-plane bending mode.[s2] Furthermore, a common peak at 1454 cm^{-1} illustrates the existence of the C–N group for the fluorescent carbon dots.[s3] The above observations confirm that the synthesized SP1 is rich in N, O−containing groups.

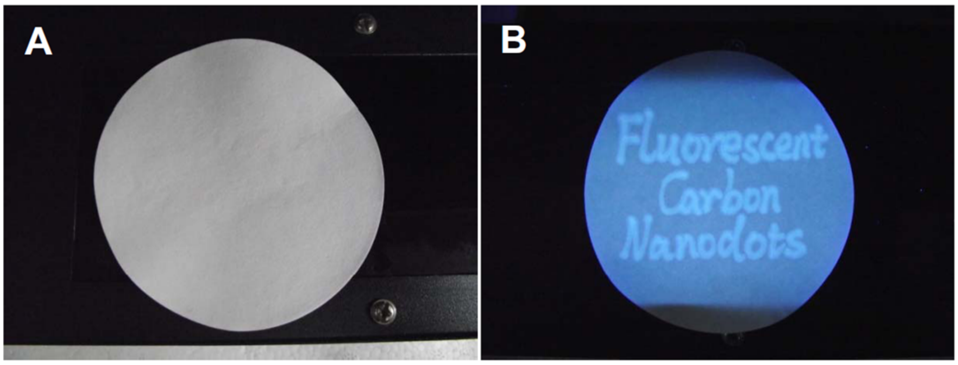


Figure S4. Digital photographs of characters written with SP1 on commercially available filter paper captured under room light (A) and UV light (B).

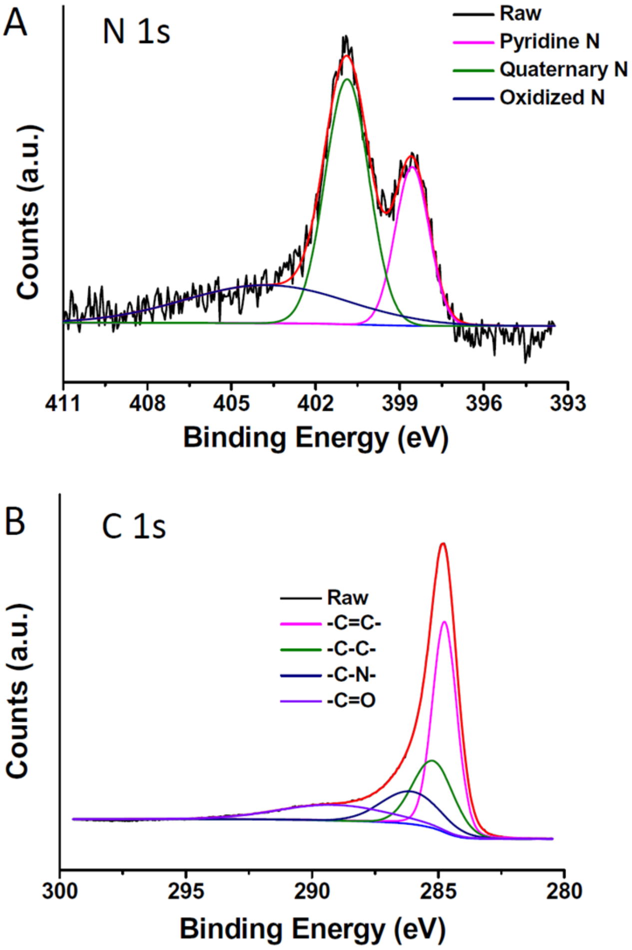
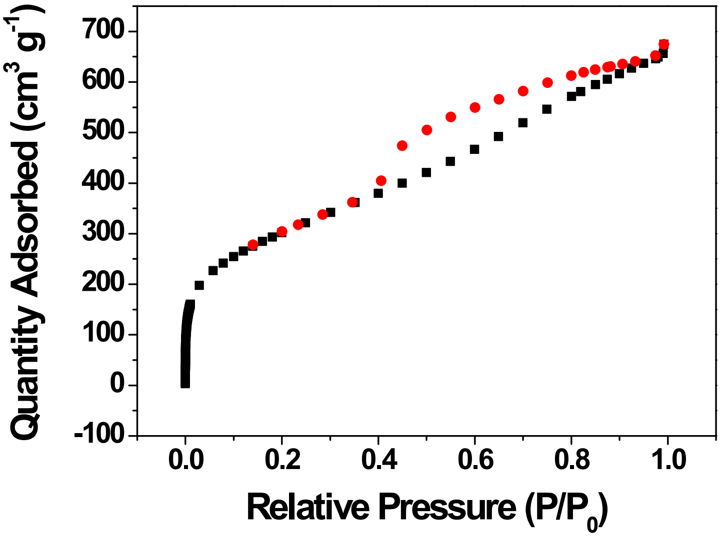


Figure S5. (A, B) High-resolution N 1s and C 1s XPS spectra of SP2, respectively.


