

## 磷化钴封装在磷富集的三维多孔碳及其双功能氧电催化性能研究

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### **Co<sub>2</sub>P@P-doped 3D Porous Carbon for Bifunctional Oxygen Electrocatalysis**

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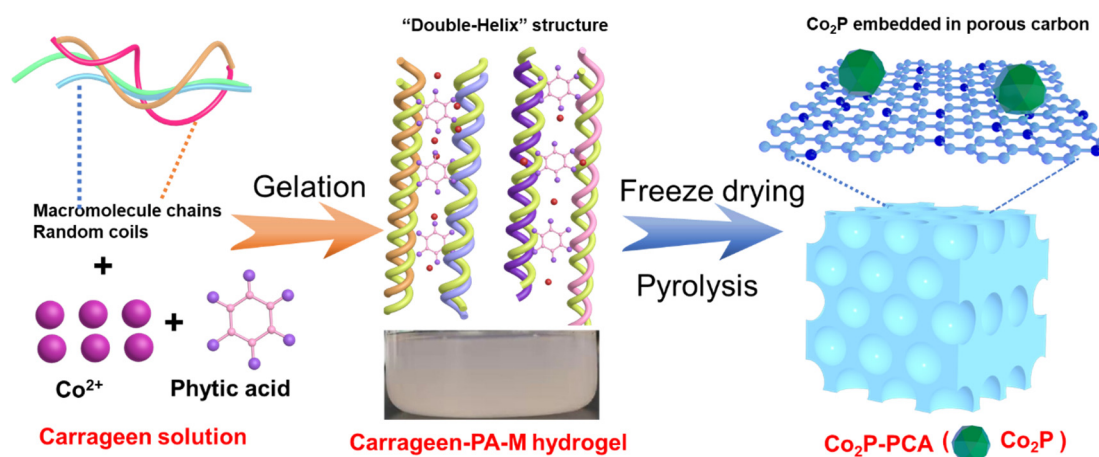


Fig. S1 Schematic of the synthesis process of the Co<sub>2</sub>P-PCA catalyst.

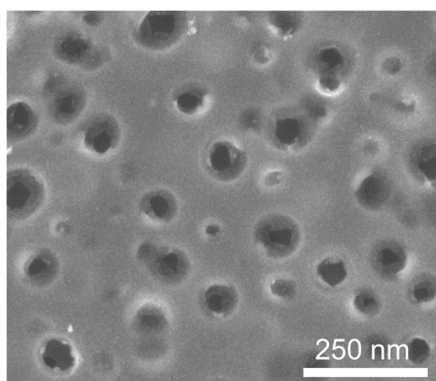


Fig. S2 SEM image of Co<sub>2</sub>P-PCA-800.

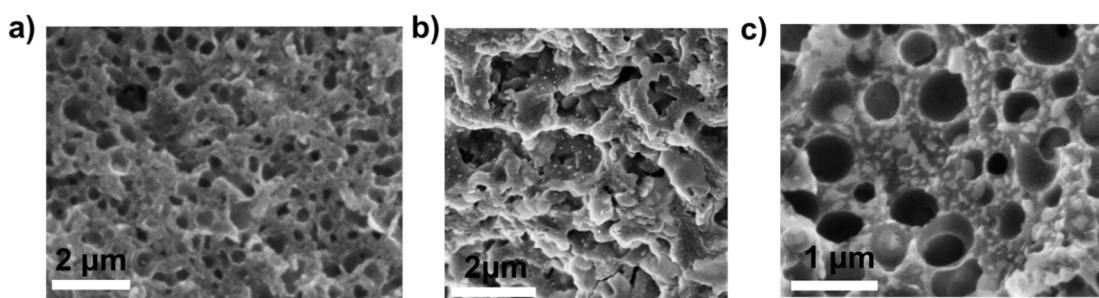


Fig. S3 SEM image of a) Co-CA; b) PCA and c) Co<sub>2</sub>P-PCA-800.

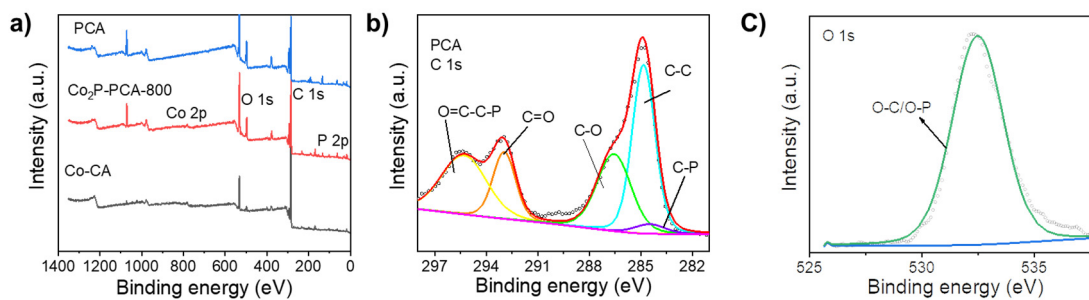


Fig. S4 a) XPS survey spectrum of Co-CA, Co<sub>2</sub>P-PCA-800 and PCA; b) C 1s of PCA; c) O 1s of Co<sub>2</sub>P-PCA-800.

