

Supporting Information

Coupling of Cerium Oxide Cyanamide with Fe-N-C for Enhanced Oxygen Reduction Reaction

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Supporting Figures and Tables

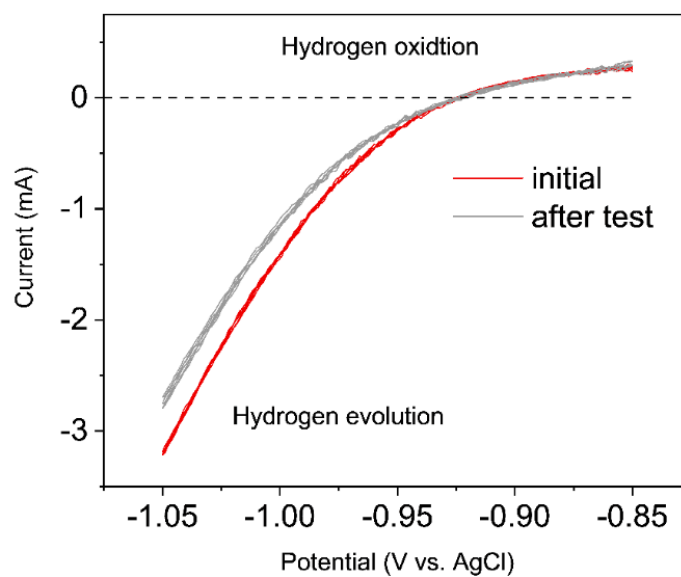


Fig. S1. Reversible hydrogen electrode (RHE) calibration results in 0.1 M KOH solution at a scan rate of 1 mV s^{-1} .

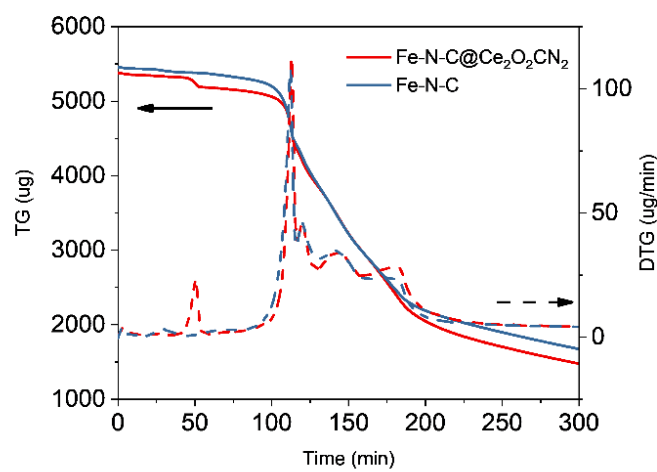


Fig. S2. TG analysis of the Fe-ZIF-8@Ce₂O₂CN₂ and Fe-ZIF-8.

