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Electronic Supplementary Information

Boosting the hydrogen evolution activity of Co-N-C electrocatalyst by codoping with Al

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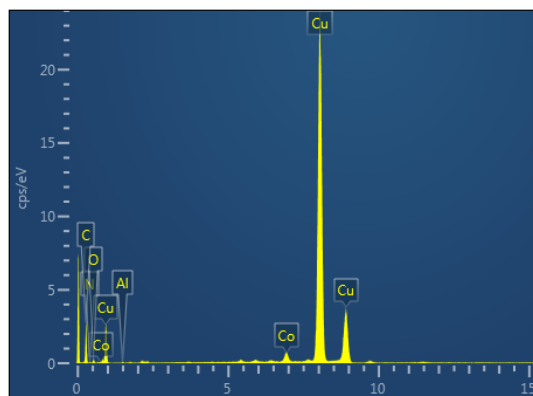


Fig. S1 EDX of CANG by TEM.

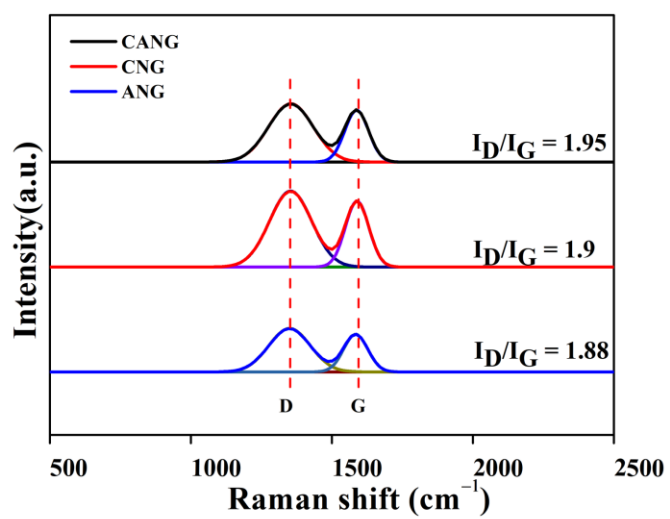


Fig. S2 The fitted Raman spectra.

