Supporting information

Robust FeCo Nanoparticles Embedded in N-doped Porous Carbon Framework for High Oxygen Conversion Catalytic Activity in Alkaline and Acidic Media

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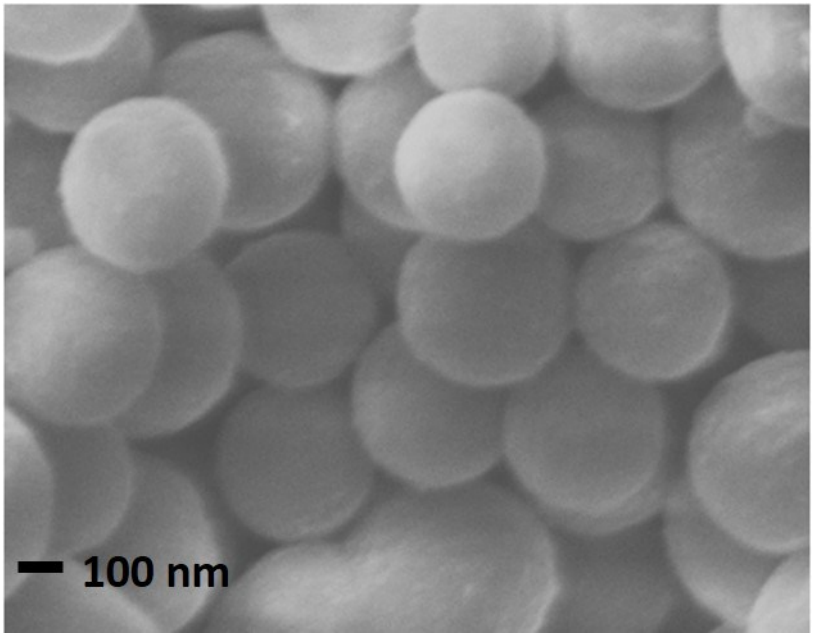

Figure S1. Scanning electron microscope (SEM) image of bare PDA sub-microspheres.

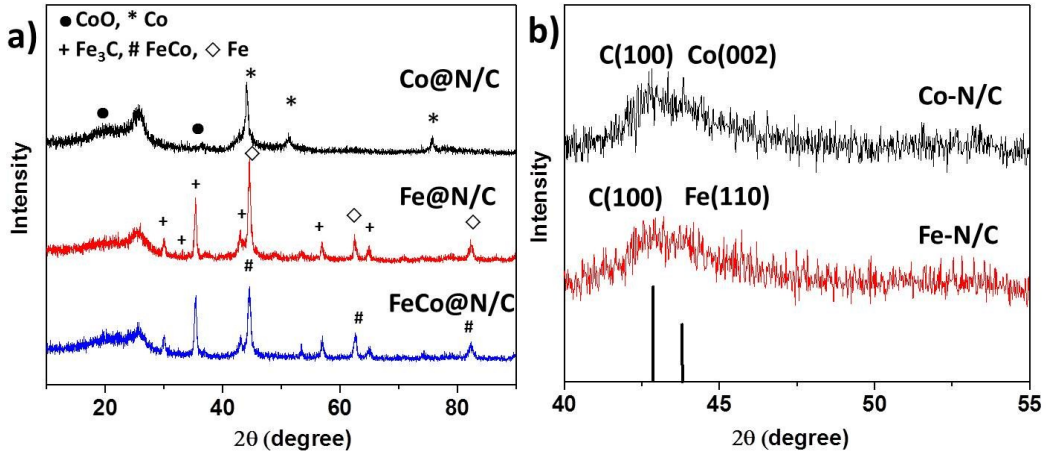

Figure S2. (a) XRD patterns of M@N-C (Co@N/C, Fe@N/C, and FeCo@N/C) before acid leaching. (b) High resolution XRD patterns in the range of 40-60º for Co-N/C and Fe-N/C.