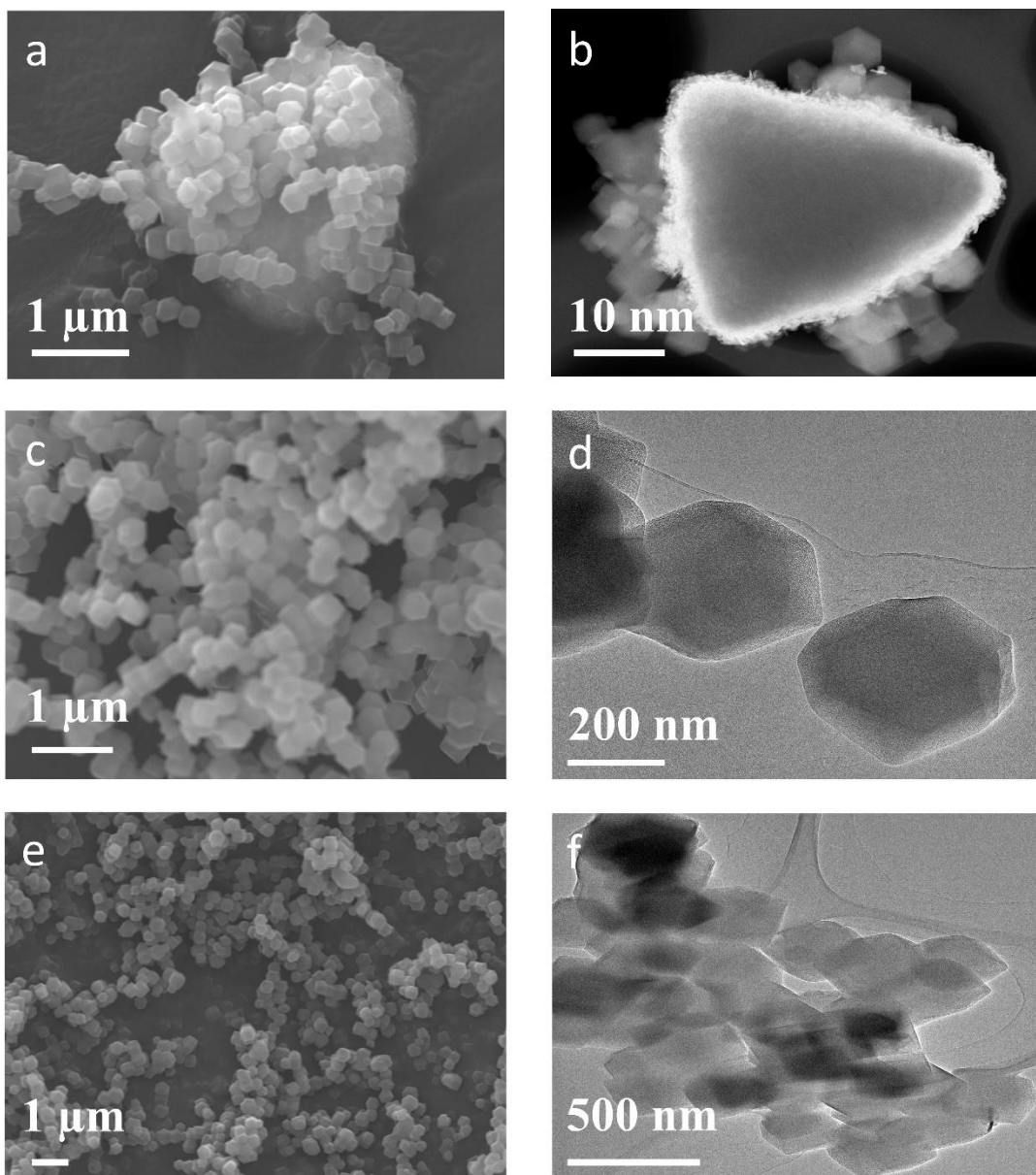


Fig. S3. SEM and TEM images of (a,b) N-C@Ce₂O₂CN₂, (c,d) Fe-N-C, and (e,f) N-C.

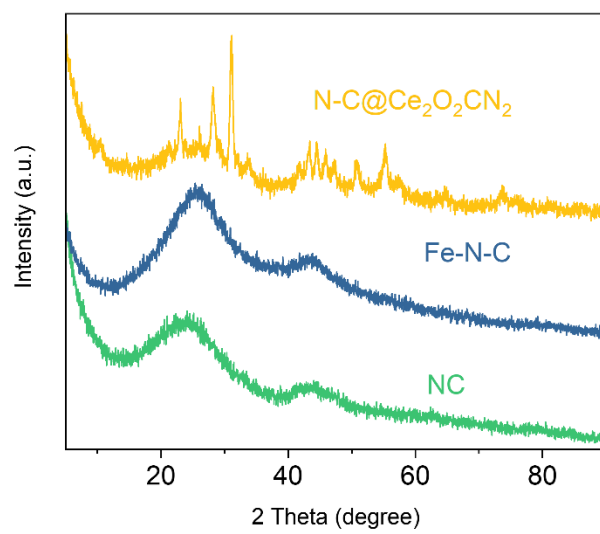


Fig. S4. PXRD patterns of N-C@Ce₂O₂CN₂, Fe-N-C, and N-C.