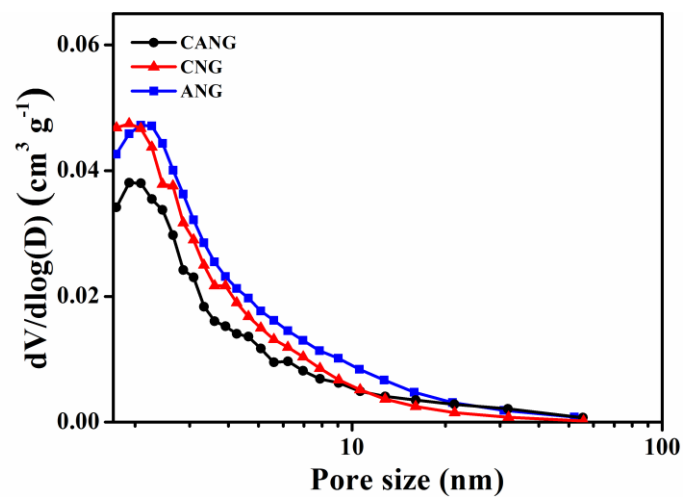


Fig. S3 The pore-size distribution curves of CANG, CNG, and ANG

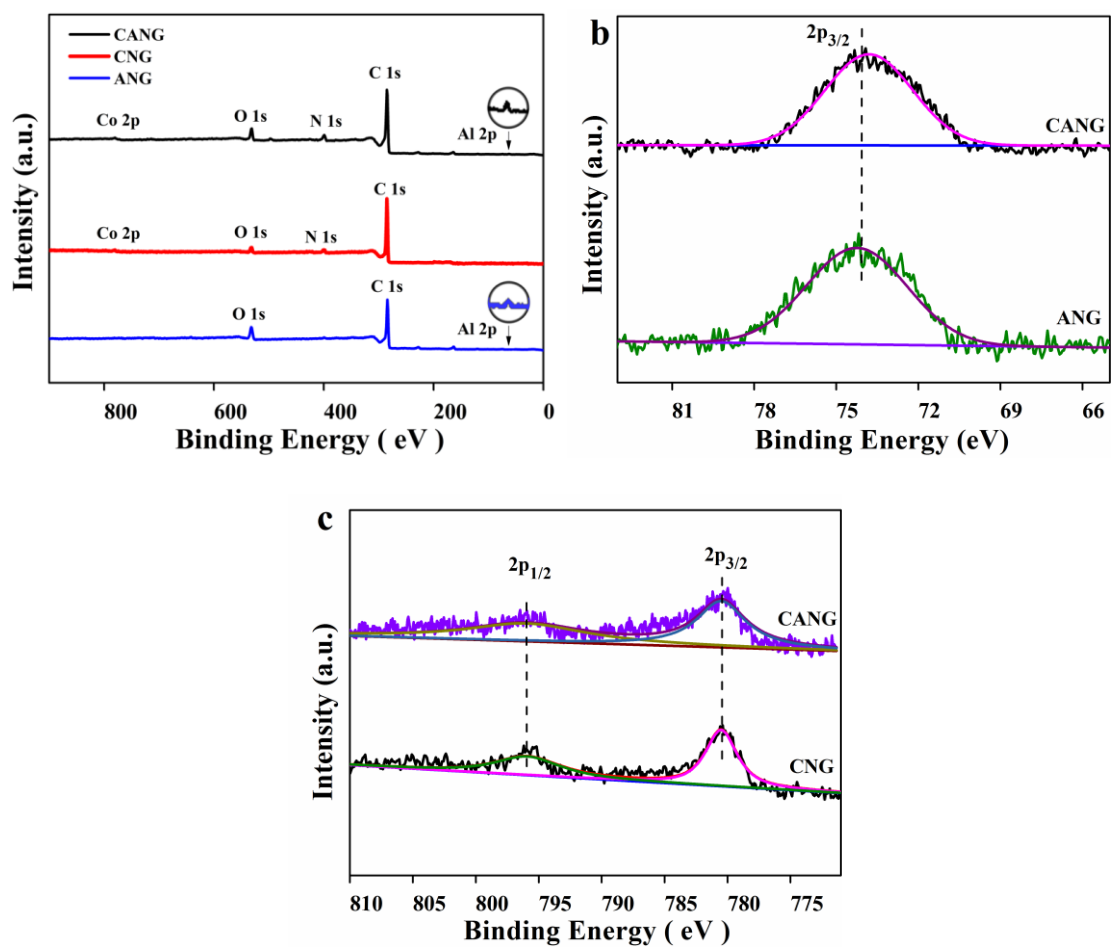


Fig. S4 The XPS survey (a), Al2p XPS (b), and Co2p (c) XPS of CANG.

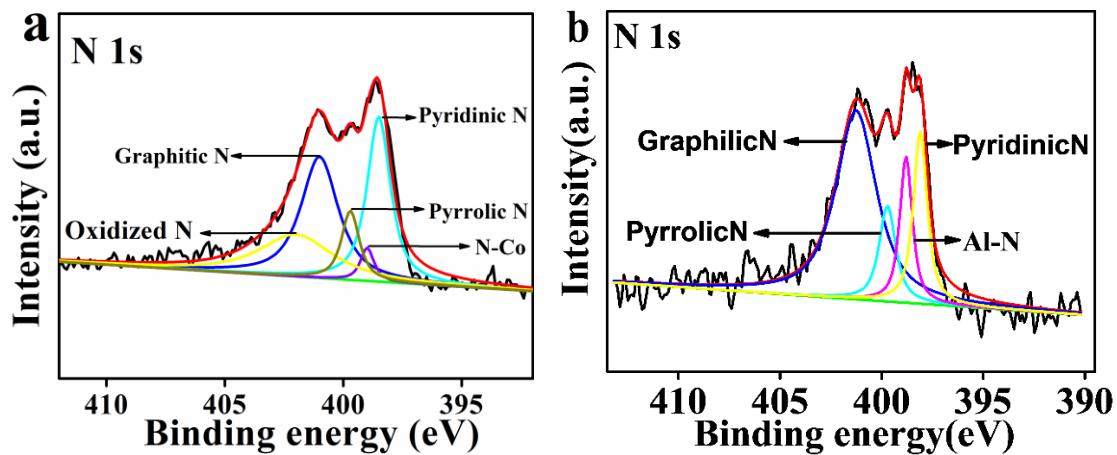


Fig. S5 The N1s XPS of CNG (a) and ANG (b).

