

## Supporting material

### **Accurately manipulating hierarchical flower-like Fe<sub>2</sub>P@CoP@nitrogen-doped carbon spheres as an efficient carrier material of Pt-based catalyst**

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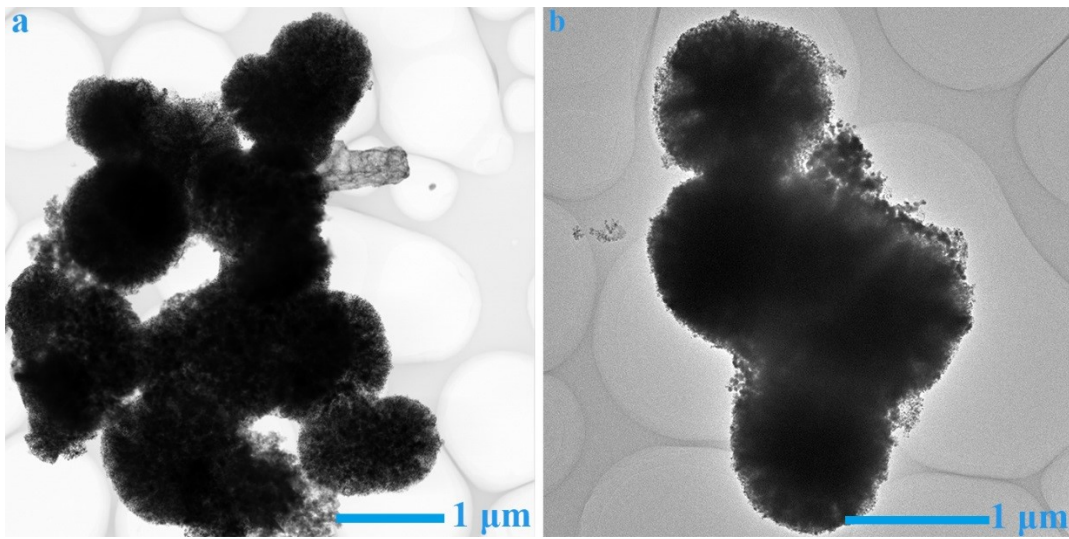
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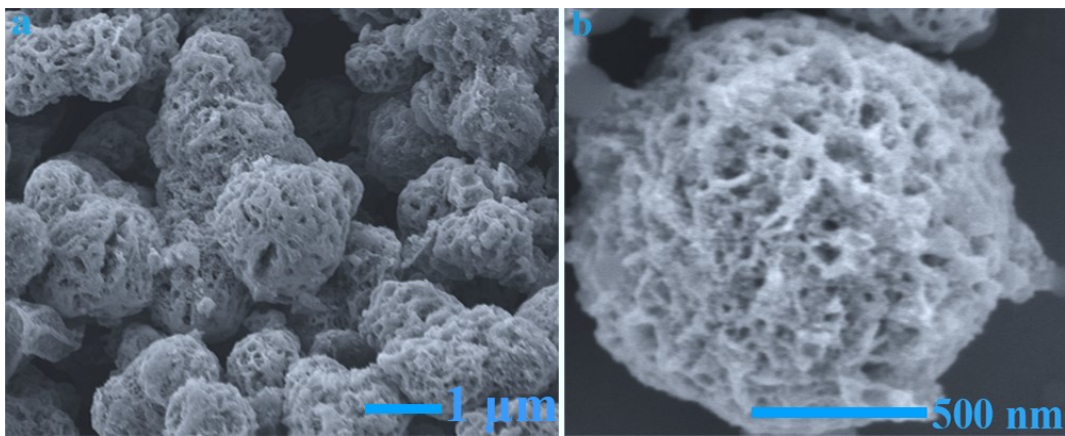
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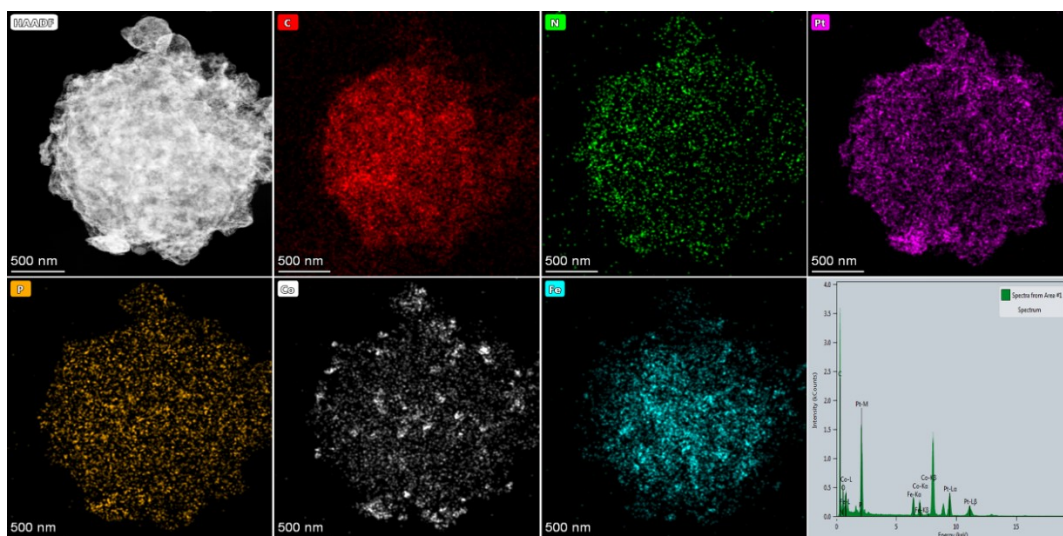
\*\*Corresponding author. E-mail address: mlsys607@126.com.



