Co_3O_4/Activated Carbon Nanocomposites as Electrocatalysts for Oxygen Evolution Reaction

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Electronic Supplementary Information

Table S1. Mass of the ZIF-67/C products, mass and yield of ZIF-67 obtained in the synthesis, and percentage (w/w) of ZIF-67 in the composites.

Samples	product	Activated carbon	ZIF-67	Yield of ZIF-67	%(w/w$_{total}$) of ZIF-67 in the composite
ZIF-67/C10	228 mg	117 mg	111 mg	40.4%	48.7%
ZIF-67/C30	480 mg	351 mg	129 mg	46.9%	26.9%
ZIF-67/C50	716 mg	581 mg	135 mg	49.1%	18.9%
ZIF-67*	135 mg	--	--	49.1%	--

*Synthesis without the presence of activated carbon

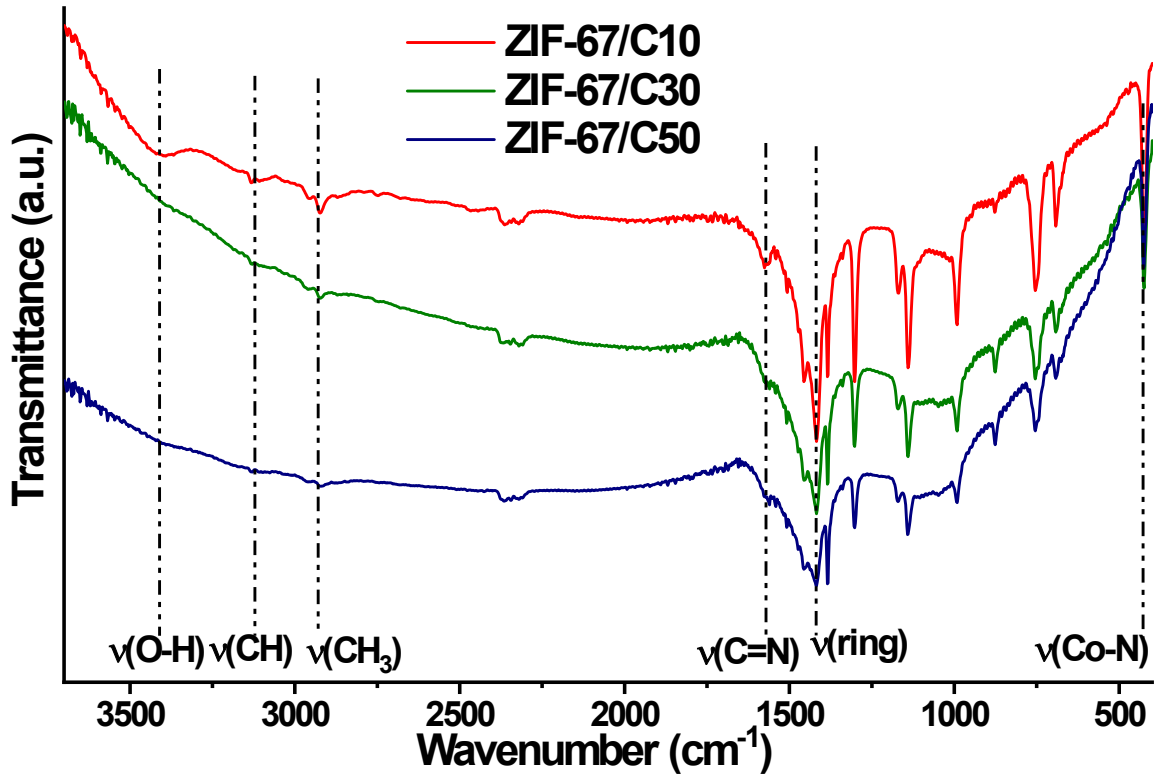

Figure S1: FT-IR spectra of the ZIF-67/C composites

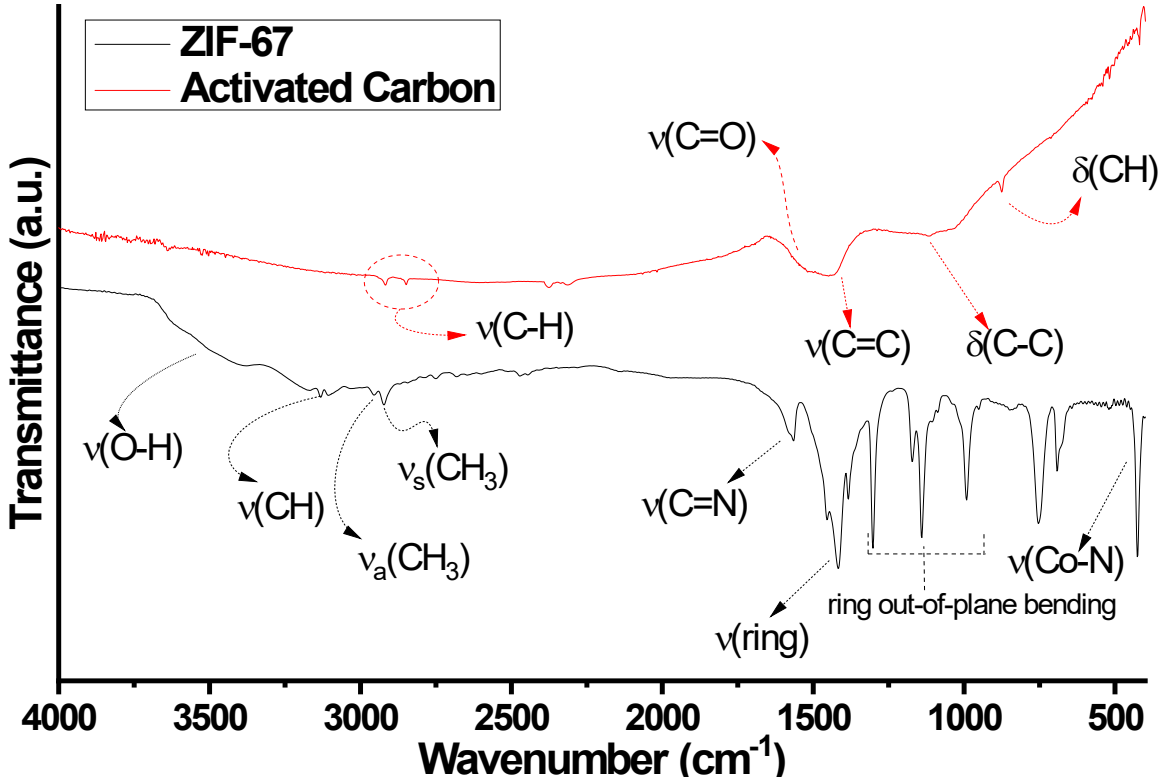

Figure S2: FT-IR spectra of activated carbon and ZIF-67.