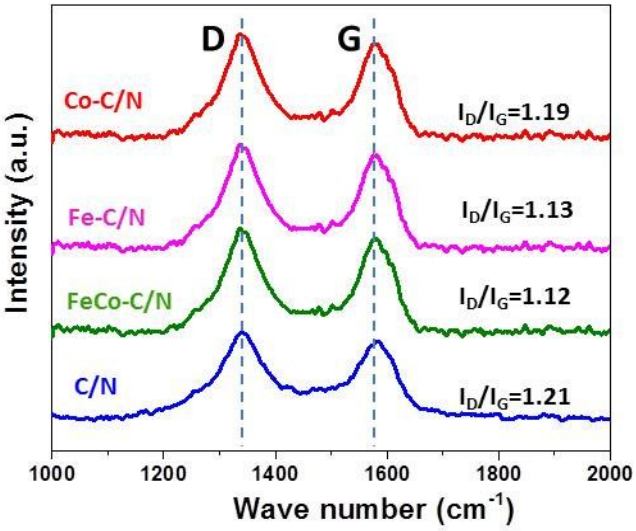

Figure S3. Raman spectra of bare N/C, Co-N/C, Fe-N/C, and FeCo-N/C.

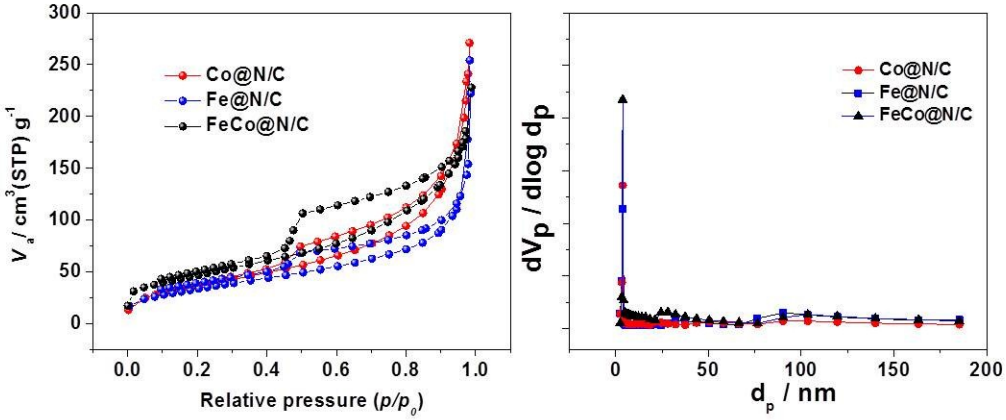

Figure S4. Nitrogen adsorption/desorption isotherms and corresponding pore size distributions of Fe@N/C, Co@N/C, and FeCo@N/C.

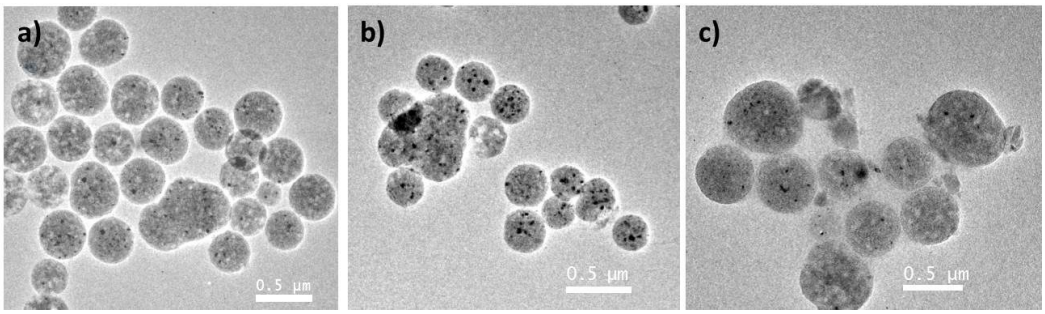

Figure S5. TEM images of FeCo-N/C (a), Fe-N/C (b), and Co-N/C (c).

Table S1. The average pore size and pore volume of the bare N/C, M@N/C (Fe@N/C, Co@N/C, and FeCo@N/C), and M-N/C (Fe-N/C, Co-N/C, and FeCo-N/C) according to N_2 adsorption/desorption measurements.

	Surface area (m^2/g)	Pore volume (cm^3/g)	BJH pore diameter (nm)
N/C	214.8	0.17	2.1
Fe@N/C	220.6	0.21	4.2
Co@N/C	266.6	0.34	4.5
FeCo@N/C	268.9	0.31	5.0
Fe-N/C	384.5	0.43	8.0
Co-N/C	417.7	0.46	15.4
FeCo-N/C	442.6	0.47	19.0