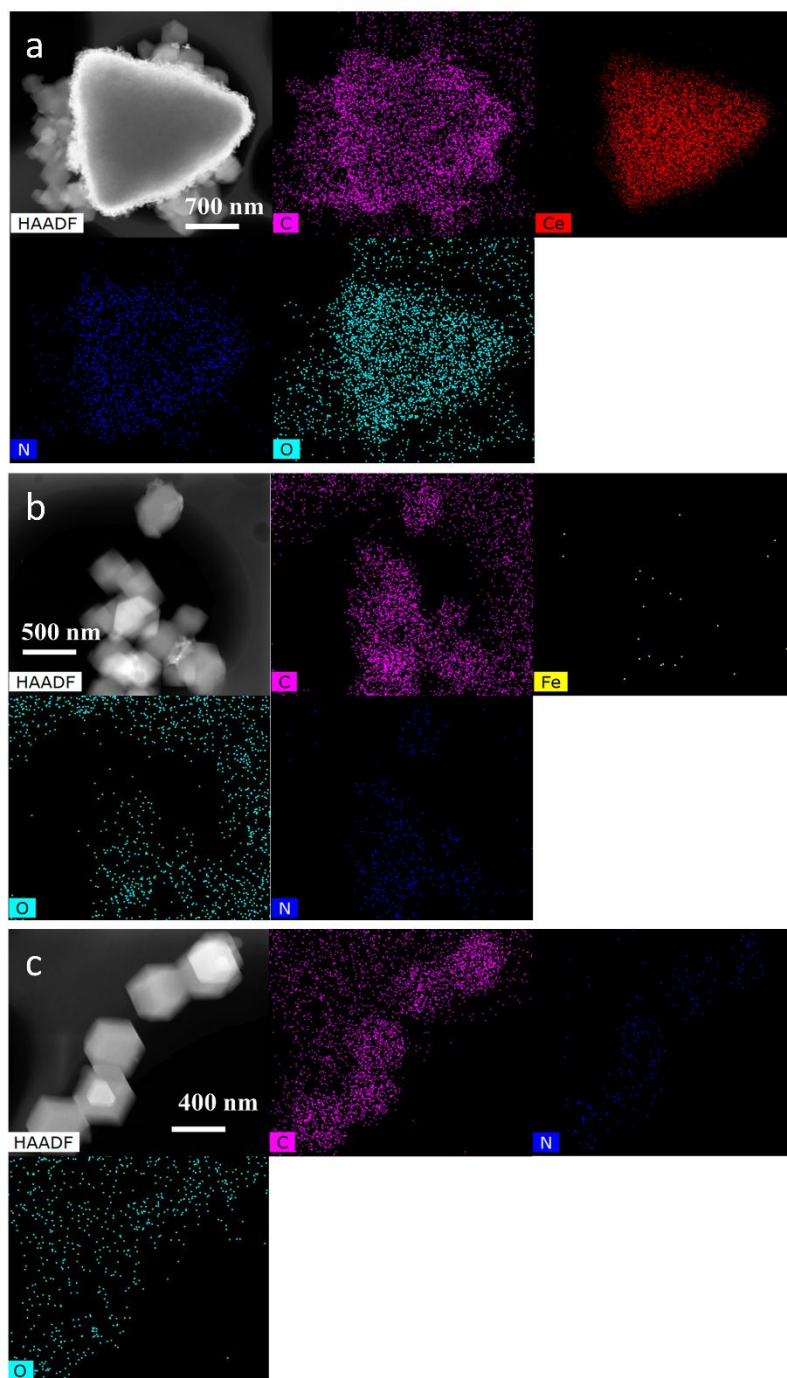


Fig. S5. HADF-STEM images and corresponding EDS elemental mappings of (a) N-C@Ce₂O₂CN₂, (b) Fe-N-C, and (c) N-C.

