

## Electronic Supplementary Information

### **Co<sub>9</sub>S<sub>8</sub>@N, P-doped porous carbon electrocatalyst using biomass-derived carbon nanodots as precursor for overall water splitting in alkaline media**

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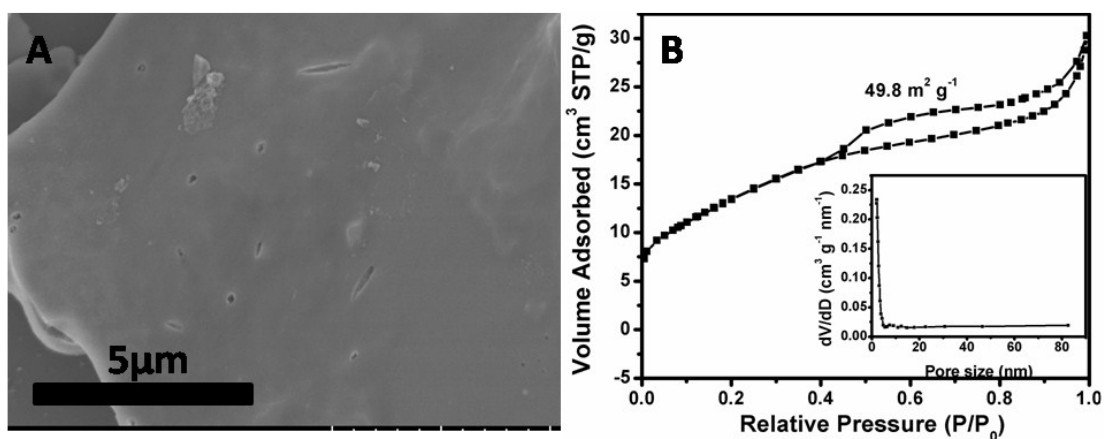
**Table S1** The content of different doped nitrogen species on the sample surface obtained by XPS.

Sample	N (at.%)	Pyridinic N (%)	Pyrrolic N (%)	Graphitic N (%)	Oxidized N (%)
Co <sub>9</sub> S <sub>8</sub> @NC	5.74	36.57	22.67	26.13	14.63
Co <sub>9</sub> S <sub>8</sub> @NPC-5	4.38	28.06	21.68	31.33	18.93
Co <sub>9</sub> S <sub>8</sub> @NPC-10	4.31	20.38	27.10	41.37	11.15
Co <sub>9</sub> S <sub>8</sub> @NPC-15	4.28	19.27	18.41	28.12	34.20

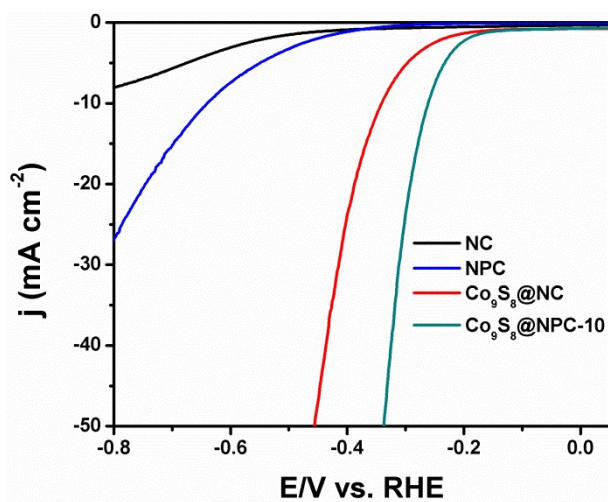
**Table S2** The comparison of the HER performances between the fabricated catalysts in this work and other Co<sub>9</sub>S<sub>8</sub>-based electrocatalysts in literatures.

	Onset potential (mV)	$\eta_j^a$ (mV)	pH	Tafel (mV/dec)	Ref.
Co <sub>9</sub> S <sub>8</sub> NT		$\eta_{20}=320$	14 <sup>b</sup>	135	1
Co <sub>9</sub> S <sub>8</sub> @C	-150	$\eta_{10}=280$	7 <sup>c</sup>		2
Co <sub>9</sub> S <sub>8</sub> /CC	-25	$\eta_{10}=175$	7		3
Co <sub>9</sub> S <sub>8</sub>	-224	$\eta_7=270$	0 <sup>d</sup>	135	4
Co <sub>9</sub> S <sub>8</sub> @NPC	-150	$\eta_{10}=261$	14	101.8	This work

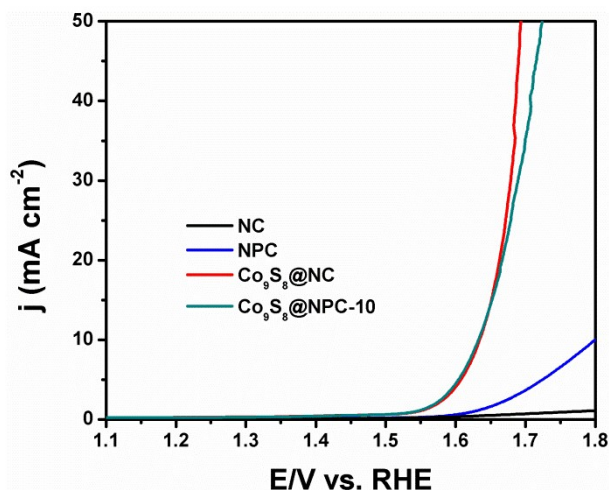
<sup>a</sup> The overpotential ( $\eta$ ) at the current density ( $j$ ); <sup>b</sup> 1.0 M KOH (pH=14); <sup>c</sup> 1.0 M phosphate buffer (pH=7.0) ; <sup>d</sup> 0.5 M H<sub>2</sub>SO<sub>4</sub> (pH=0).



**Fig. S1** (A) SEM image of  $\text{Co}_9\text{S}_8@\text{NPC-10}$  without NaCl-KCl, (B)  $\text{N}_2$  adsorption-desorption isotherm of  $\text{Co}_9\text{S}_8@\text{NPC-10}$  without NaCl-KCl and corresponding pore size distribution.



**Fig. S2** HER polarization curves of NC, NPC,  $\text{Co}_9\text{S}_8@\text{NC}$  and  $\text{Co}_9\text{S}_8@\text{NPC-10}$  electrocatalysts at a scan rate of  $5.0 \text{ mV s}^{-1}$  in  $1.0 \text{ M KOH}$  electrolyte.



**Fig. S3** OER polarization curves of NC, NPC,  $\text{Co}_9\text{S}_8@\text{NC}$  and  $\text{Co}_9\text{S}_8@\text{NPC-10}$  electrocatalysts at a scan rate of  $5.0 \text{ mV s}^{-1}$  in  $1.0 \text{ M KOH}$  electrolyte.

## References

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