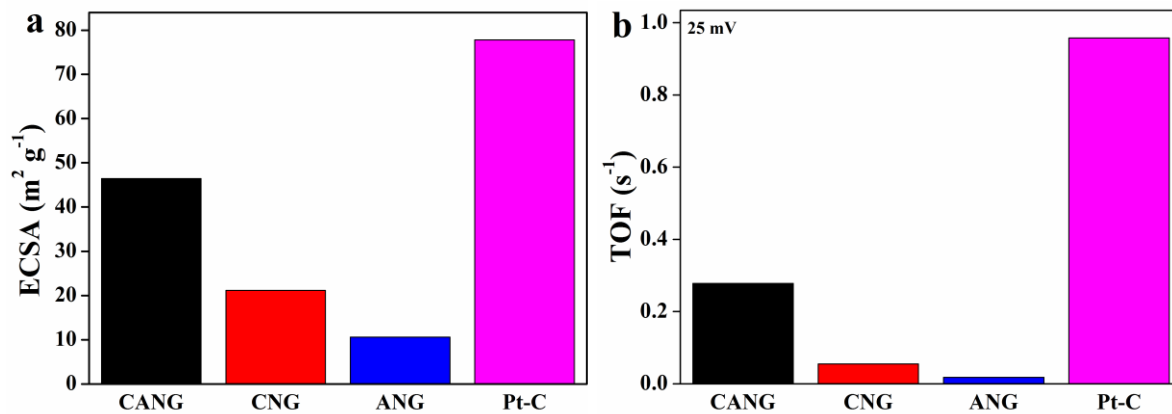


Fig. S6 The ECSA and TOF (@25mV) of CANG, CNG, ANG and Pt/C in 0.5 M H_2SO_4 .

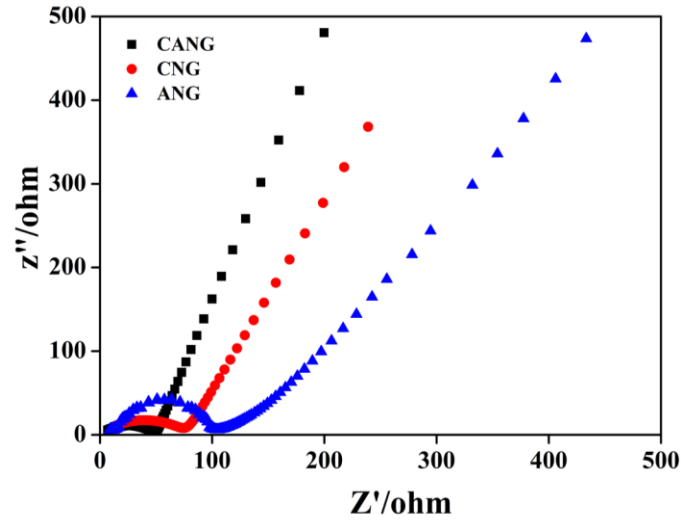


Fig. S7 The EIS of CANG, CNG, and ANG in 0.5 M H_2SO_4 .