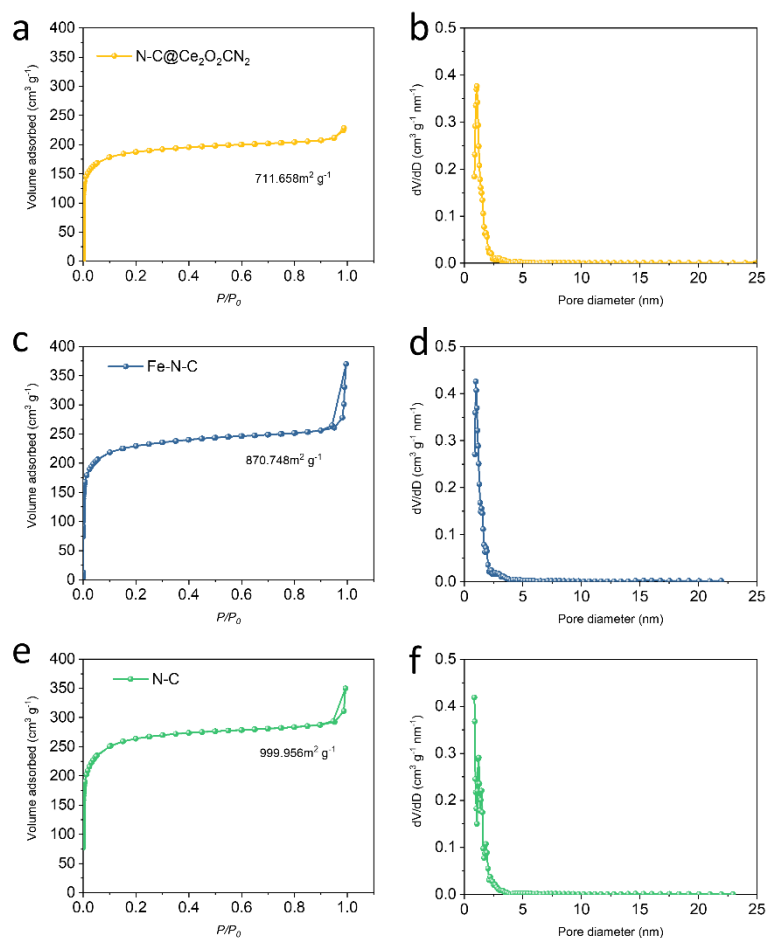


Fig. S6. N₂ adsorption-desorption isotherms and pore size distributions of (a,b) N-C@Ce₂O₂CN₂, (c,d) Fe-N-C, and (e,f) N-C.

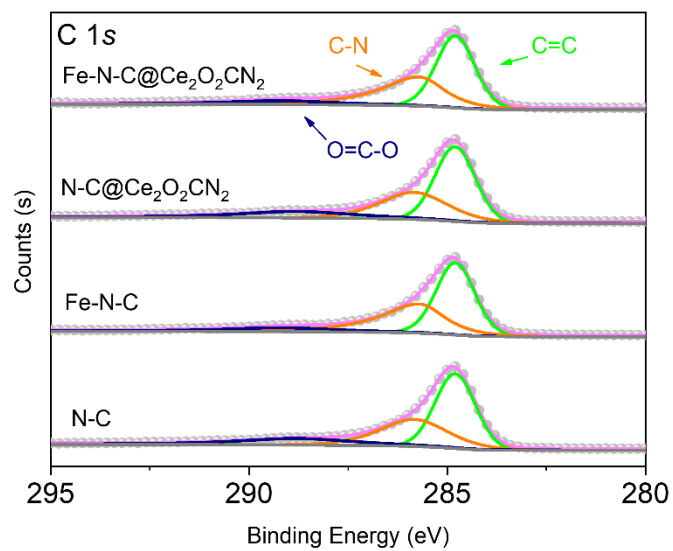


Fig. S7. High resolution XPS spectra for C 1s in all samples.

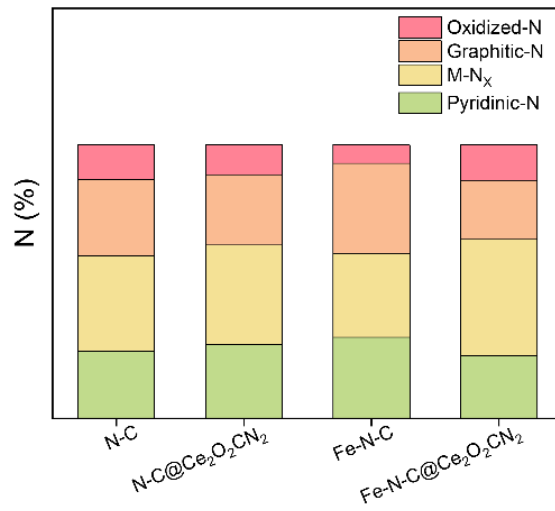


Fig. S8. The atomic percentage of pyridinic-N, M-N_x, graphitic-N, and oxidized-N of obtained catalysts.

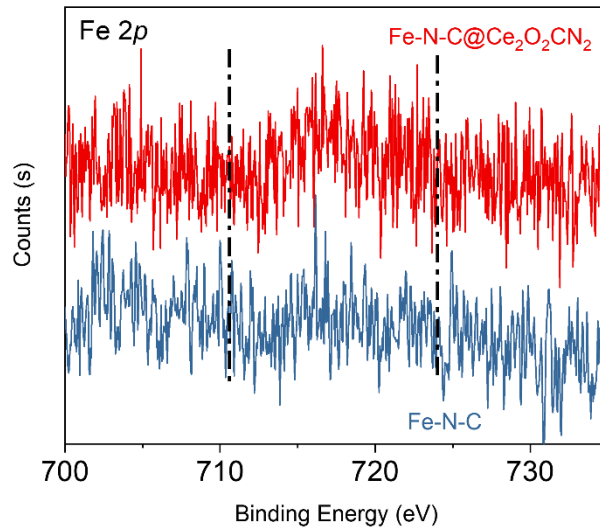


Fig. S9. High resolution XPS spectra for Fe 2p in Fe-N-C@Ce₂O₂CN₂ and Fe-N-C.