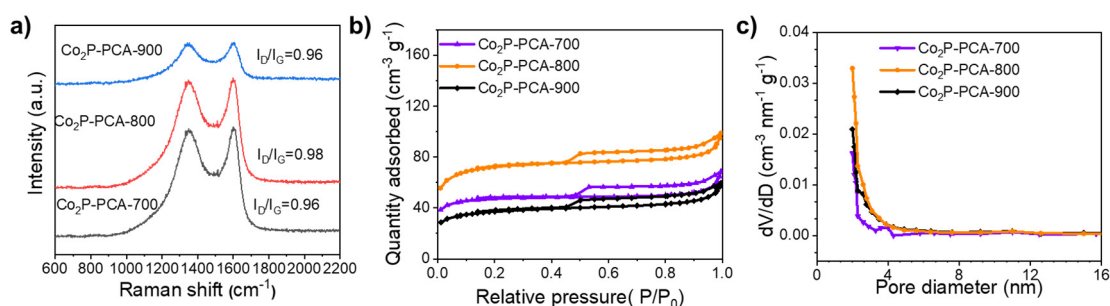


Fig. S5 a) Raman spectrum of Co<sub>2</sub>P-PCA-700, Co<sub>2</sub>P-PCA-800 and Co<sub>2</sub>P-PCA-900; (b, c) Nitrogen adsorption-desorption isotherms and pore-size distribution of Co<sub>2</sub>P-PCA-700, Co<sub>2</sub>P-PCA-800 and Co<sub>2</sub>P-PCA-900.

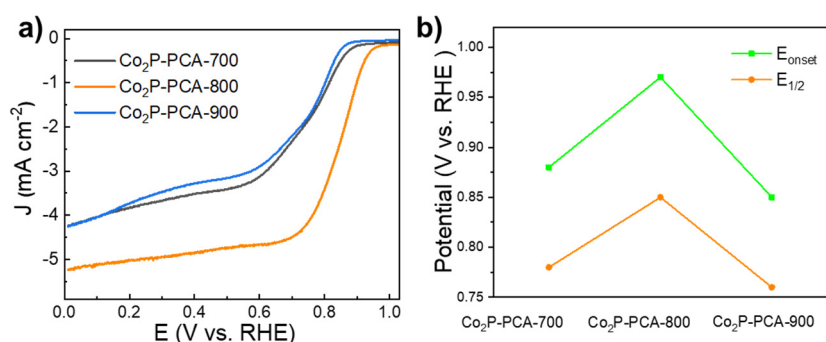


Fig. S6 a) ORR polarization curves in O<sub>2</sub>-saturated 0.1 mol·L<sup>-1</sup> KOH (rotation speed: 1600 rpm) for Co<sub>2</sub>P-PCA at different temperature; (b) Comparison of the onset (E<sub>onset</sub>) and half-wave (E<sub>1/2</sub>) potentials of different catalysts.

