

Figure S1. TEM images of CoNHCS-900 catalyst. The black dots in (a) are Co particles.

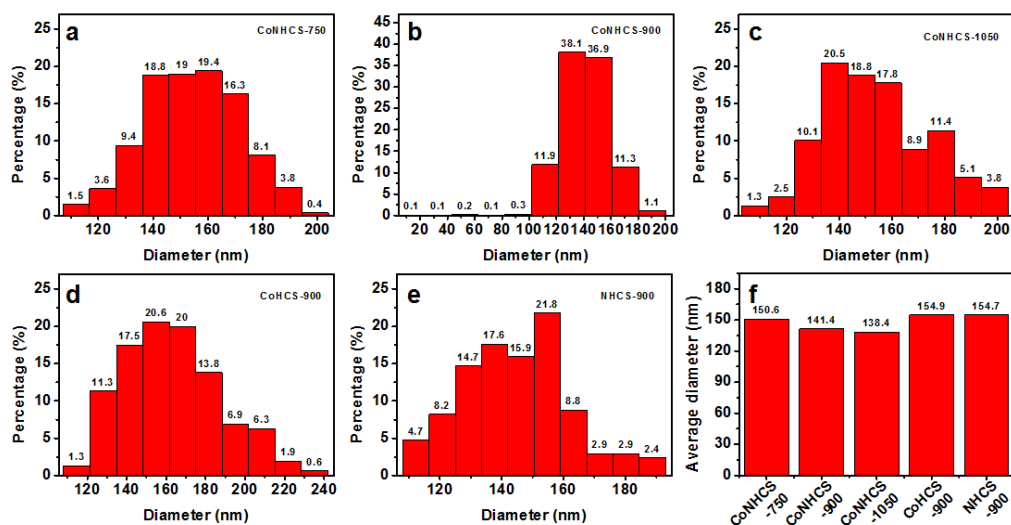


Figure S2. Particle size distribution of (a) CoNHCS-750, (b) CoNHCS-1050, (c) CoHCS-900, (d) CoHCS-900, (e) NHCS-900 and (f) is the mean particle diameter of samples.

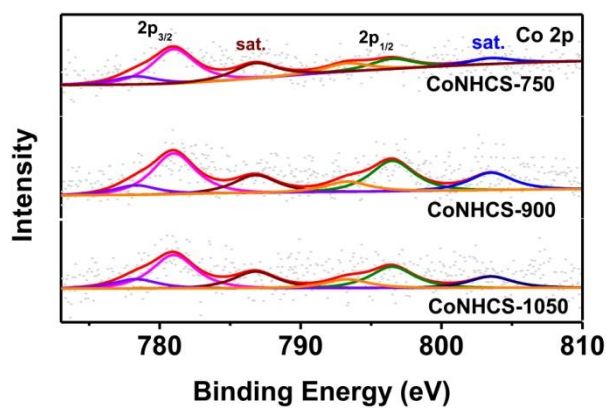


Figure S3. XPS spectra of Co 2P for CoNHCSs at different temperatures.

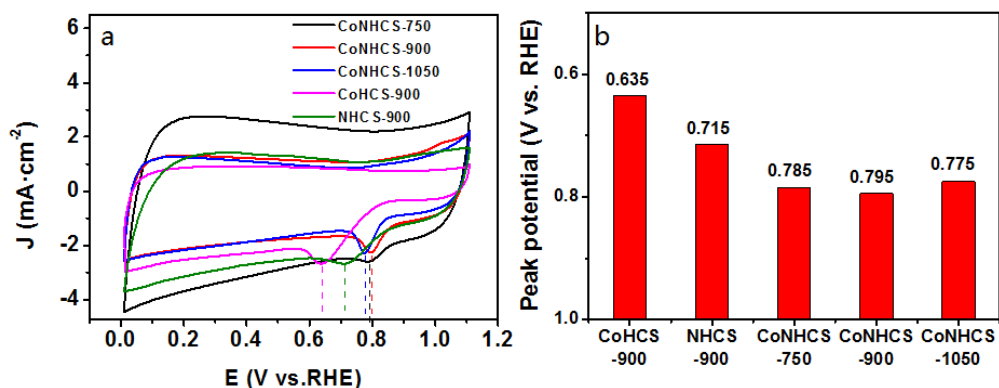


Figure S4. (a) Cyclic voltammograms (CVs) recorded at room temperature in O₂-saturated in 0.1 KOH solution with a sweep rate of 200 mV s⁻¹. (b) The potentials histogram of oxidation peak for catalysts.