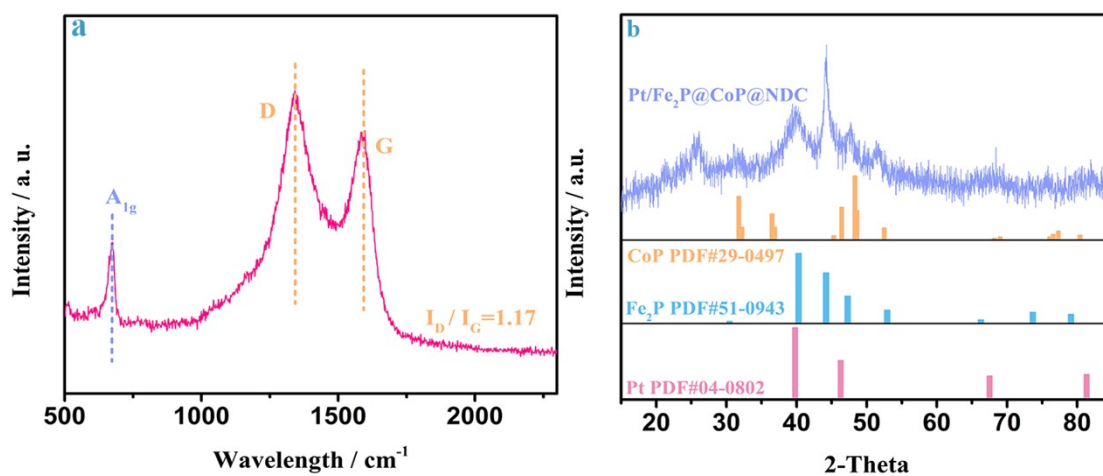
**Fig. S1** TEM images of  $\text{Fe}_2\text{P}@CoP@NDC$



**Fig. S2** SEM images of  $\text{Pt}/\text{Fe}_2\text{P}@CoP@NDC$  porous spheres.



**Fig. S3** EDS mapping images of Pt/Fe<sub>2</sub>P@CoP@NDC porous spheres.



**Fig. S4** Raman spectrum (a) of flower-like Fe<sub>2</sub>P@CoP@NDC spheres, XRD pattern (b) of Pt/Fe<sub>2</sub>P@CoP@NDC porous spheres.

