Electronic Supplementary Material (ESI) for Analyst.
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Supporting Information

Synergetic enhancement of electrochemical H_2O_2 detection in nitrogen-doped carbon encapsulated FeCo alloy architecture

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Materials and reagents

Iron(III) nitrate nonahydrate ($Fe(NO_3)_3 \cdot 9H_2O$), cobalt(II) acetate tetrahydrate ($Co(AC)_2 \cdot 4H_2O$), dopamine (DA), urea (Urea), glucose (Glu), sucrose (Sur), frucose (Fru),ascorbic acid (AA), potassium chloride (KCl) and sodium chloride (NaCl) were purchased from Aladdin Industrial Inc. Ethylene diamine tetraacetic acid tetrasodium (EDTA·4Na), $K_2HPO_4 \cdot 3H_2O$, $KH_2PO_4 \cdot 3H_2O$ and hydrogen peroxide (H_2O_2) were purchased from Chengdu Kelong reagent Co., Ltd. Milk and orange juice purchased from Walmart. The serum samples were obtained from Sichuan University. The phosphate buffer solution (0.1 M, pH = 7.4, PBS) was used as a supporting electrolyte. A stock solution of H_2O_2 (10.0 mM) was prepared daily by diluting 35 % (v/v) H_2O_2 into 10 mL with distilled water. All of these reagents were analytical grade without further treatment and deionized water (Mill Q, 18.2 MΩ) was used.

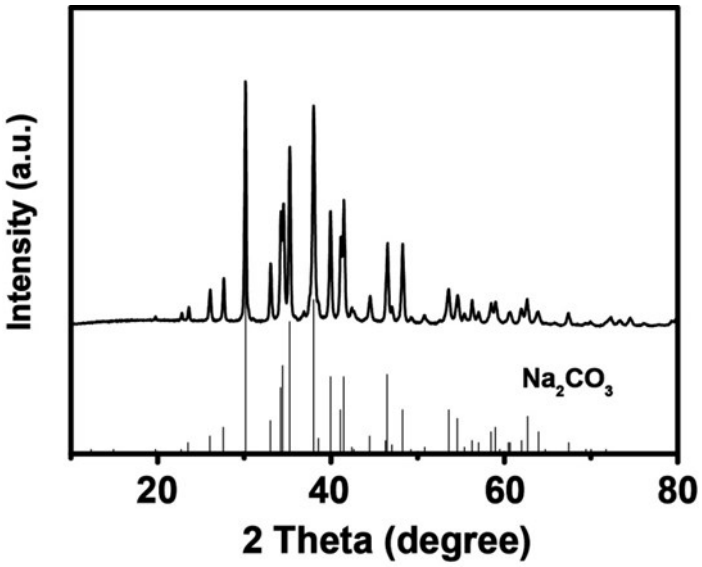

Fig. S1 XRD pattern of the carbonized product of EDTA-4Na.

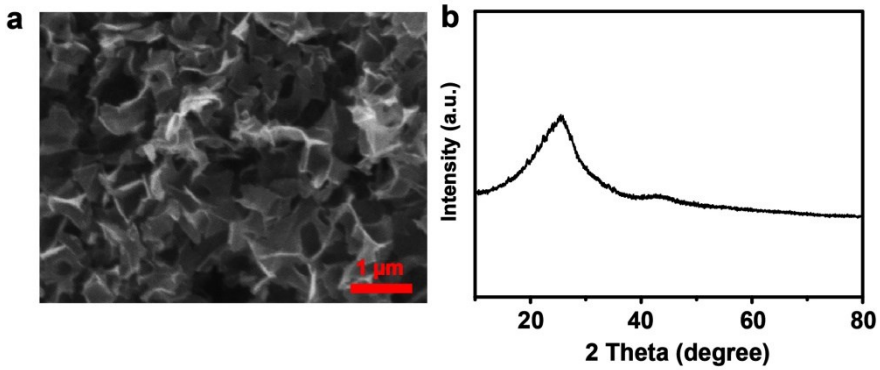

Fig. S2 SEM image (a) and XRD pattern (b) of $Fe_{0.06}Co_{0.04}$/NPC.

