Supporting information

Interfacial engineering of a tri-phase CoFe/$CoFeO_x$/Co-Fe_3O_4 electrocatalyst for promoting oxygen evolution reaction

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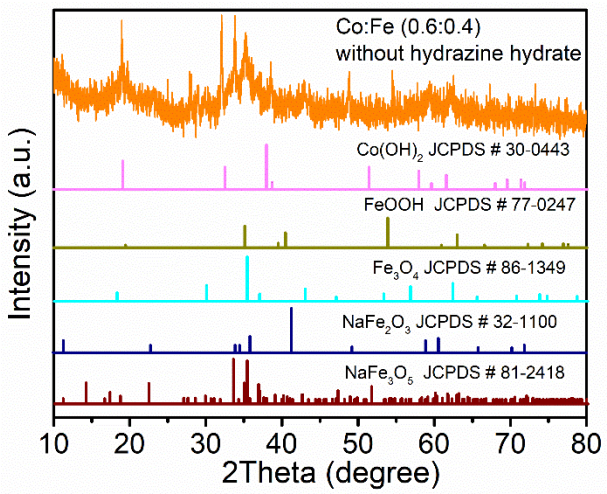


Fig. S1 The XRD pattern of the sample synthesized without hydrazine hydrate.

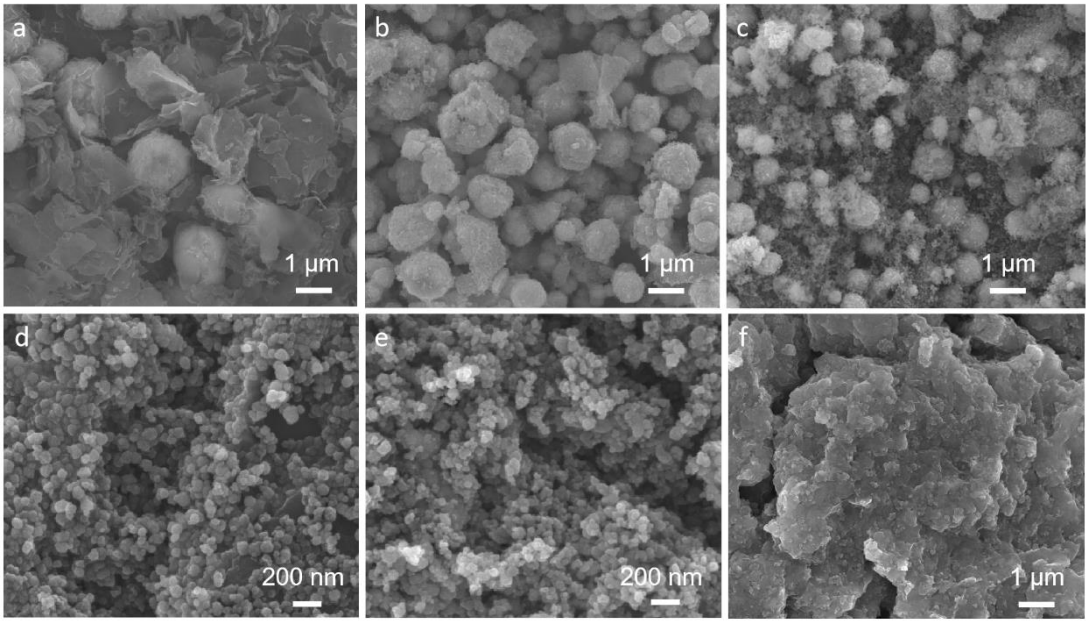


Fig. S2 FESEM images of the samples with different Co/Fe atom ratios: (a) 1:0, (b) 0.8:0.2, (c) 0.6:0.4, (d) 0.4:0.6, (e) 0.2:0.8, (f) 0:1.