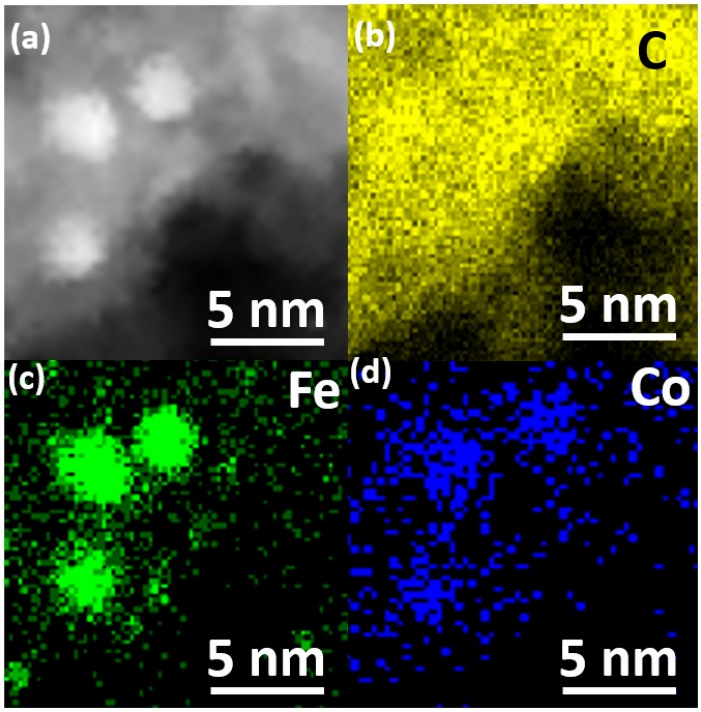

Figure S6. (a) TEM image and (b-e) selected-area HR-EDS mapping for Co and Fe for the indivial nanoparticle embedded in carbon layer.

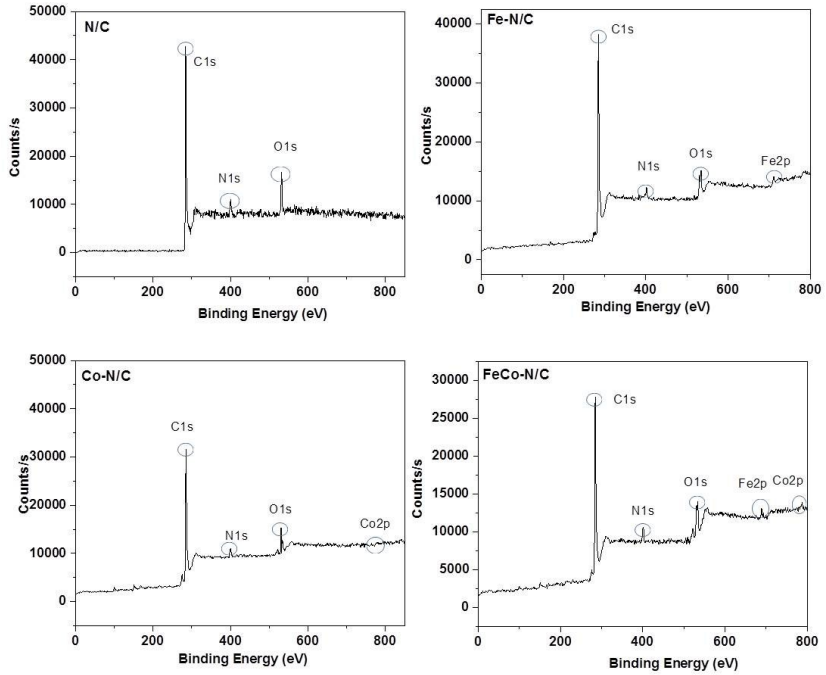

Figure S7. XPS survey scans of bare N/C, Fe-N/C, Co-N/C, and FeCo-N/C.

Table S2. Elemental compositions of bare C/N, Fe-N/C, Co-N/C, and FeCo-N/C, as determined by XPS.

	C atom %	N atom %	O atom %	NPM atom %
N/C	92.4	4.7	2.9	
Co-N/C	91.5	5.9	2.2	0.4
Fe-N/C	91.6	6.0	1.8	0.6
FeCo-N/C	91.8	5.4	2.2	Co: 0.3 Fe: 0.4

Table S3.Contents of metals in the M-N/C obtained by ICP-OES.

	Fe-N/C	Co-N/C	FeCo-N/C
Fe (atom.%)	0.71	-	0.42
Co (atom.%)	-	0.59	0.36

Table S4. Summary of quantitative analysis of N 1s XPS spectra for bare N/C, Co-N/C, Fe-N/C, and FeCo-N/C.