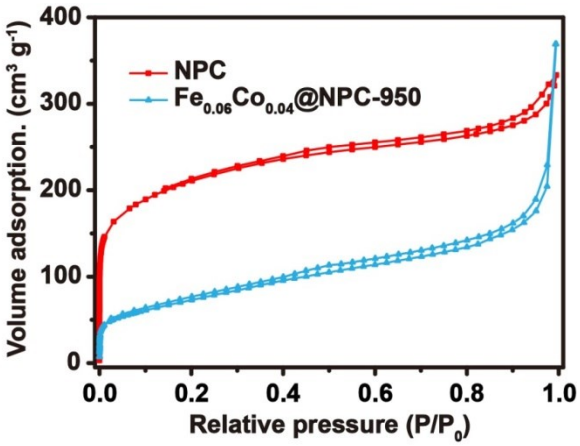

Fig. S3 N_2 adsorption–desorption isotherms of NPC and $Fe_{0.06}Co_{0.04}$@NPC-950.

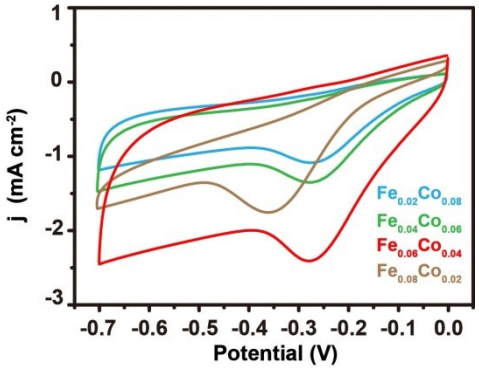

Fig. S4 CVs of $Fe_{0.02}Co_{0.08}$@NPC-950, $Fe_{0.04}Co_{0.06}$@NPC-950, $Fe_{0.06}Co_{0.04}$@NPC-950 and $Fe_{0.08}Co_{0.02}$@NPC-950 in 0.1 M PBS at a scan rate of 50 mV s^{-1} in 7 mM H_2O_2 with potential range of 0 to -0.7 V.

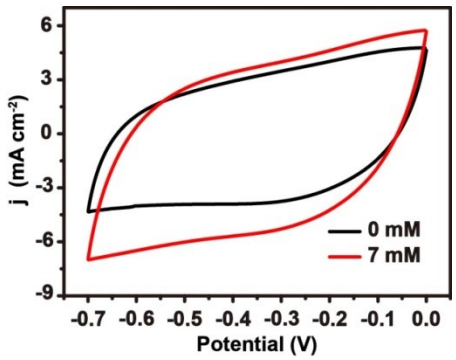

Fig. S5 CVs of NPC in PBS containing 0 and 7 mM H_2O_2.

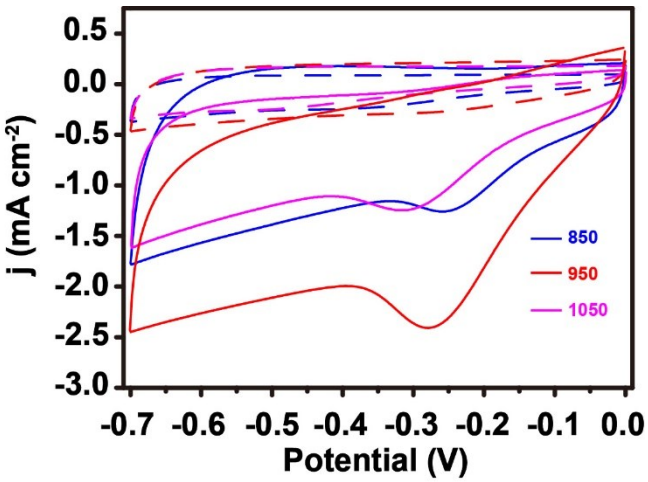

Fig. S6 CVs of $Fe_{0.06}Co_{0.04}$@NPC-850, $Fe_{0.06}Co_{0.04}$@NPC-950 and $Fe_{0.06}Co_{0.04}$@NPC-1050 in 0.1 M PBS at a scan rate of 50 mV s^{-1} in 0 mM and 7 mM H_2O_2 with potential range of 0 to -0.7 V.