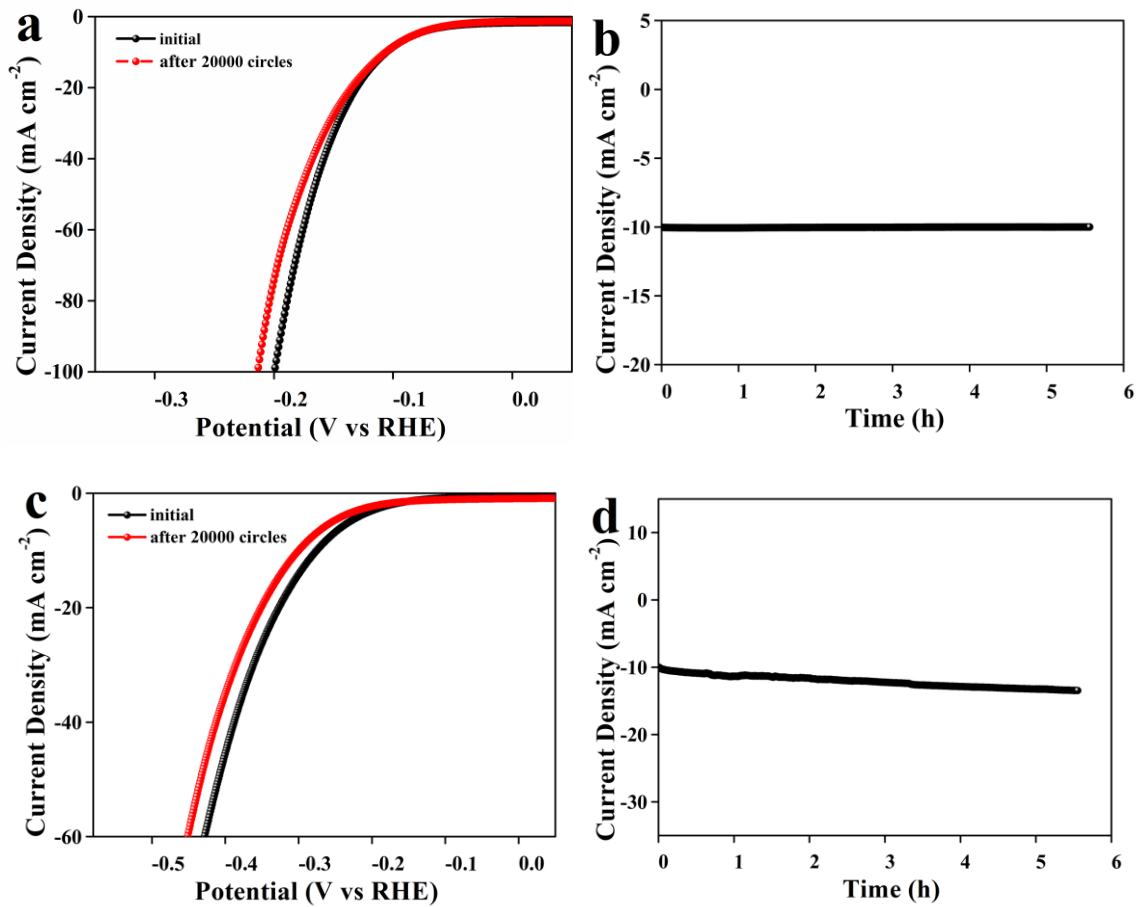


Fig. S8 The cyclic stability of CANG in 0.5 M H_2SO_4 (a, b) and 1 M KOH (c, d). (a, c) LSV curves, (b, d) i-t curves.

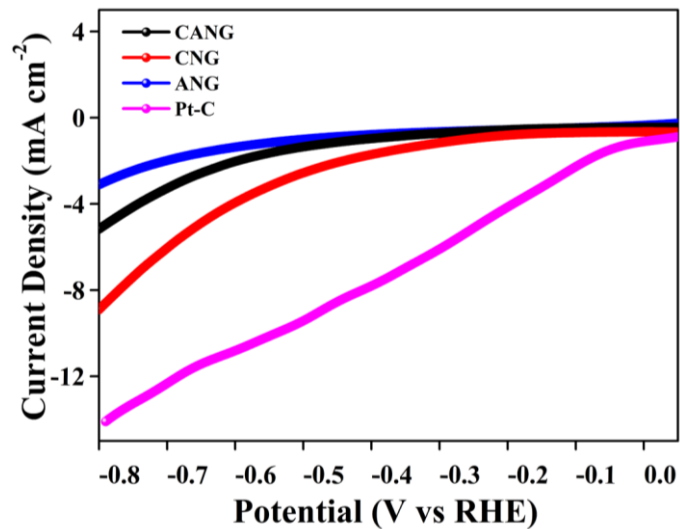


Fig. S9 The HER activity of CANG, CNG, ANG, and Pt/C in a neutral media (1 M PBS).

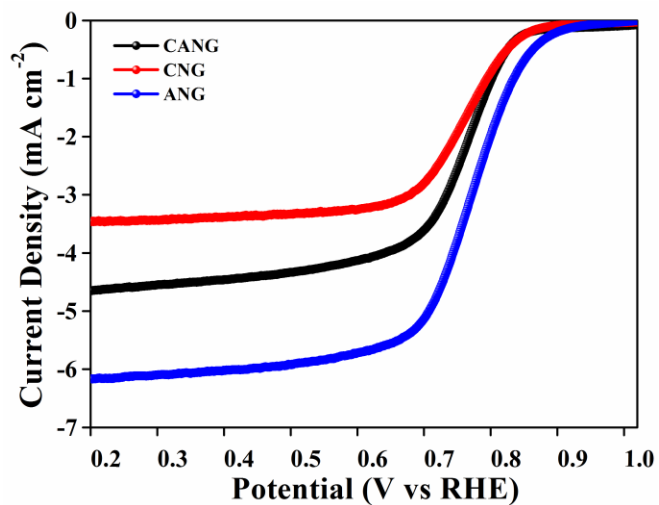


Fig. S10 The ORR activity of CANG, CNG, and ANG in 0.1 M KOH.