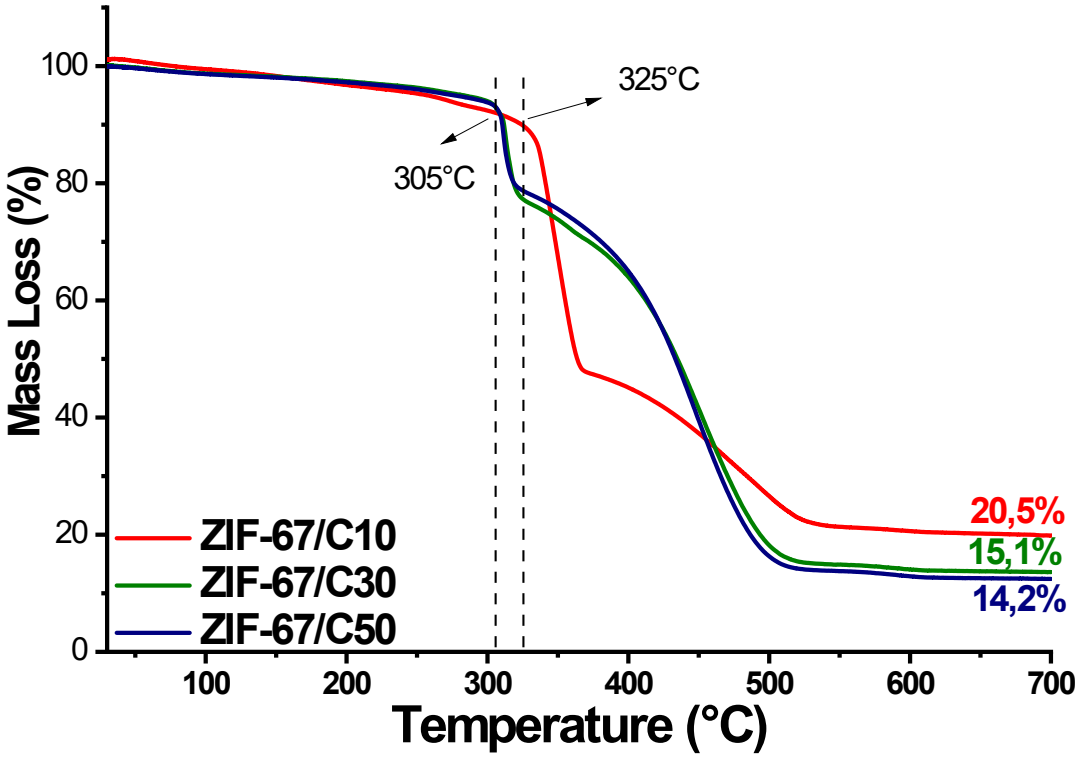

Figure S3: TGA curves of ZIF-67/C composites.

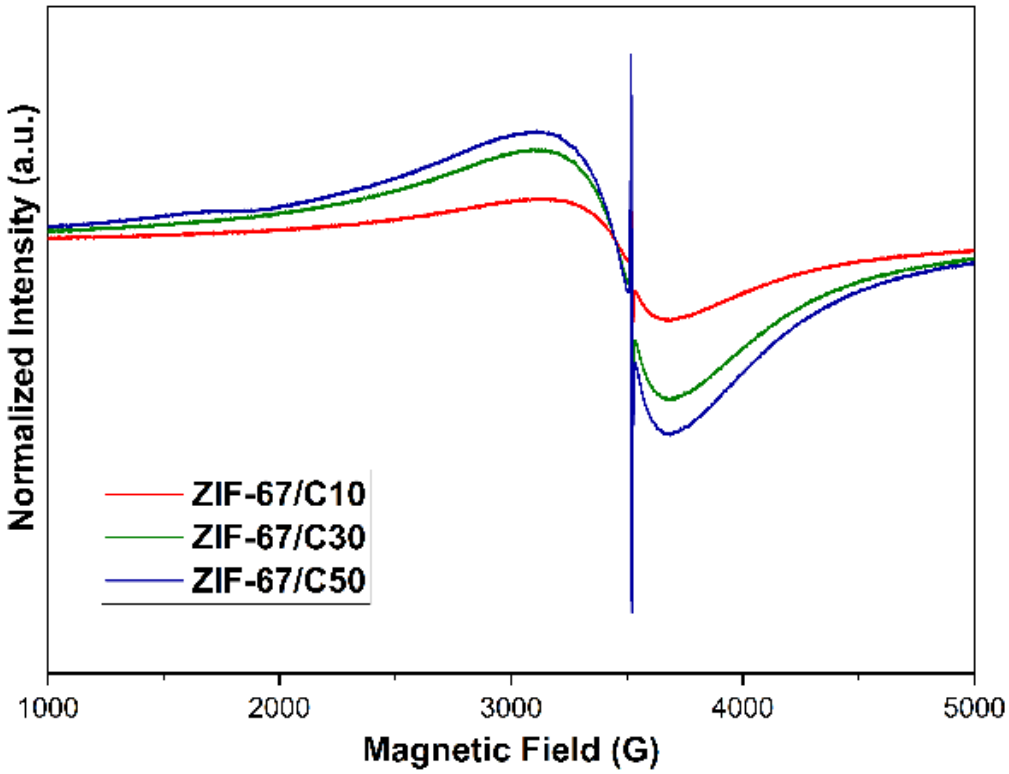

Figure S4: EPR spectra of ZIF-67/C composites.