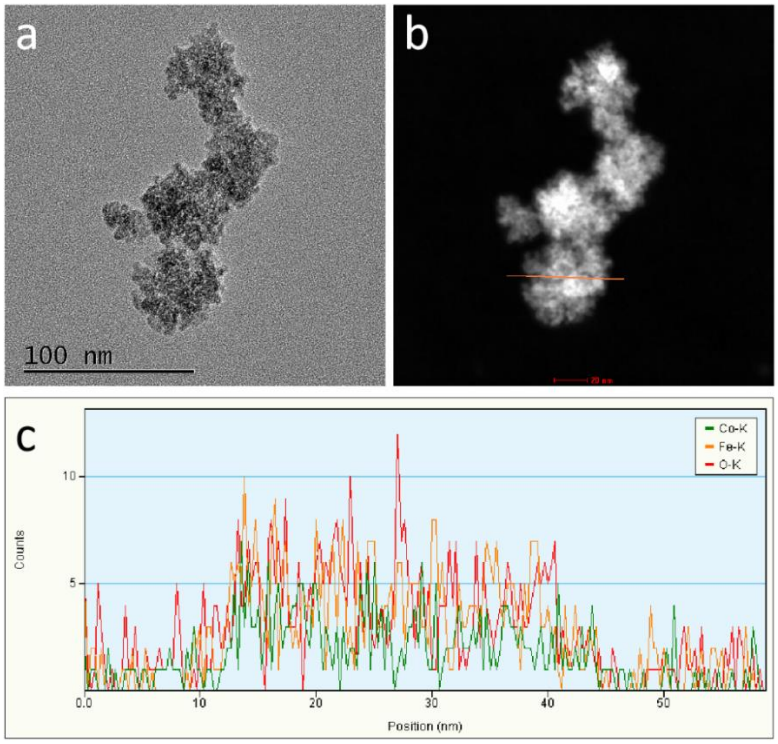
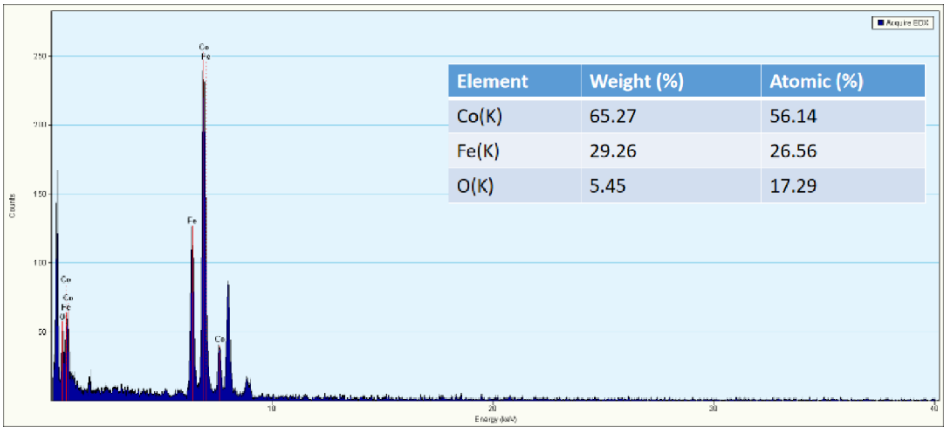


Fig. S3 (a) a typical TEM of the surrounded Co-Fe_3O_4 nanoparticles in CoFe/$CoFeO_x$/Co-Fe_3O_4 (0.4: 0.6), (b) HAADF-STEM image of the nanoparticles, and (c) the line-scan profile across the nanoparticles.



Element	Weight (%)	Atomic (%)
Co(K)	65.27	56.14
Fe(K)	29.26	26.56
O(K)	5.45	17.29

Fig. S4 EDS-TEM spectrum of the CoFe/$CoFeO_x$/Co-Fe_3O_4.

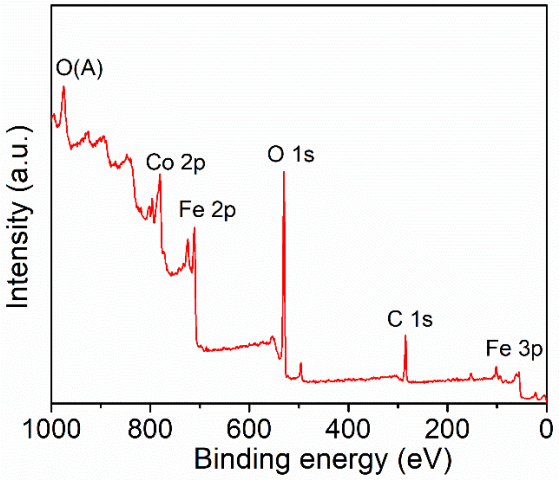


Fig. S5 XPS survey spectrum of the CoFe/CoFeO$_x$/Co-Fe$_3$O$_4$.