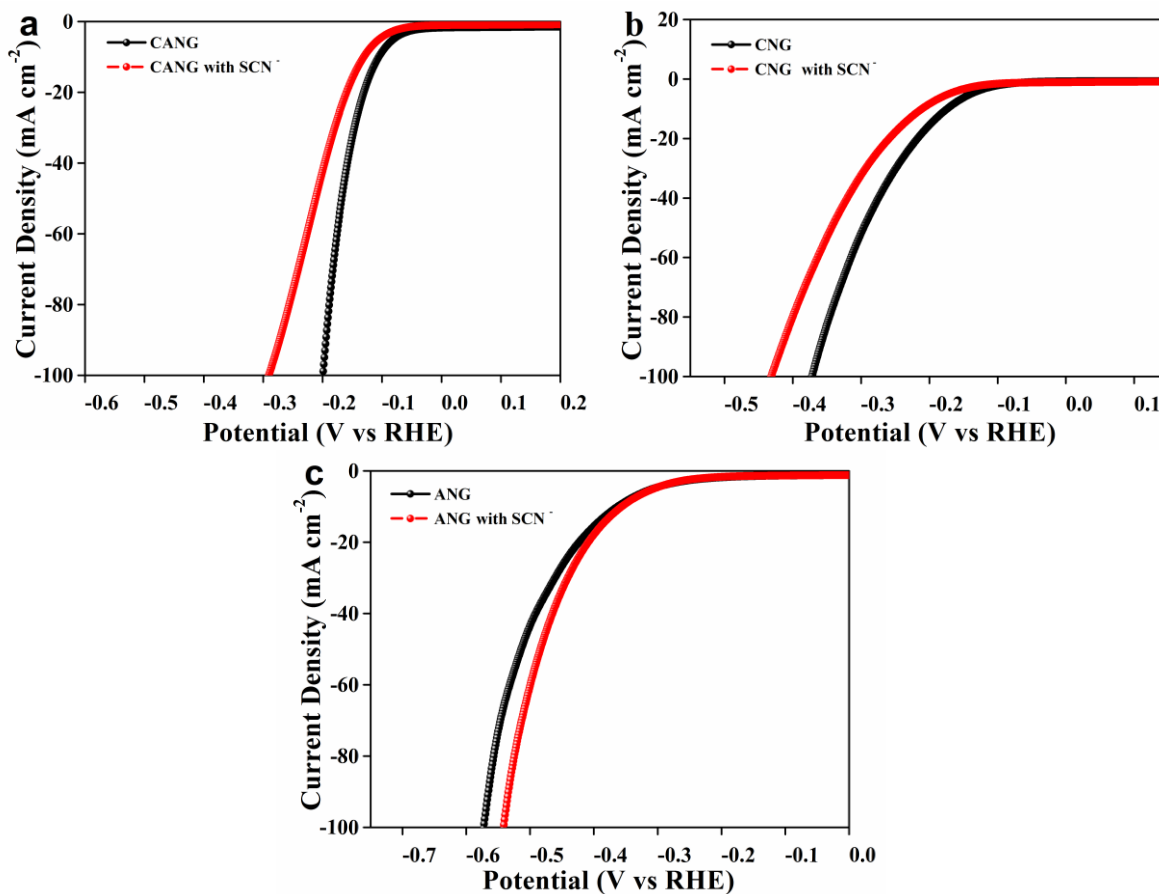


Fig. S11 The SCN⁻ tests of CANG (a), CNG (b), and ANG (c) in 0.5 M H₂SO₄.