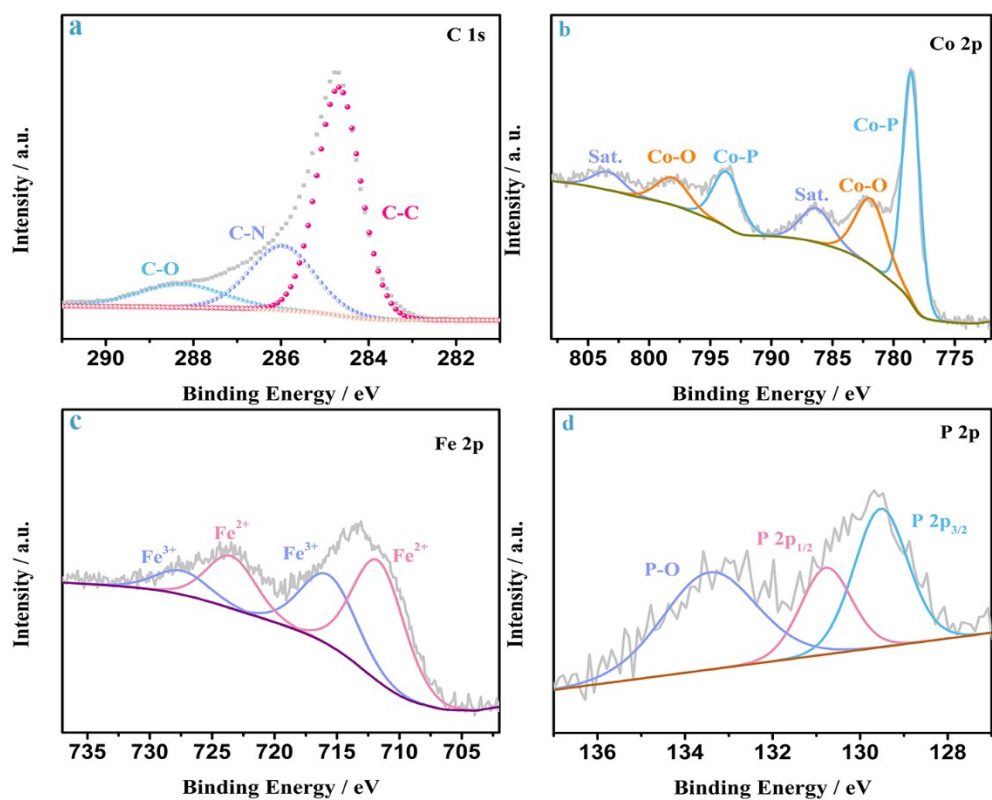


Fig. S5 XPS spectra of C 1s (a), Co 2p (b), Fe (c) and P 2p (d) for Pt/Fe<sub>2</sub>P@CoP@NDC porous spheres.