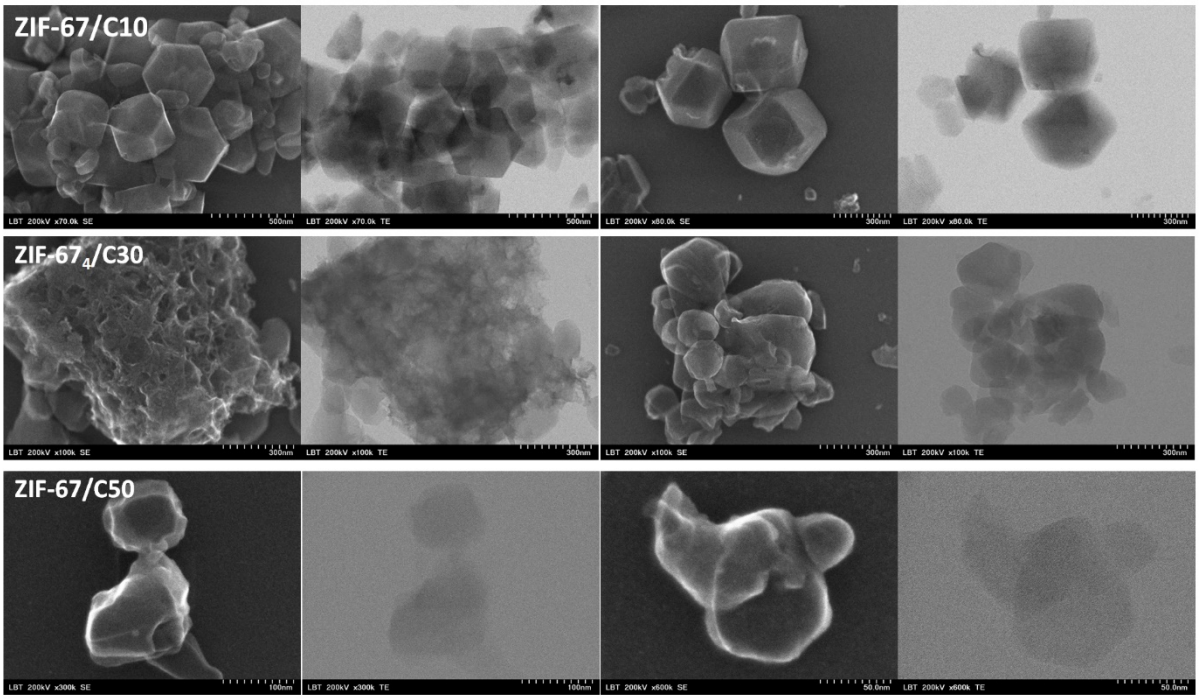

Figure S5: S-TEM images of collected for ZIF-67/C nanocomposites.