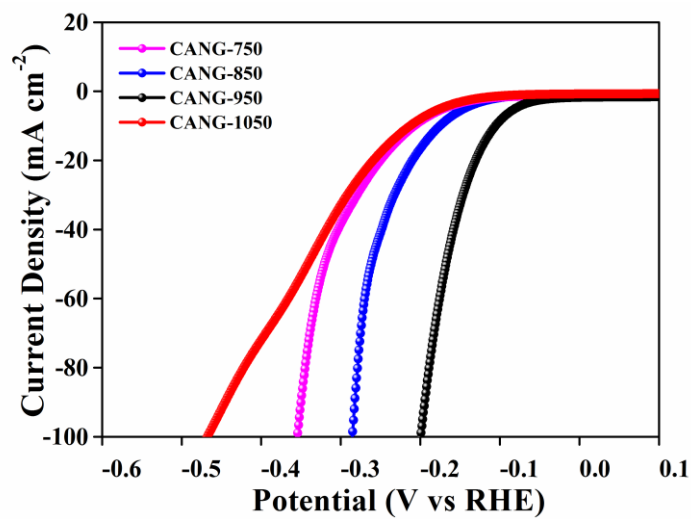
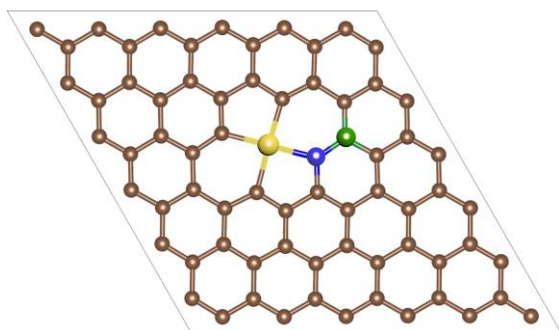
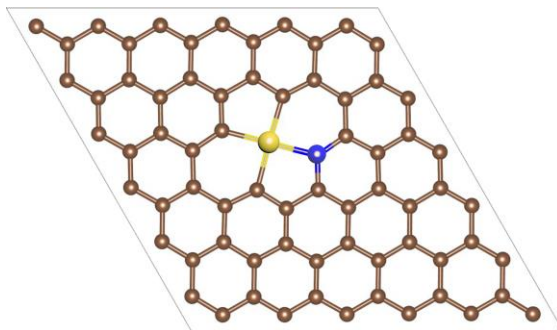


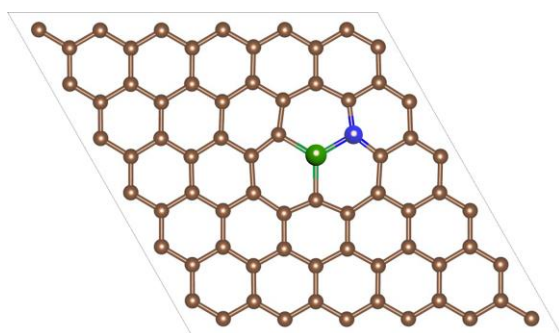
Fig. S12 The HER activity of CANG fabricating at various temperatures ranged from 750 °C to 1050 °C in 0.5 M H₂SO₄.



(CANG)



(CNG)



(ANG)

Fig. S13 The structural model of active centre of CANG, CNG, and ANG.

Tab. S1 The comparison of HER activity of our CANG with those reported Co-based catalyst in literature.

Catalyst	Medium	η_{10} (mV)	Tafel slope (mV dec ⁻¹)	Reference
CANG	0.5 M H ₂ SO ₄	106	81.5	This work
	1 M KOH	275	120	
PANiCo750A	0.5 M H ₂ SO ₄	138	55	[1]
CoN _x /C	0.5 M H ₂ SO ₄	133	57	[2]
Co-NG	0.5 M H ₂ SO ₄	147	82	[3]
Co ₃ C/Co-N-C/G	0.5 M H ₂ SO ₄	103	99	[4]
NC-Co _{0.85} Se	0.5 M H ₂ SO ₄	127	34.1	[5]
CoP/C	0.5 M H ₂ SO ₄	151	128	[6]
CeO ₂ /Co (OH) ₂	1 M KOH	317	140	[7]
Co ₉ S ₈	1 M KOH	293	127	[8]
Co ₉ S ₈ HMs-140/C	1 M KOH	250	108	[9]

Tab. S2 The elemental component of CANG fabricated at various temperatures.

	750 °C	850 °C	950 °C	1050 °C
Co	1.57%	1.84%	2.18%	1.84%
Al	0.21%	0.50%	0.51%	0.82%
N	7.55%	5.51%	4.50%	3.33%

Reference

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