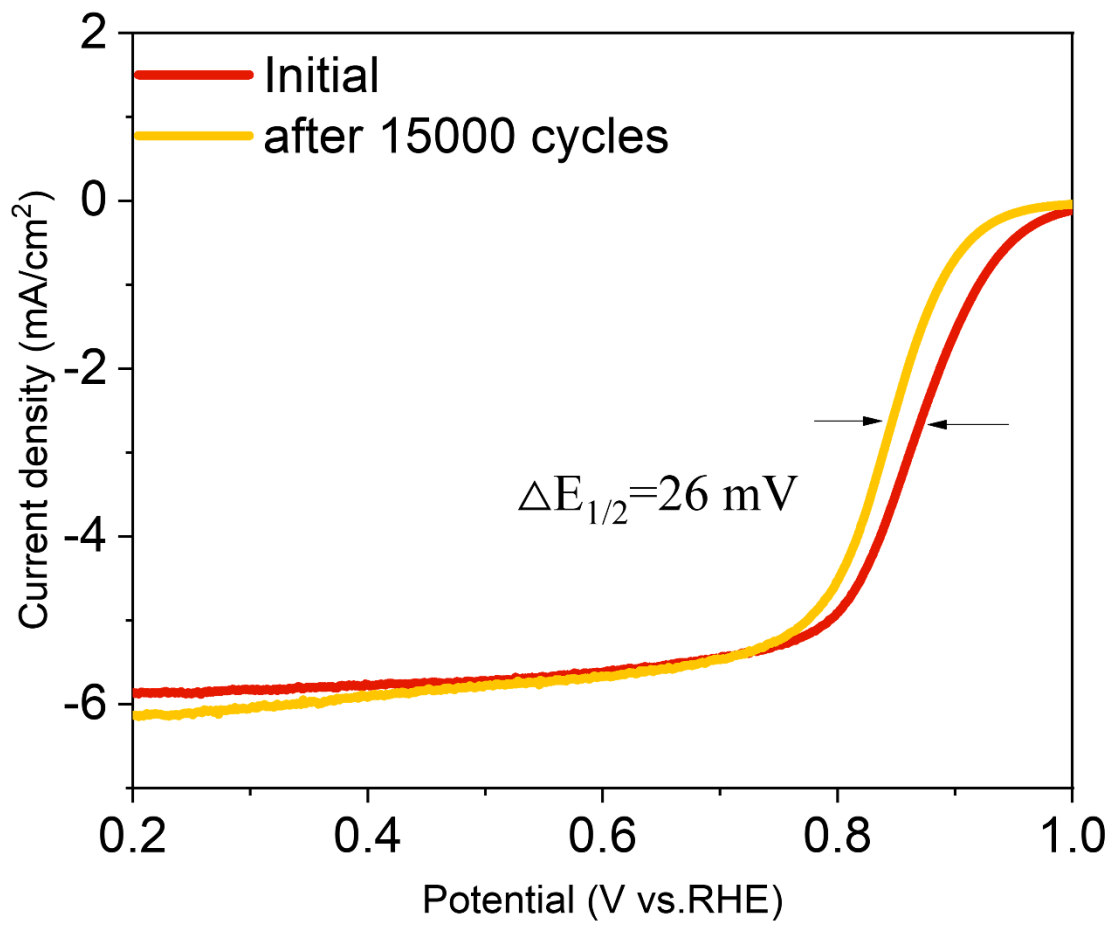


Fig. S10. RDE polarization curves of Pt/C before and after 15000 cycles ranging from 0.6 to 1.1 V at 500 mV/s in O₂-saturated 0.1 M KOH.