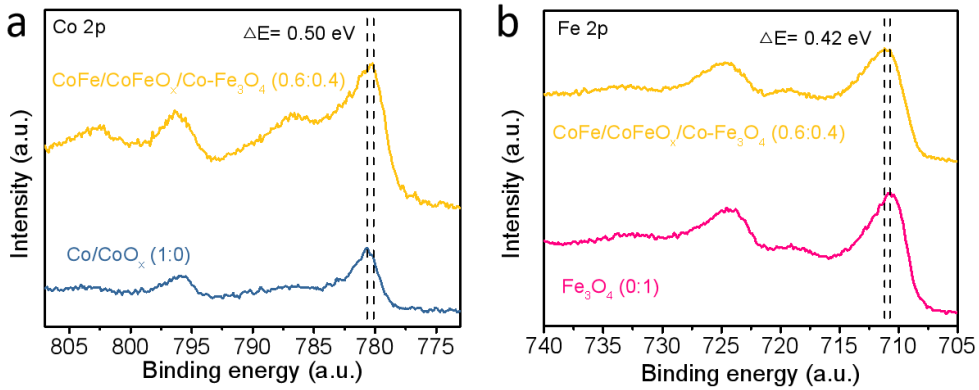


Fig. S6 XPS core level spectra of (a) the Co 2p and (b) the Fe 2p for different catalysts.

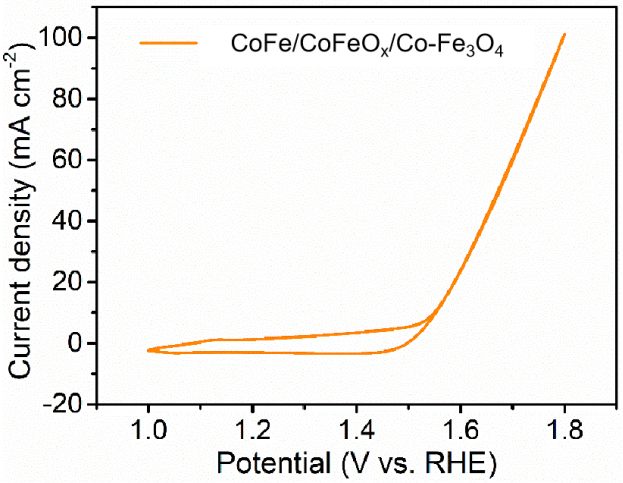


Fig. S7 CV curve of the CoFe/CoFeO$_x$/Co-Fe$_3$O$_4$ (0.6:0.4) at a scan rate of 50 mV s^{-1}.

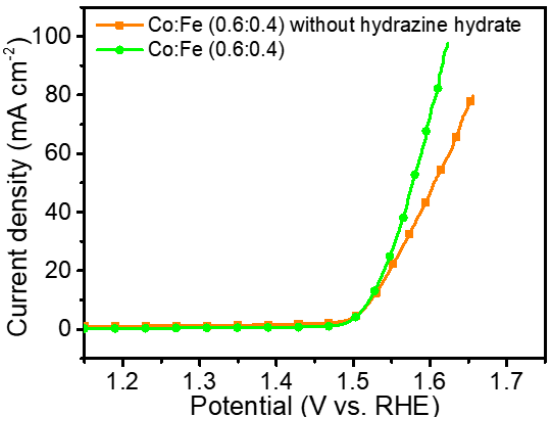


Fig. S8 The LSV curve of the sample synthesized without hydrazine hydrate.

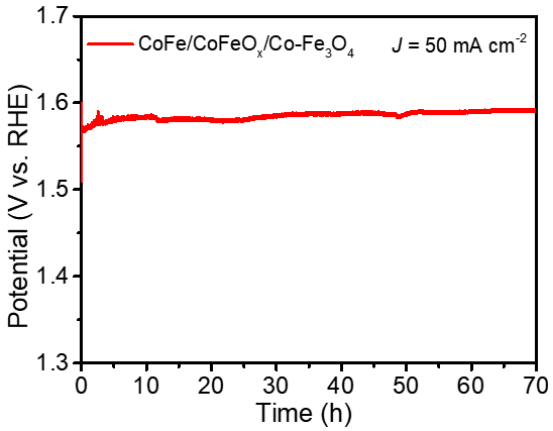


Fig. S9 The stability test of the $CoFe/CoFeO_x/Co\text{-}Fe_3O_4$ (0.6:0.4) for a long-term electrolysis of 70 h at 50 mA cm^{-2}.