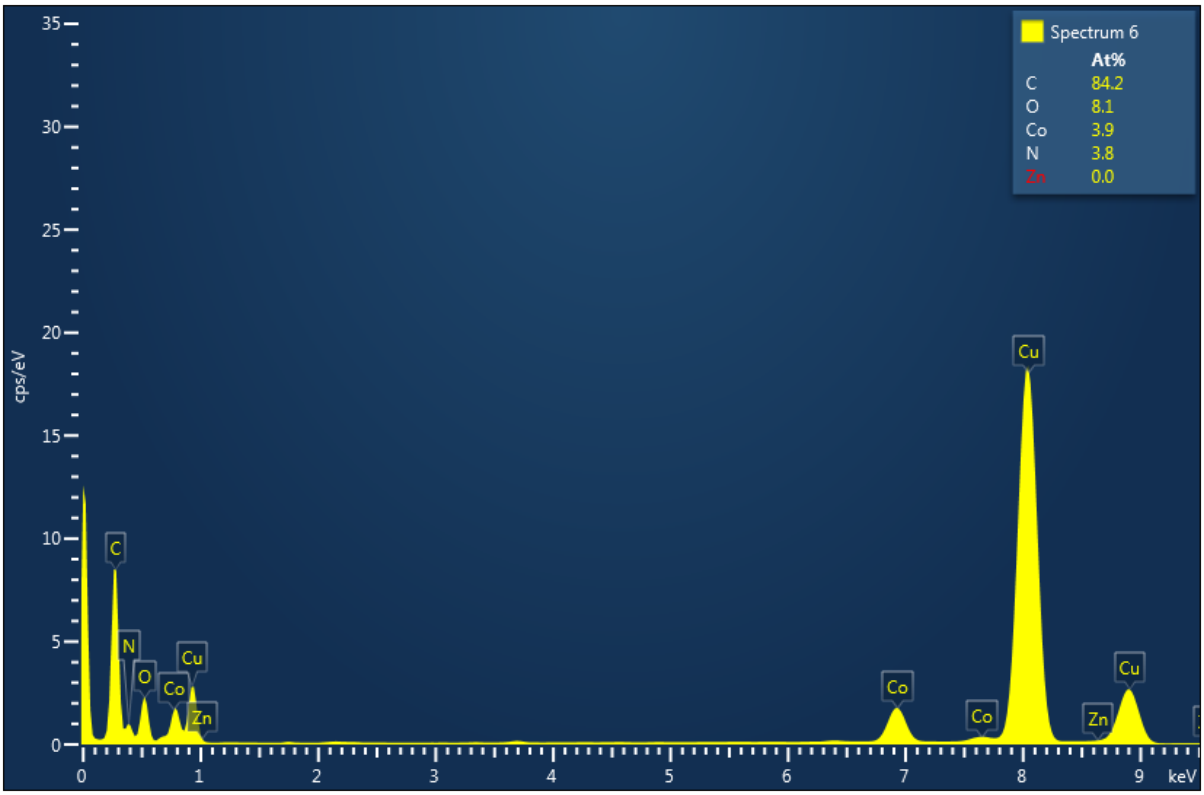

Figure S6: EDS spectra of the ZIF-67/C10 composite.

*Cu signals are related to the TEM grid sample holder.

Table S2. Cell parameters and crystallite size of Co_3O_4/C nanocomposites obtained from the Rietveld refinement.

Samples	a = b = c (Å)	Crystallite size (nm)	Volume (Å^3)
Co_3O_4 (ICSD – 150805)	8.0800	--	527.51
Co_3O_4/C10	8.0807±0.003	13.94	527.65
Co_3O_4/C30	8.0773±0.003	13.20	526.99
Co_3O_4/C50	8.0770±0.002	15.27	526.93

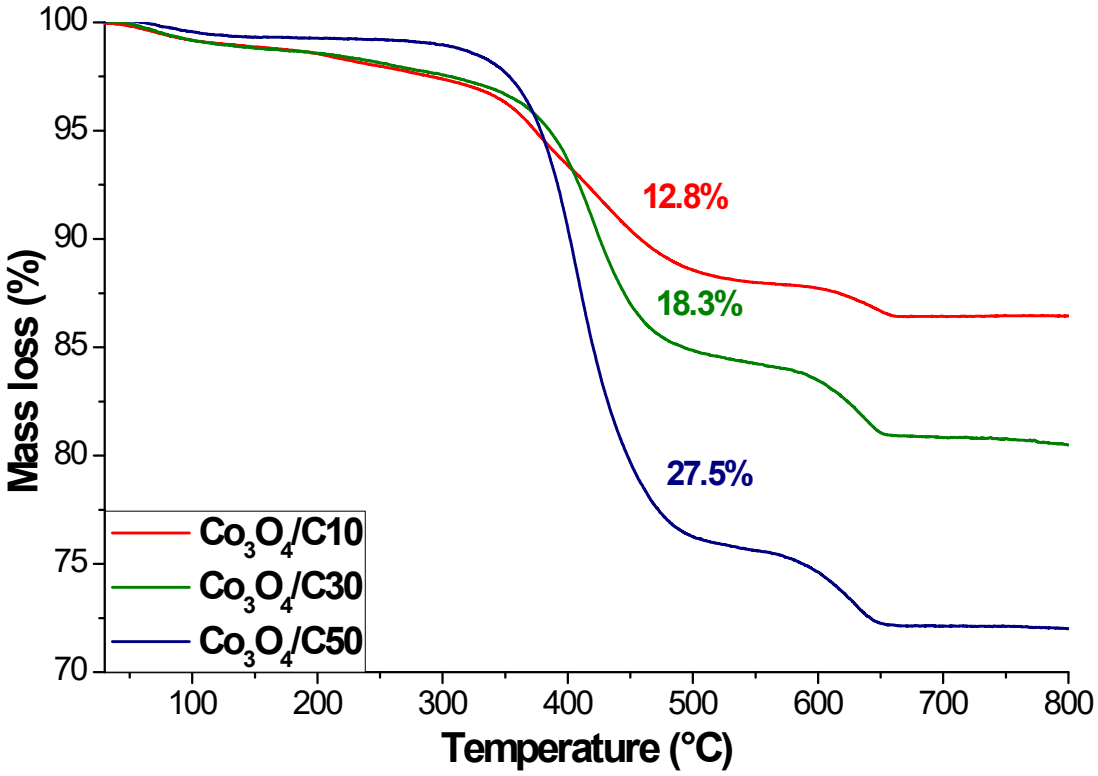

Figure S7: TGA curves of Co_3O_4/C composites.