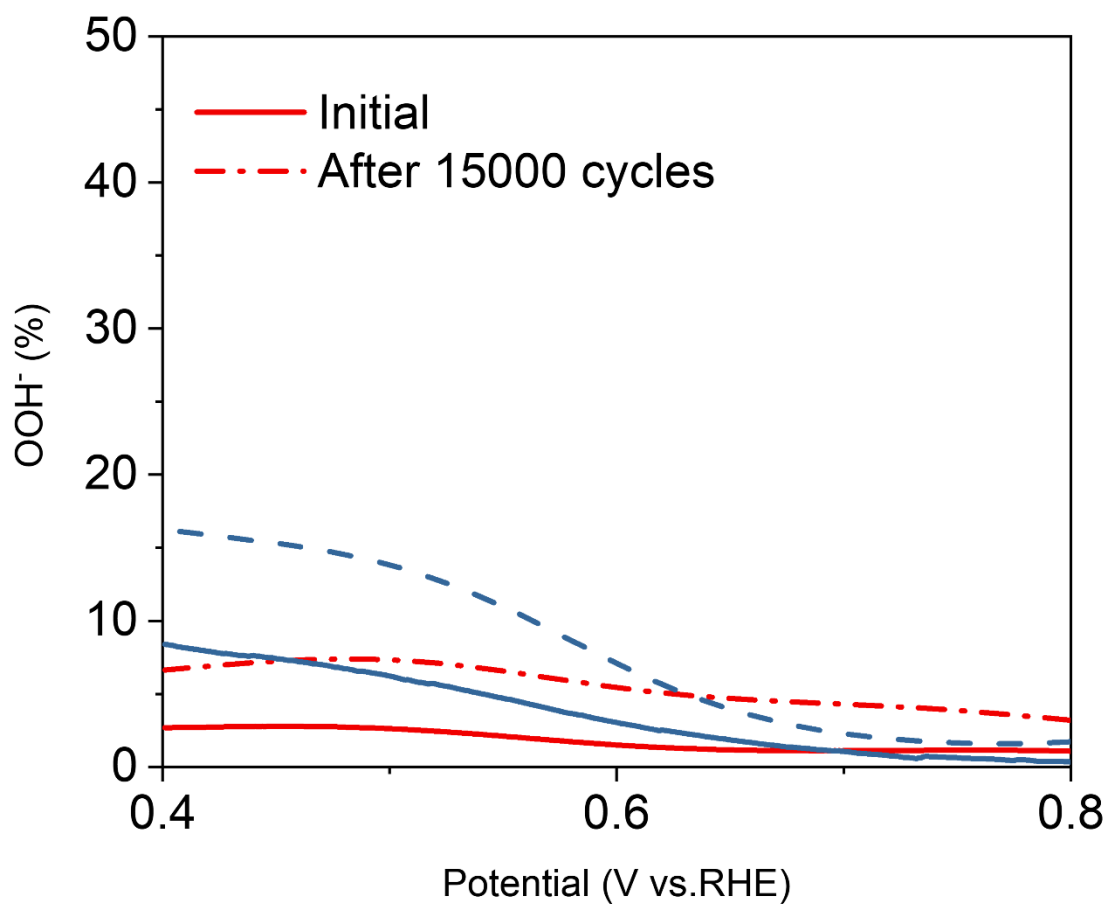


Fig. S11. OOH^- yields of Fe-N-C@Ce₂O₂CN₂ (red) and Fe-N-C (blue) before and after 15000 cycles accelerated durability tests.