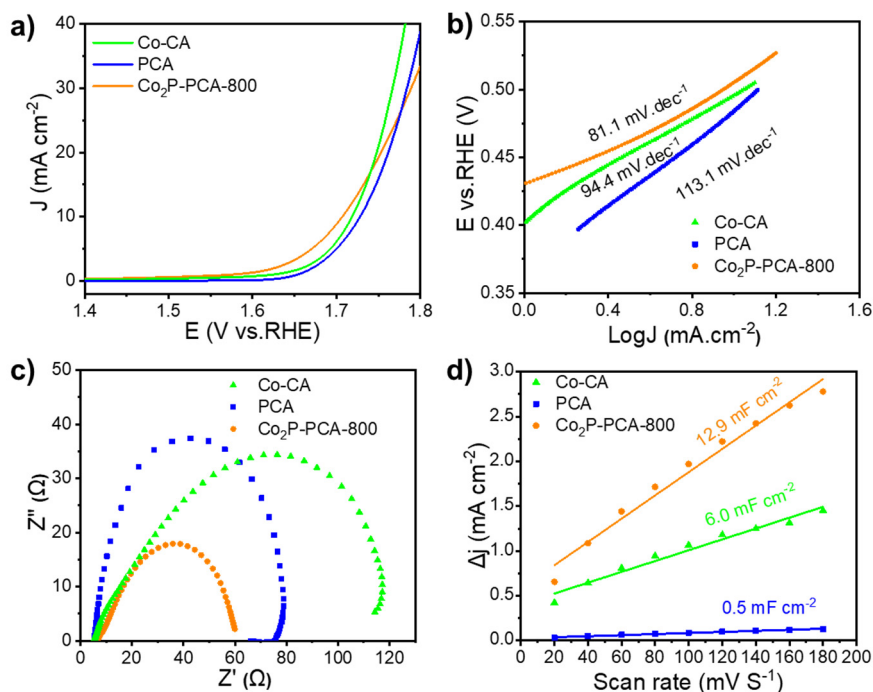


Fig. S7 a) OER polarization curves in O<sub>2</sub>-saturated 1 mol·L<sup>-1</sup> KOH (rotation speed: 1600 rpm); b) Tafel plots derived from (a); c) Nyquist plots at an overpotential of 430 mV; d) Current density difference at 1.326 V plotted against scan rate in a non-Faradaic range.

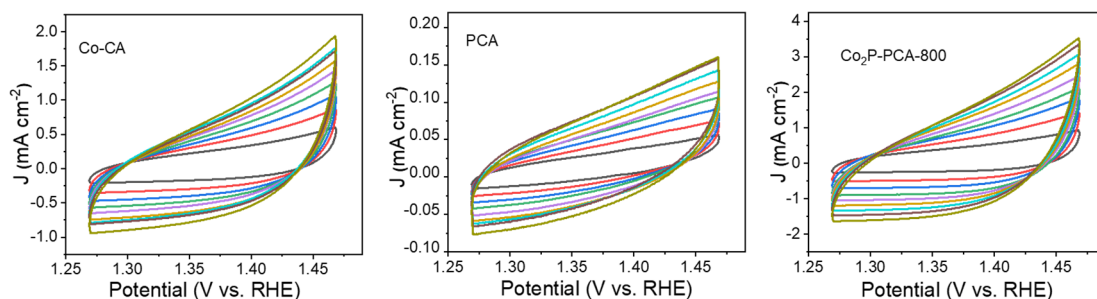


Fig. S8 Cyclic voltammetry (CV) curves in the potential range of 1.27–1.37 V at different scan rates.

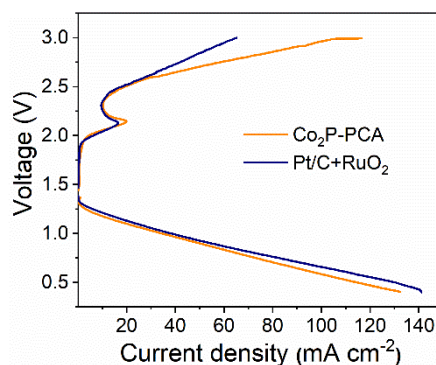


Fig. S9 Charge and discharge polarization curves of Co<sub>2</sub>P-PCA-800 and Pt/C||RuO<sub>2</sub>

Table S1 Summary on the surface areas, total pore volumes, and pore sizes of Co-CA, PCA, Co<sub>2</sub>P-PCA-700, Co<sub>2</sub>P-PCA-800 and Co<sub>2</sub>P-PCA-900.

Samples	$S_{\text{BET}}/(\text{m}^2\cdot\text{g}^{-1})$	$V_{\text{pore}}/(\text{cm}^3\cdot\text{g}^{-1})$	Pore size/nm
Co-CA	42.53	0.043	16.29
PCA	229.18	0.165	8.35
Co <sub>2</sub> P-PCA-700	164.89	0.091	10.22
Co <sub>2</sub> P-PCA-800	266.98	0.136	6.13
Co <sub>2</sub> P-PCA-900	137.05	0.080	2.22

Table S2 Summary of recently reported transition metal phosphide metal based catalytic performances of bifunctional oxygen electrodes in 0.1 mol·L<sup>-1</sup> KOH.

Catalysts	ORR onset potential (V vs. RHE)	ORR half-wave potential (V vs. RHE)	OER potential at 10 mA·cm <sup>-2</sup> (V vs. RHE)	Reference
Co <sub>2</sub> P-PCA-800	0.97	0.84	1.82	This work
Pt/C	1.04	0.85	–	This work
Co <sub>2</sub> P/CoN-in-NCNTs	0.96	0.85	1.55	Ref. 1
Co <sub>2</sub> P@CNF	0.91	0.80	1.69	Ref. 2
BNC/Co <sub>2</sub> P-3	0.91	0.84	–	Ref. 3
7.1%CuCo <sub>2</sub> P@2D-NPC	0.95	0.83	1.57	Ref. 4
In-CoO/CoP FNS	0.94	0.81	1.60	Ref. 5
CoP NCs	0.8	0.7	–	Ref. 6

## References

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