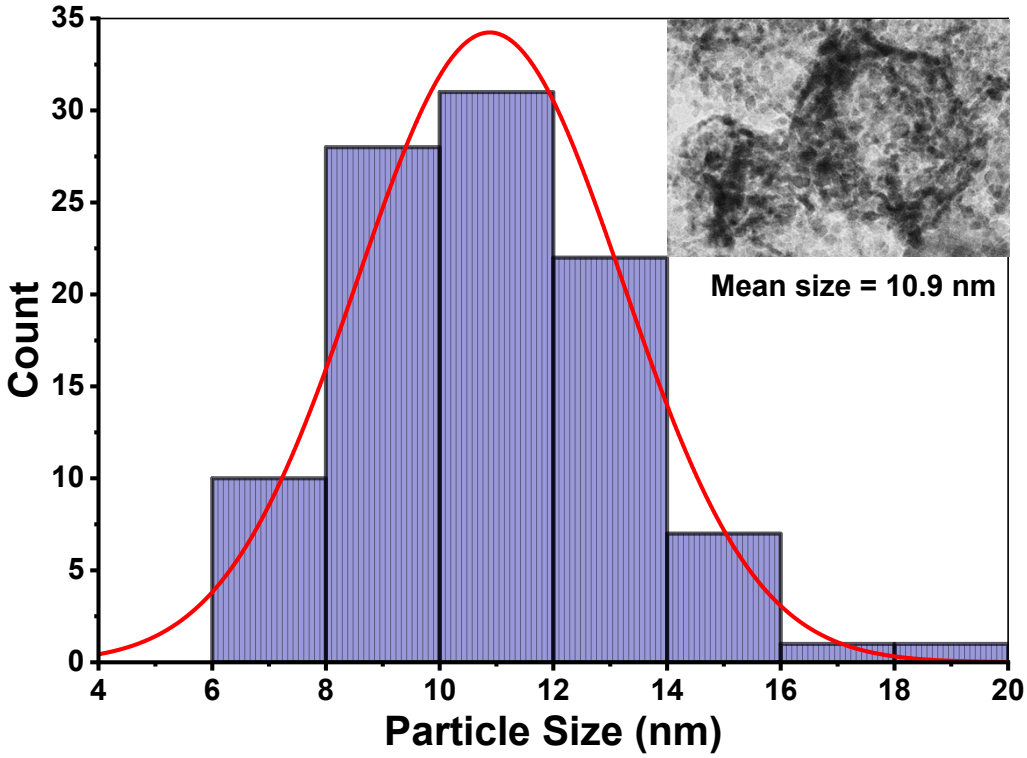

Figure S8: Particle size distribution for the Co_3O_4/C10 nanocomposite, calculated from TEM image.