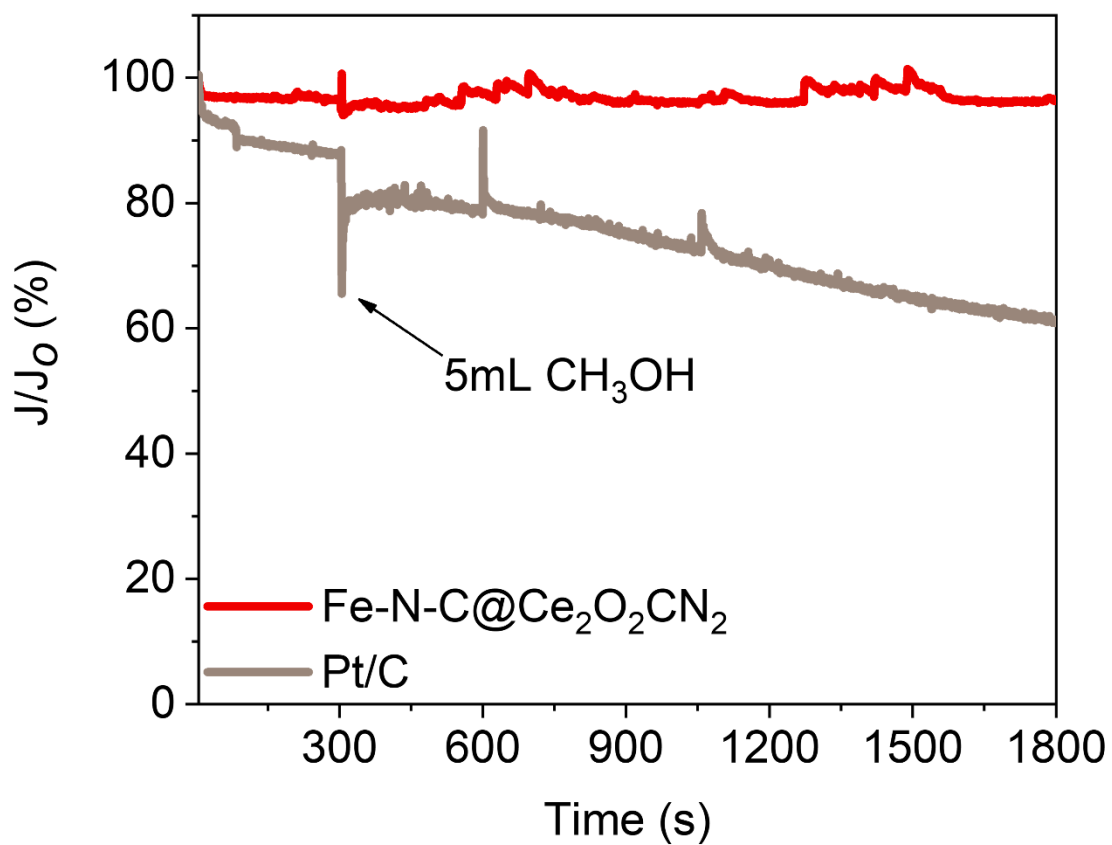


Fig. S12. Chronoamperometric responses of Pt/C at 0.5 V after injecting 5 ml methanol into 180 ml 0.1 M KOH.

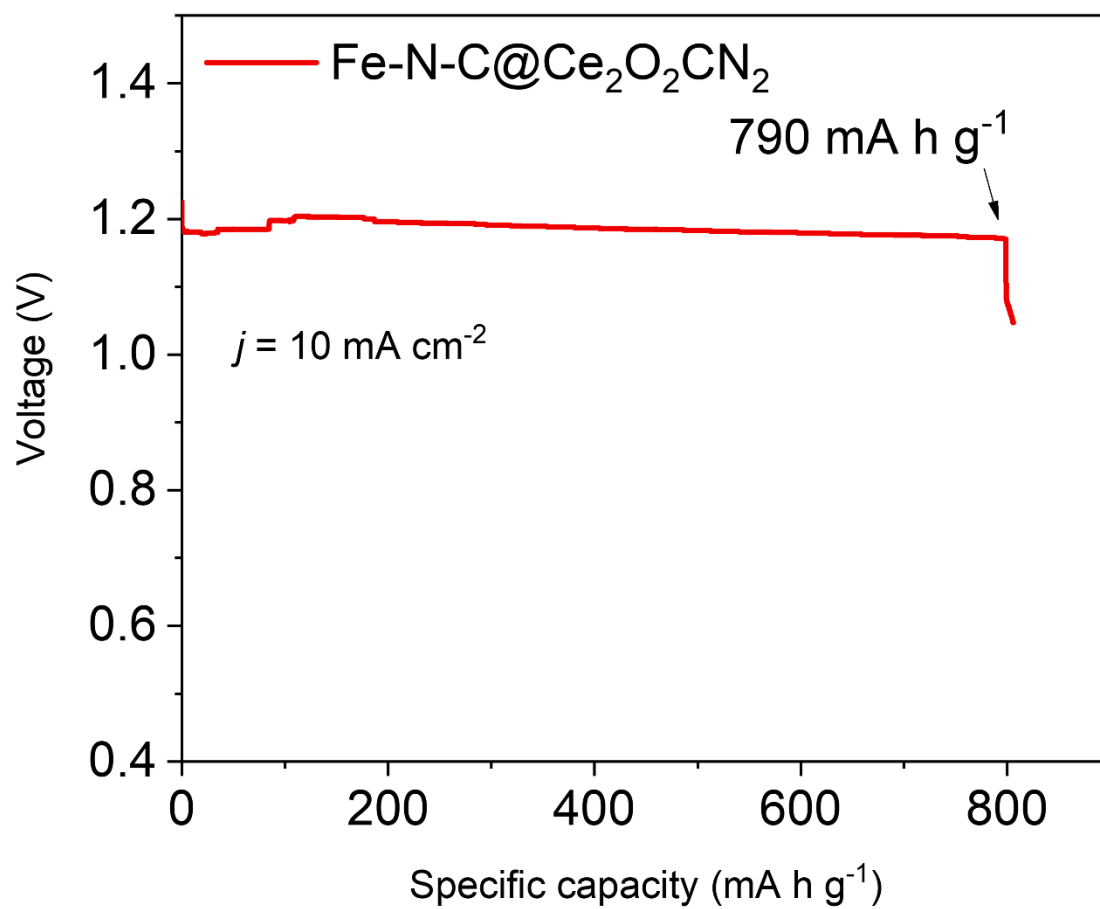


Fig. S13. Specific capacity of Fe-N-C@Ce₂O₂CN₂.