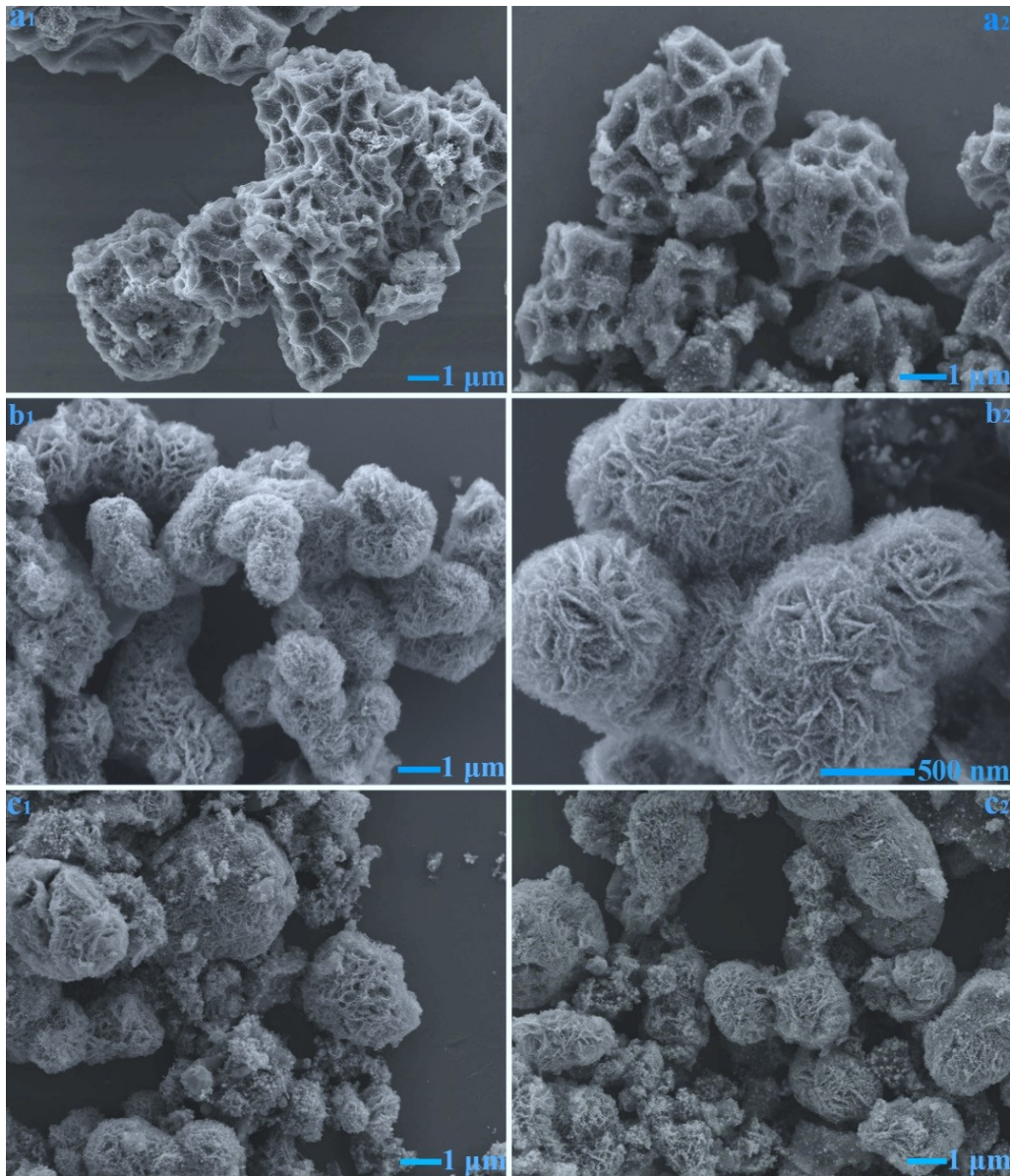
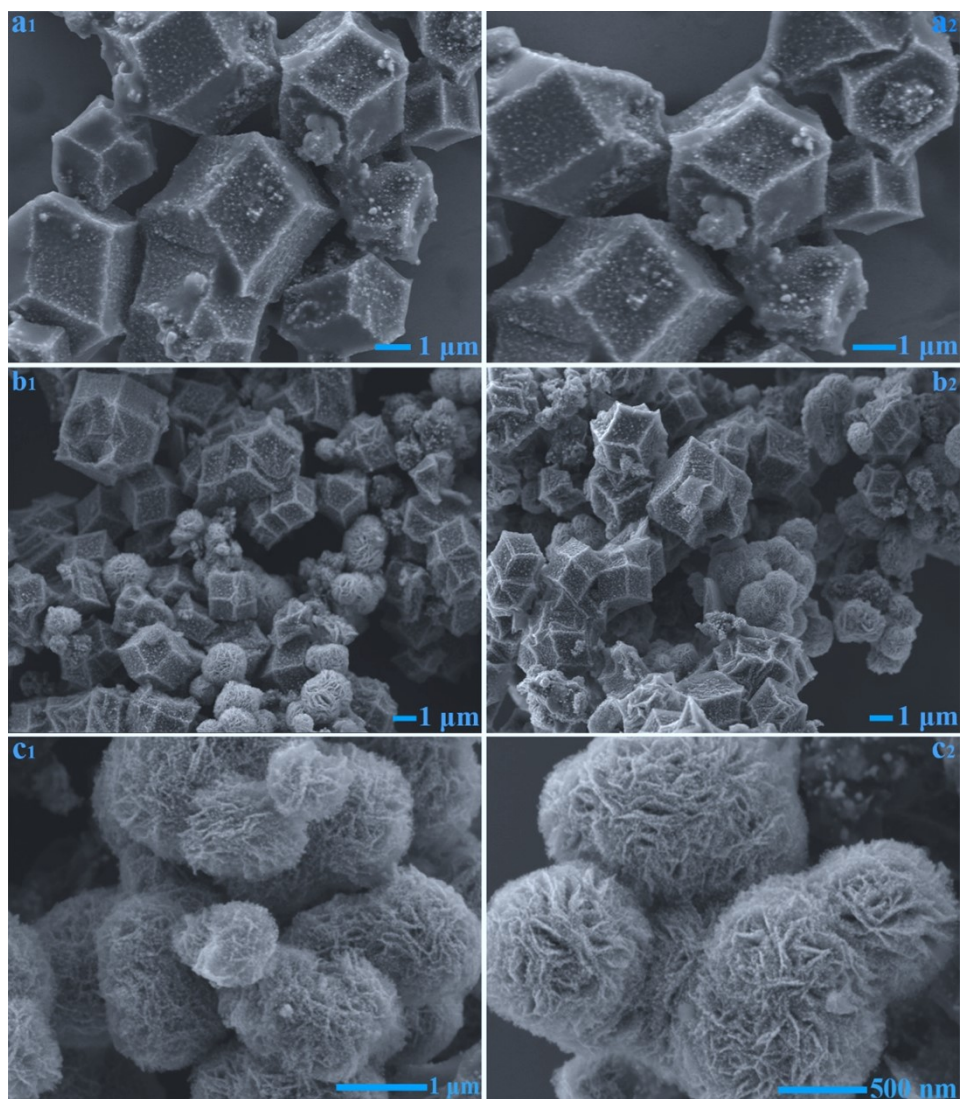