Quantity Adsorbed (cm^3 g^{-1})
700
600
500
400
300
200
100
0
-100
0.0
0.2
0.4
0.6
0.8
1.0
Relative Pressure (P/P_0)

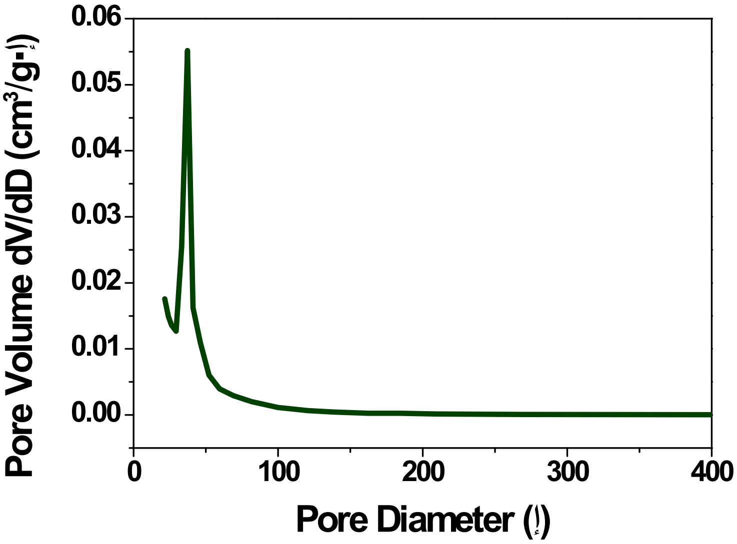

Pore Volume dV/dD (cm^3/g·Å)
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
100
200
300
400
Pore Diameter (Å)

Figure S6. He adsorption–desorption isotherms of SP2 (A) and pore diameter distribution calculated from BJH Desorption (B).

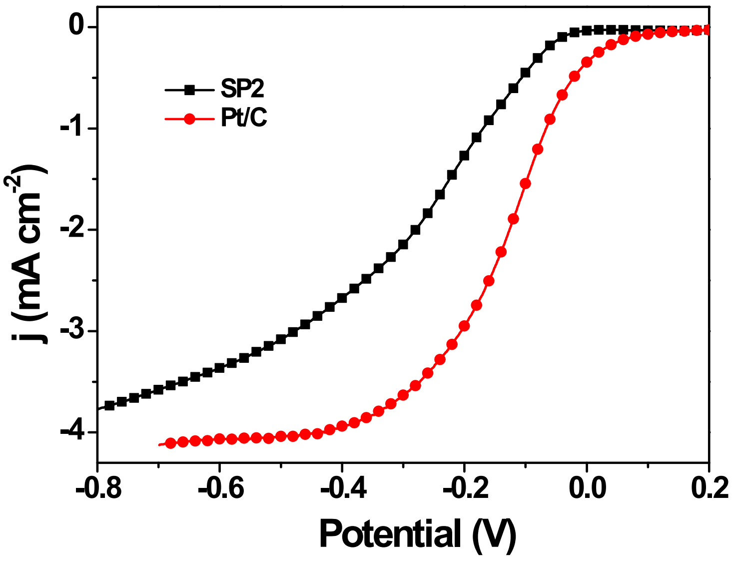


Figure S7. The comparison of ORR curves from the SP2 catalyst and Pt/C catalyst under 1600 rpm and with the background CV current extracted.

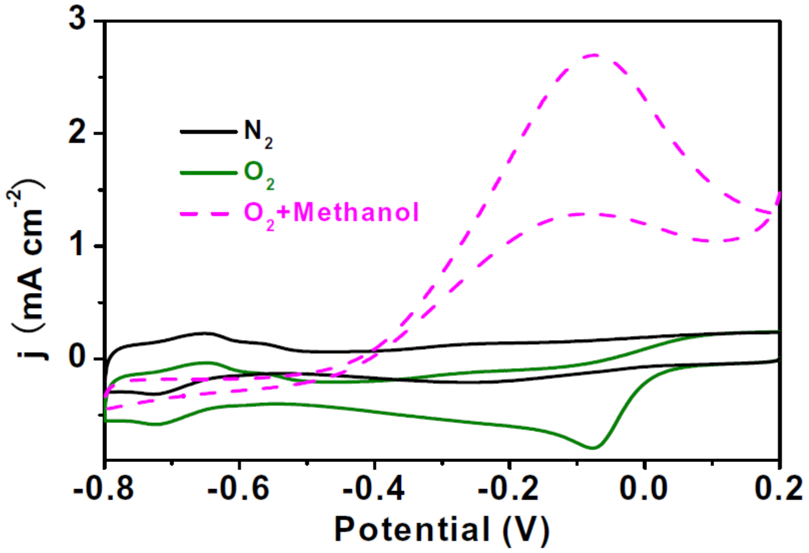


Figure S8. CV curves of 20 wt% Pt/C in O_2-saturated 0.1 M KOH solution with and without 10 vol% methanol at a scan rate of 10 mV s^{-1}.

Table S1 Onset potential (V_{onset}), diffused-limited current density (j_L), half-wave potential and mass activity by LSV at room temperature and 10 mV s^{-1} in 0.1 M KOH of Pt-m-N-C, SP-2，S1-AZ-800，and Pt/C (20 wt%).

Samples	Onset potential (V vs Hg/HgO) [a)]	Diffused-limited current density j_L [mA cm^{-2}]$^{b)}$	Half-wave potential (V vs Hg/HgO)	Mass activity[mA cm^{-2} mg^{-1}]$^{c)}$	Ref.
Pt-m-N-C	-0.110	3.16	/	29.3454	[4]
SP-2	-0.002	3.08	-0.244	61.6406	This article
S1-AZ-800	-0.060	3.75	/	75.9964	[5]
Pt/C (20 wt. %)	0.070	4.04	-0.129	40.4033	This article

[a)] Potential measured at the ORR current is 5% of −0.3 V (1600 rpm);

[b)] Diffused-limited current density measured by $B = 0.2nF(D_{O_2})^{\frac{2}{3}}\nu^{\frac{-1}{6}}C_{O_2}$ and $j_L = B\omega^{\frac{1}{2}}$;

[c)] Mass activities are determined using the LSV profiles reported in Figure S8 at -0.5 V.

References

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