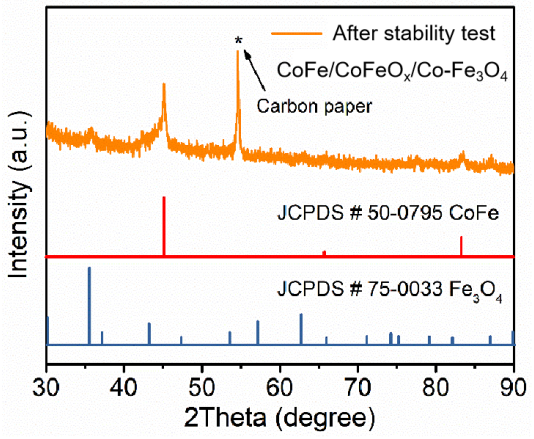


Fig. S10 XRD pattern of the spent $CoFe/CoFeO_x/Co\text{-}Fe_3O_4$ (0.6:0.4).

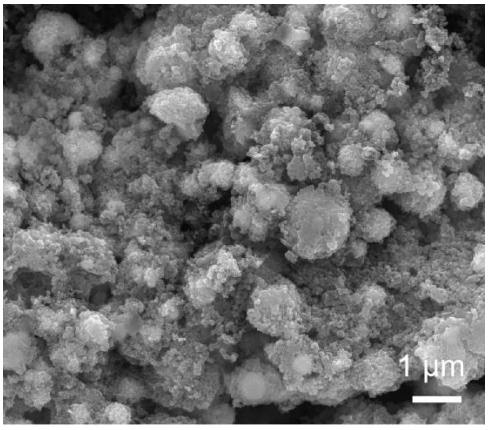


Fig. S11 FESEM image of the spent CoFe/$CoFeO_x$/Co-Fe_3O_4 (0.6:0.4).

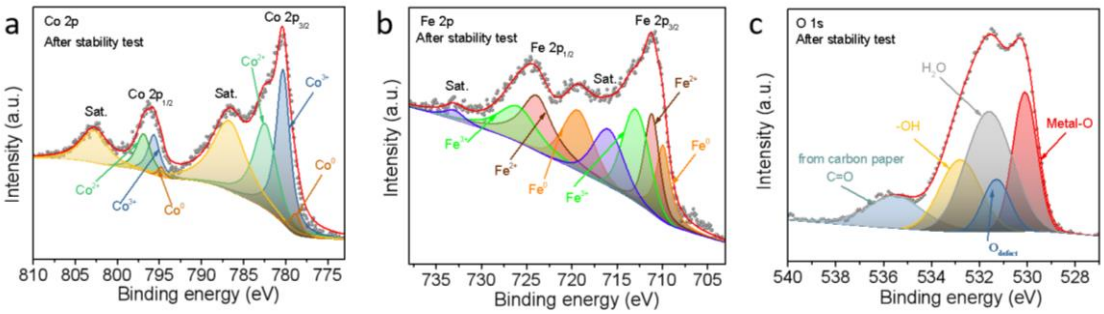


Fig. S12 XPS spectra of the spent CoFe/$CoFeO_x$/Co-Fe_3O_4 (0.6:0.4).

Table S1 OER performance comparison of recently reported CoFe-based electrocatalysts.

Catalysts	Overpotential (mV) @ 10 mA cm^{-2}	Tafel slope (mV dec^{-1})	Electrolyte	Substrate	Year published	Ref.
CoFeV hydroxide	376	26	1 M KOH	Glassy carbon	2021	[1]
CoFe alloy/N-doped carbon	340	77	1 M KOH	Glassy carbon	2022	[2]
La-doped CoFe layered double hydroxide	317	125	1 M KOH	Glassy carbon	2021	[3]
$CoFe_2O_4$/carbon nanotube	390	82	0.1 M KOH	Glassy carbon	2021	[4]
Se-doped Co-Fe sulfide	281	51.8	1 M KOH	Glassy carbon	2021	[5]
CoFe alloy/N-doped carbon nanosheets	285	39	1 M KOH	Glassy carbon	2021	[6]
CoFe/S, N co-doped carbon nanotubes	358	259	0.1 M KOH	Glassy carbon	2021	[7]
N-doped CoFe phosphate	313	58.92	1 M KOH	Glassy carbon	2021	[8]
Mesoporous Co-Fe oxides	280	68	1 M KOH	Glassy carbon	2021	[9]
Co_3Fe_1-layered double hydroxides	314	79.4	1 M KOH	Glassy carbon	2022	[10]
Tri-phase $CoFe/CoFeO_x/Co\text{-}Fe_3O_4$	291	47.8	1 M KOH	Carbon paper	–	This work

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