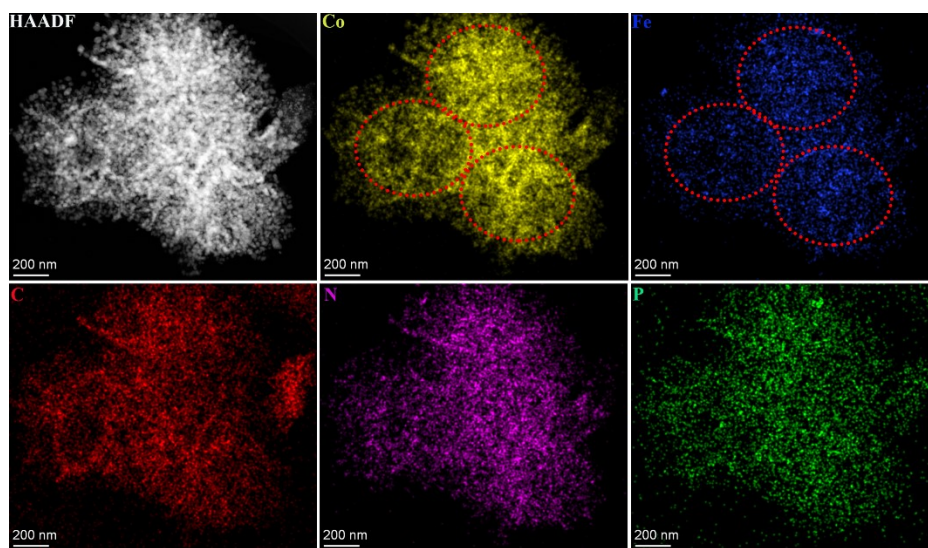