	Pyridinic-N (%)	Pyrrolic-N	Graphitic-N	Pyridinic-N^+-O^-
N/C	26.1	27.1	32.5	14.3
Co-N/C	49.2	3.4	37.8	9.6
Fe-N/C	50.6	6.0	33.4	10.2
FeCo-N/C	42.8	6.5	39.4	11.3

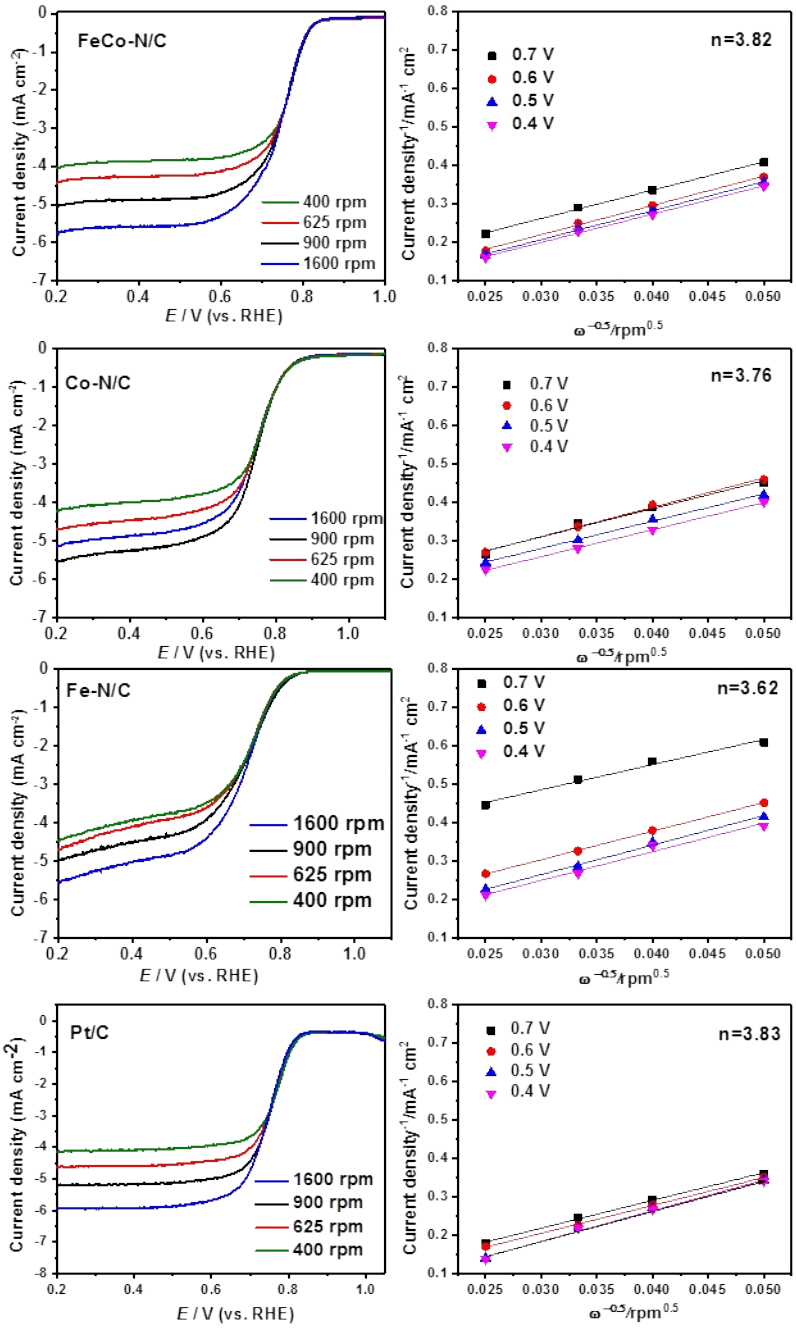

Figure S8. LSV curves of various catalysts in O_2-saturated 0.1 M KOH electrolyte at different rotation rates and corresponding Koutecky-Levich plots.