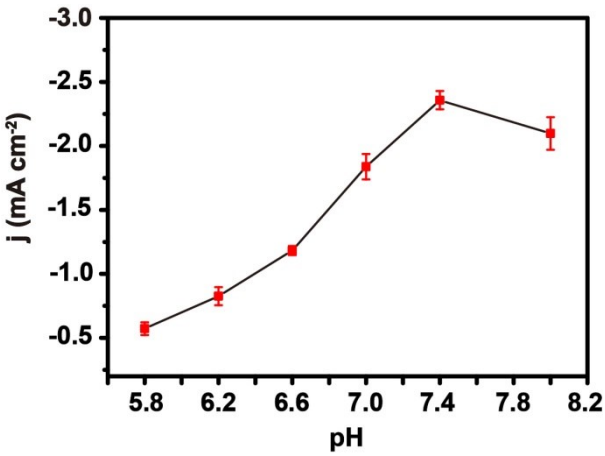

Fig. S7 Current intensity change with the pH values changed from 5.8 to 8.0.

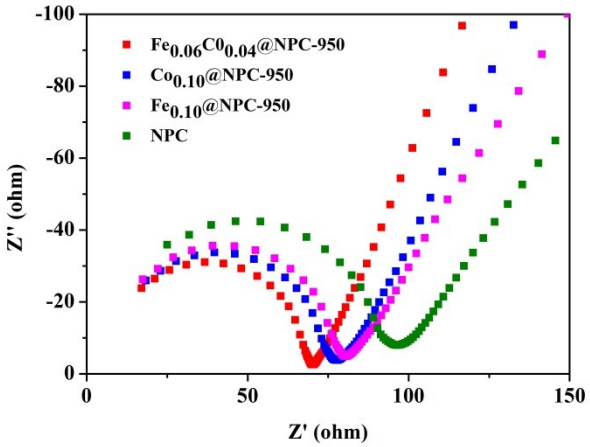

Fig. S8 EIS of $Fe_{0.06}Co_{0.04}$@NPC-950, $Fe_{0.10}$@NPC-950, $Co_{0.10}$@NPC-950 and NPC in 0.1 M PBS containing 1.0 mM H_2O_2.

Table S1. The iron and cobalt content of as-prepared catalysts detected by ICP-OES.

Samples	Concentration (Fe/mg L^{-1})	Concentration (Co/mg L^{-1})	Volume (L)	Mass total (mg)	Fe (wt. %)	Co (wt. %)
$Fe_{0.06}Co_{0.04}$/NPC	2.589	1.464	10	4	0.98	0.47
$Fe_{0.06}Co_{0.04}$@NPC	1.533	0.585	10	4	0.38	0.13

Table S2. Comparison of the sensor modified by $Fe_{0.06}Co_{0.04}$@NPC-950 with reported electrochemical H_2O_2 sensors.

Catalysts/Electrodes	Sensitivity ($\mu A\ mM^{-1}\ cm^{-2}$)	Linear range (mM)	Detection limit (μM)	Referrence
AuPd-PDA	83.1	0.001-11.22	0.26	[1]
CoFe/NGR-2	435.7	0.001-8.564	0.28	[2]
Ni_2P NA/TM	690.7	0.001-20	0.2	[3]
Co_3N NW/TM	139.9	0.002-28	1	[4]
Fe_3O_4/graphene	274.15	0.008-0.3344	0.078	[5]
GN/FeOOH	265.7	0.00025-1.2	0.08	[6]
ZIF-67/rGO/GCE	51.86	0.005–2.15	1.5	[7]
	19.44	2.15–11.15		
hollow CuO/PANI fibers	-	0.005-9.255	0.11	[8]
Fe-NGCs	184.4	0.001-5	0.53z.star	[9]
MXene/$NiCo_2S_4$	267	-	0.193	[10]
Co@MOF-808	382.27	0.01-0.45	1.3	[11]
3D $Co_{0.6}Ni_{0.4}Se_2$ NWs	89;	0.0005-6;	0.16	[12]
	31.8	6-15		
Vit.B_{12}-NGr	4.08	0.02 -0.168	-	[13]
Gox/CoS-MWCNTs	15	0.008 - 1.5	5	[14]
$NiCo_2O_4$/$CoNiO_2$@$pRGO_{600}$	1.295;	0.005–3;	0.41	[15]
	0.936	3–12		
$Fe_{0.06}Co_{0.04}$@NPC-950	794	0.004-8	0.13	This work.

Table S3. Summarized results for the detection of H_2O_2 in real samples by using $Fe_{0.06}Co_{0.04}$@NPC-950.

Samples	Added (μM)	Found (μM)	Recovery (%)	R.S.D (%)[a]
Milk	10	8.96	89.6	1.12
Orange juice	10	9.72	97.2	1.07
Serum	10	10.28	102.8	0.78

[a] Relative standard deviation estimated from three separated experiments

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