Fig. S6 SEM images of  $\text{Fe}_2\text{P}@CoP@NDC$  at different reaction times: 6 h (a), 12 h (b), 18 h (c).



**Fig. S7** SEM images of Fe<sub>2</sub>P@CoP@NDC at different amount of PVP: 0 g (a), 0.2 g (b), 0.4 g (c).



**Fig. S8** EDS mapping images of Fe<sub>2</sub>P@CoP@NDC

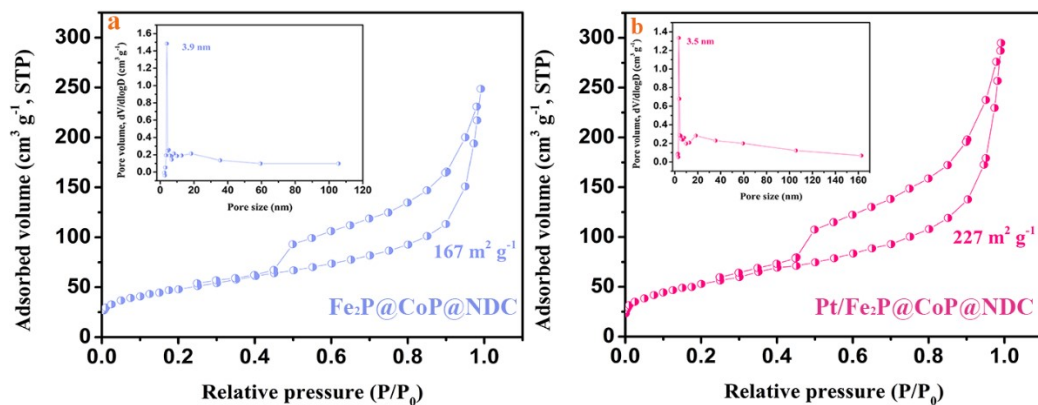


Fig. S9 Nitrogen adsorption/desorption isotherms of  $\text{Fe}_2\text{P@CoP@NDC}$  (a) and  $\text{Pt/Fe}_2\text{P@CoP@NDC}$  (b).

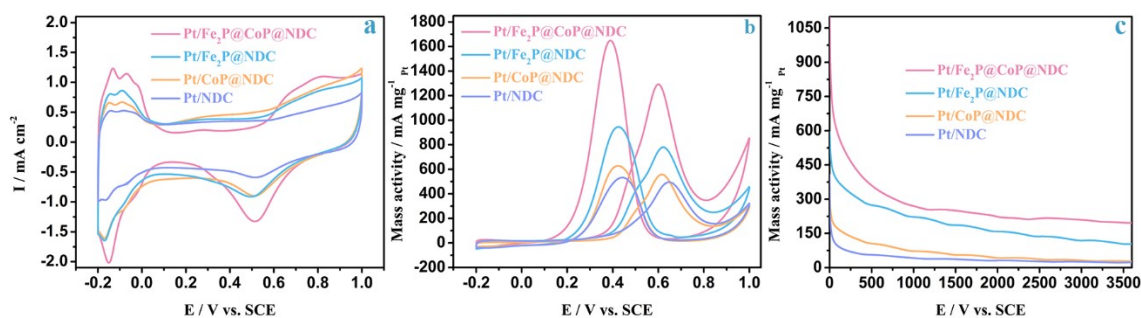


Fig. S10 CV curves (a), mass activity (b) and chronoamperometric curves (c) of  $\text{Pt/Fe}_2\text{P@CoP@NDC}$ ,  $\text{Pt/Fe}_2\text{P@NDC}$ ,  $\text{Pt/CoP@NDC}$  and  $\text{Pt/NDC}$  catalysts.