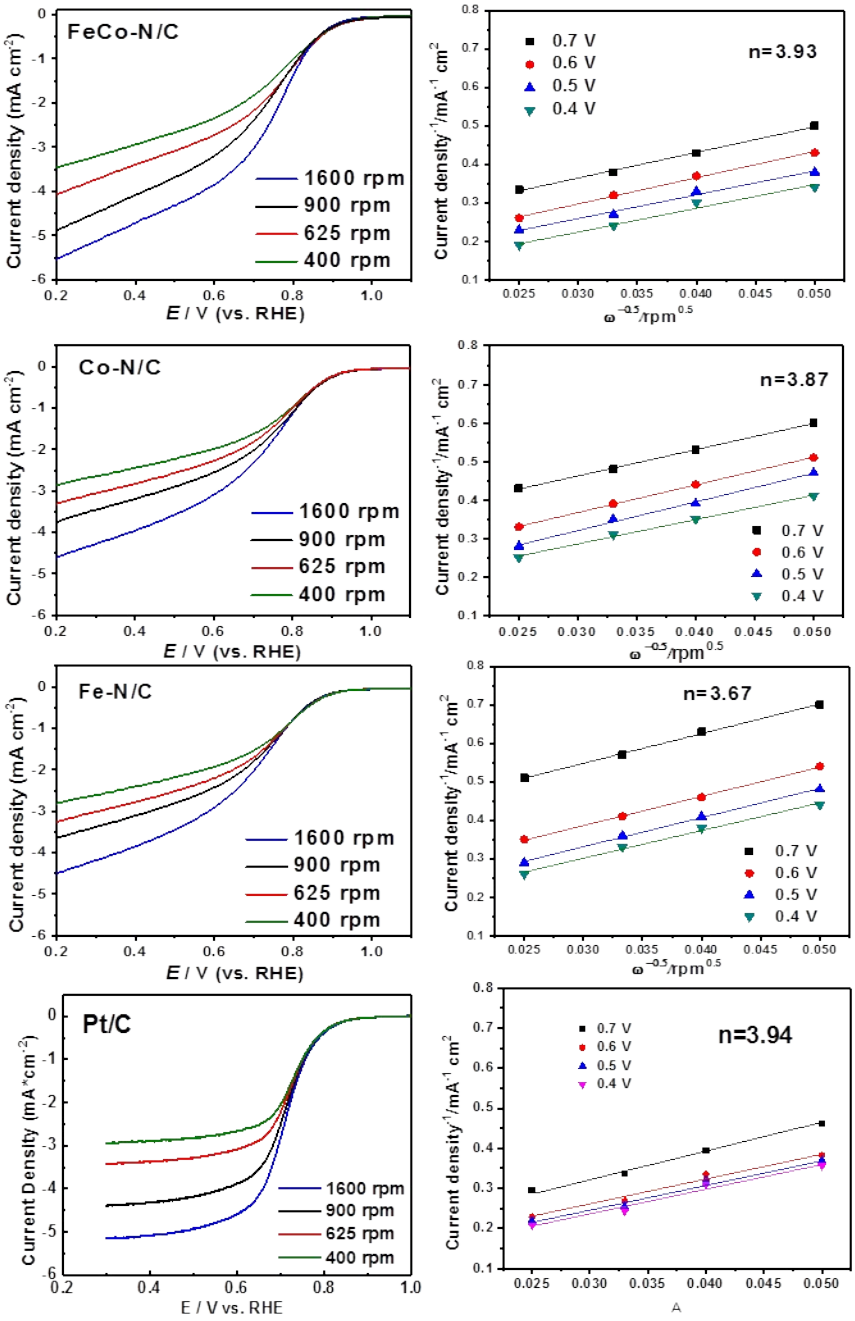

Figure S9. LSV curves of various catalysts in O_2-saturated 0.5 M H_2SO_4 electrolyte at different rotation rates and corresponding Koutecky-Levich plots.

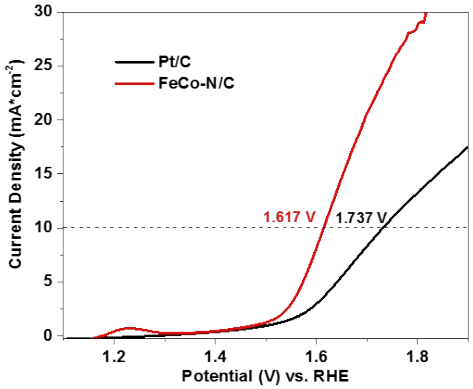

Figure S10. OER polarization curves of FeCo-N/C and Pt/C catalysts. The potential at 10 mA cm^{-2} for FeCo-N/C and Pt/C are 1.617 V and 1.737 V, respectively, suggesting the high OER catalytic activity of FeCo-N/C.