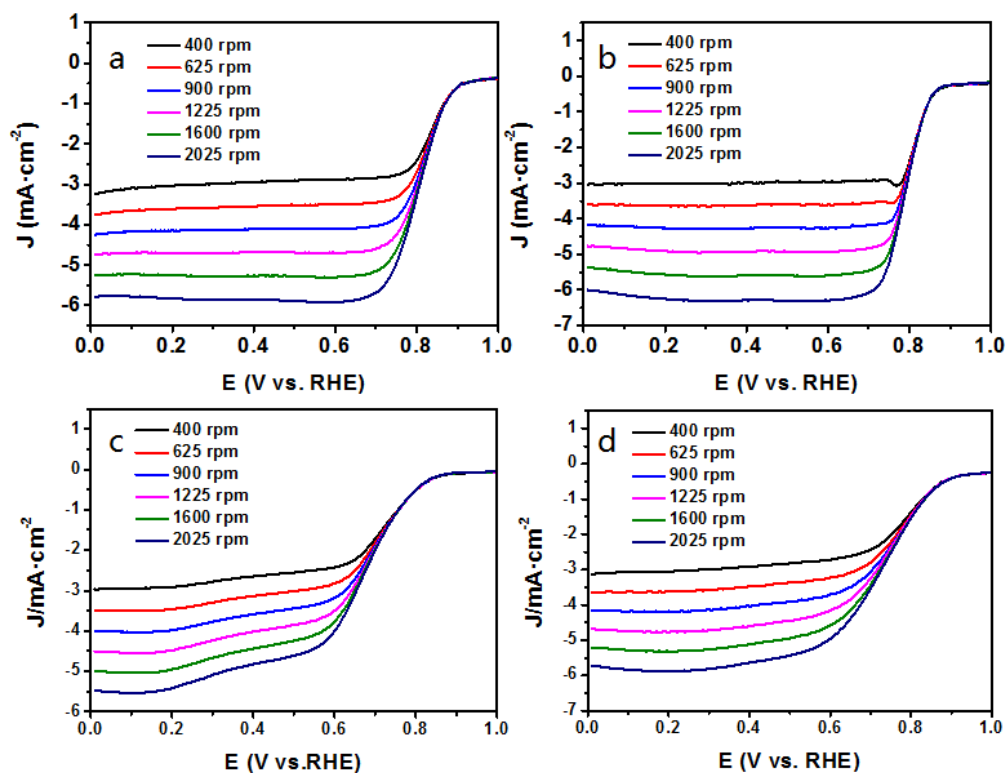


Figure S5. The LSVs for the ORR using the (a) CoNHCS-750, (b) CoNHCS-1050, (c) CoHCS-900, (d) NHC S-900 in O₂-saturated 0.1 M KOH solution at different rotation rates ranging from 400 to 2025 rpm.

Table S1 The comparison for the electrochemical ORR performances of various Co-containing nitrogen-doped carbon spheres.

Catalysts	$E_{\text{onset(Pt/C)}} - E_{\text{onset}}$ (mV vs. RHE)	Current density (mA cm ⁻²)	Ref.
CoNHCS-950	55	5.58	This work
Co _x N/NHCS	1	5.16	[1]
Co-N/Co-O@N-C	5	3 (100°C)	[2]
ISAS-Co/NHCS	40	5.12	[3]
CoO@NS-CSs	-20	5.47	[4]
Co-N-mC	6	4.36	[5]
Co-N-pCNs	6	3.5	[6]

References

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2. Lee, K.J., et al., Hierarchical cobalt-nitride and -oxide co-doped porous carbon nanostructures for highly efficient and durable bifunctional oxygen reaction electrocatalysts. *Nanoscale*, 2017.
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