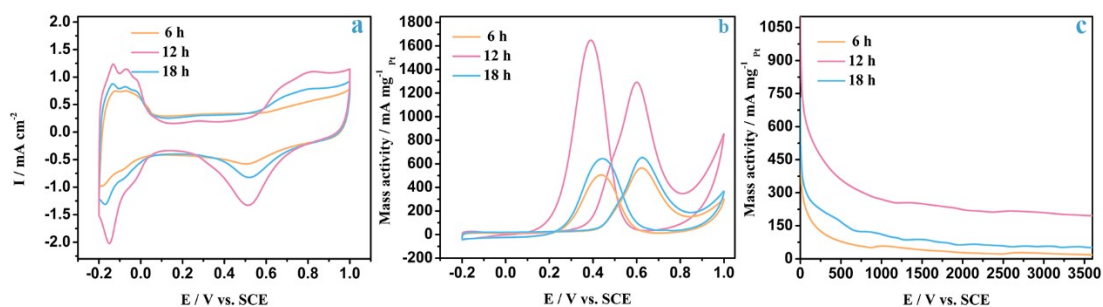
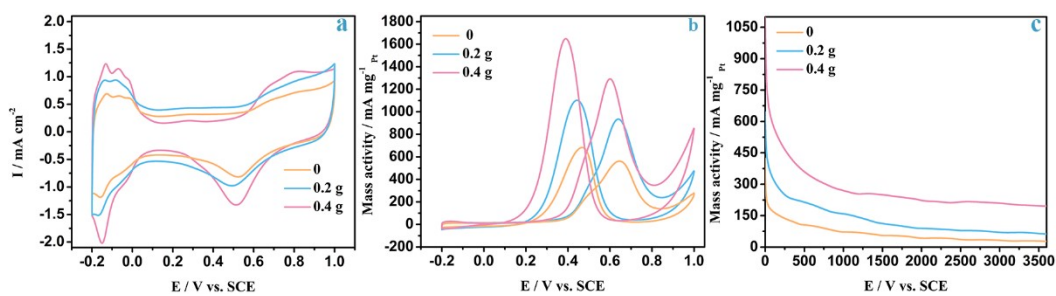


Fig. S11 CV curves (a), mass activity (b) and chronoamperometric curves (c) of  $\text{Pt/Fe}_2\text{P@CoP@NDC}$  catalyst at different reaction time: 6h, 12h and 18h.



**Fig. S12** CV curves (a), mass activity (b) and chronoamperometric curves (c) of Pt/Fe<sub>2</sub>P@CoP@NDC catalyst at different amount of PVP: 0 g, 0.2 g, 0.4 g.

**Table S1** The exact amount of metal in the Pt/Fe<sub>2</sub>P@CoP@NDC and commercial Pt/C catalysts obtained by ICP-OES.

Samples	Pt amount / wt%	Fe amount / wt%	Co amount / wt%
Pt/Fe <sub>2</sub> P@CoP@NDC	18.97	13.26	11.92
Commercial Pt/C	20	/	/

**Table S2** Relative content of three types Pt for Pt/Fe<sub>2</sub>P@CoP@NDC and commercial Pt/C catalysts.

Samples	Pt <sup>0</sup>		Pt <sup>2+</sup>		Pt <sup>4+</sup>	
	Binding energy / eV	Ratio %	Binding energy / eV	Ratio %	Binding energy / eV	Ratio %
Pt/Fe <sub>2</sub> P@CoP@NDC	71.35	70.32	72.45	18.67	73.84	11.01
	74.75		75.96		77.48	
Commercial Pt/C	71.45	61.33	72.57	26.21	74.20	12.46
	74.85		75.97		77.55	