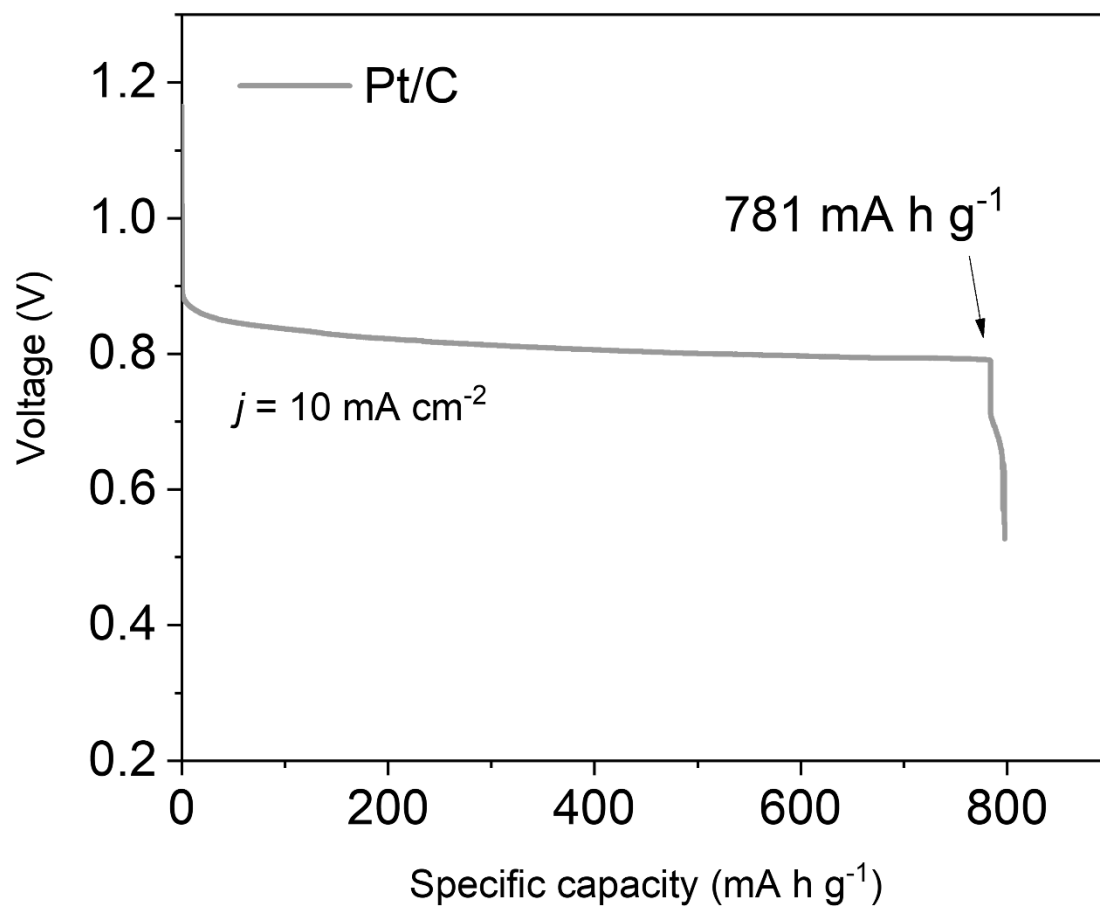


Fig. S14. Specific capacity of Pt/C.

Table S1. Comparison of ORR electrocatalysis performance of the as-prepared catalyst with reported catalysts.

Samples	E_{ONSET} (V vs. RHE)	$E_{1/2}$ (V vs. RHE)	Reference
Fe-N-C@Ce ₂ O ₂ CN ₂	0.951	0.89	This work
Fe-N-C-2HT-1AL	0.92	0.82	1
Fe-N-CC	0.94	0.83	2
p-Fe-N-CNFs	0.91	0.82	3
Fe-NC SAC	0.98	0.90	4
Fe-N/P-C-700	0.941	0.867	5
Fe ₂ -Z8-C	0.985	0.871	6
CNT@f-FeNC170	0.97	0.84	7
Fe-N-C/MXene	0.92	0.84	8

Table S2. Comparison of ZABs performance of the as-prepared catalyst with reported catalysts.

Samples	OCP (V)	P _{max} (mV/cm ²)	Reference
Fe-N-C@Ce ₂ O ₂ CN ₂	1.43	120	This work
FeCo NPs-N-CNTs	1.51	116	9
CoN ₄ /NG	1.51	115	10
Co ₃ FeS _{1.5} (OH) ₆	-	113.1	11
Fe-N/C-1/30	1.525	121.8	12
CoNi-SAs/NC	1.45	101.4	13
Pd/FeCo	1.42	117	14
FeCoMoS@NG	1.44	118	15
Fe-2-WNPC-NCNTs	1.43	101.3	16

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