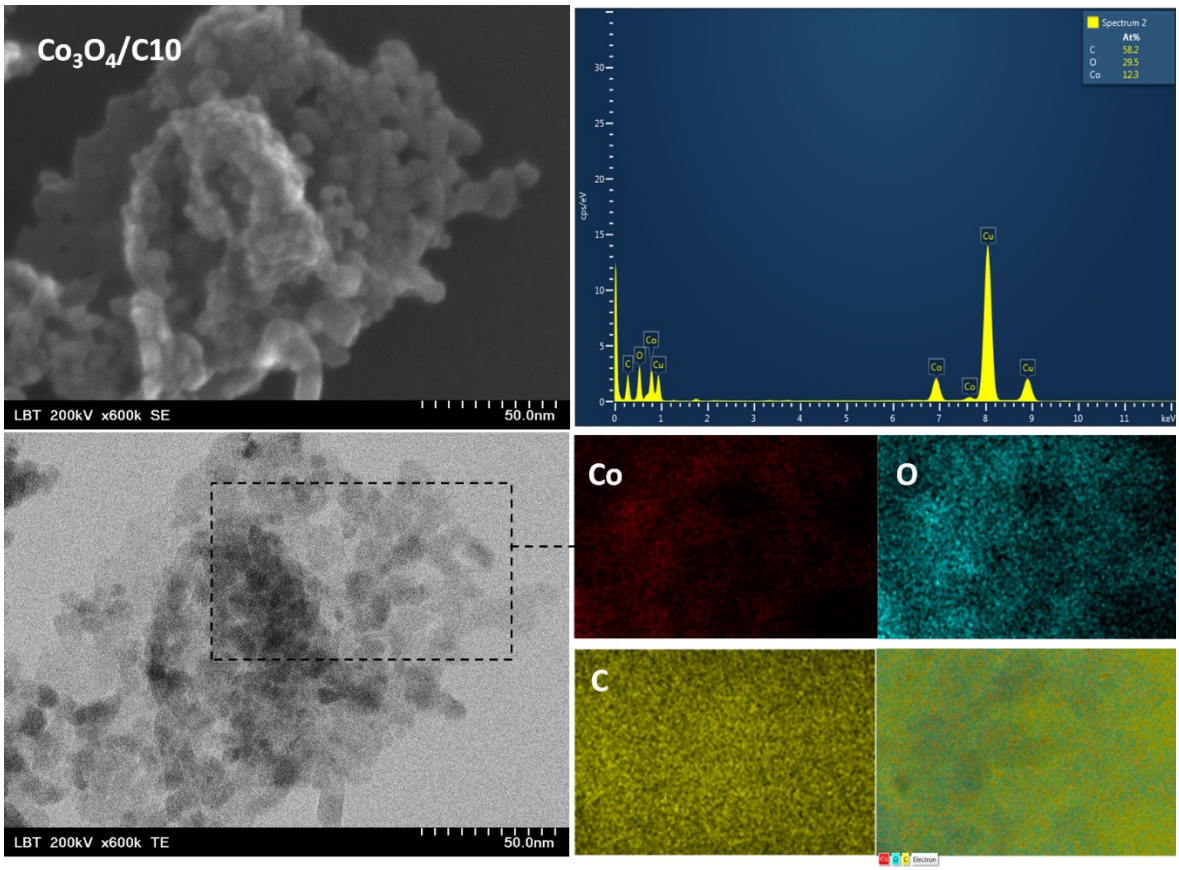

Figure S9: S-TEM images and elementary EDX mapping collected for Co_3O_4/C10 nanocomposite.

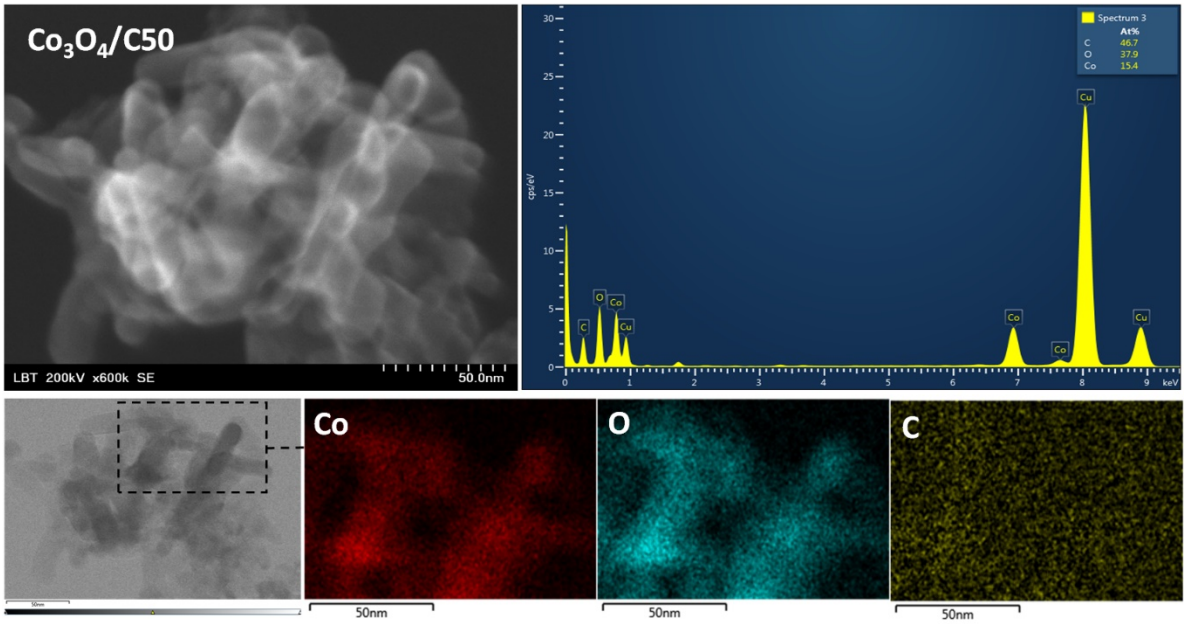

Figure S10: S-TEM images and elementary EDX mapping collected for Co_3O_4/C50 nanocomposite.

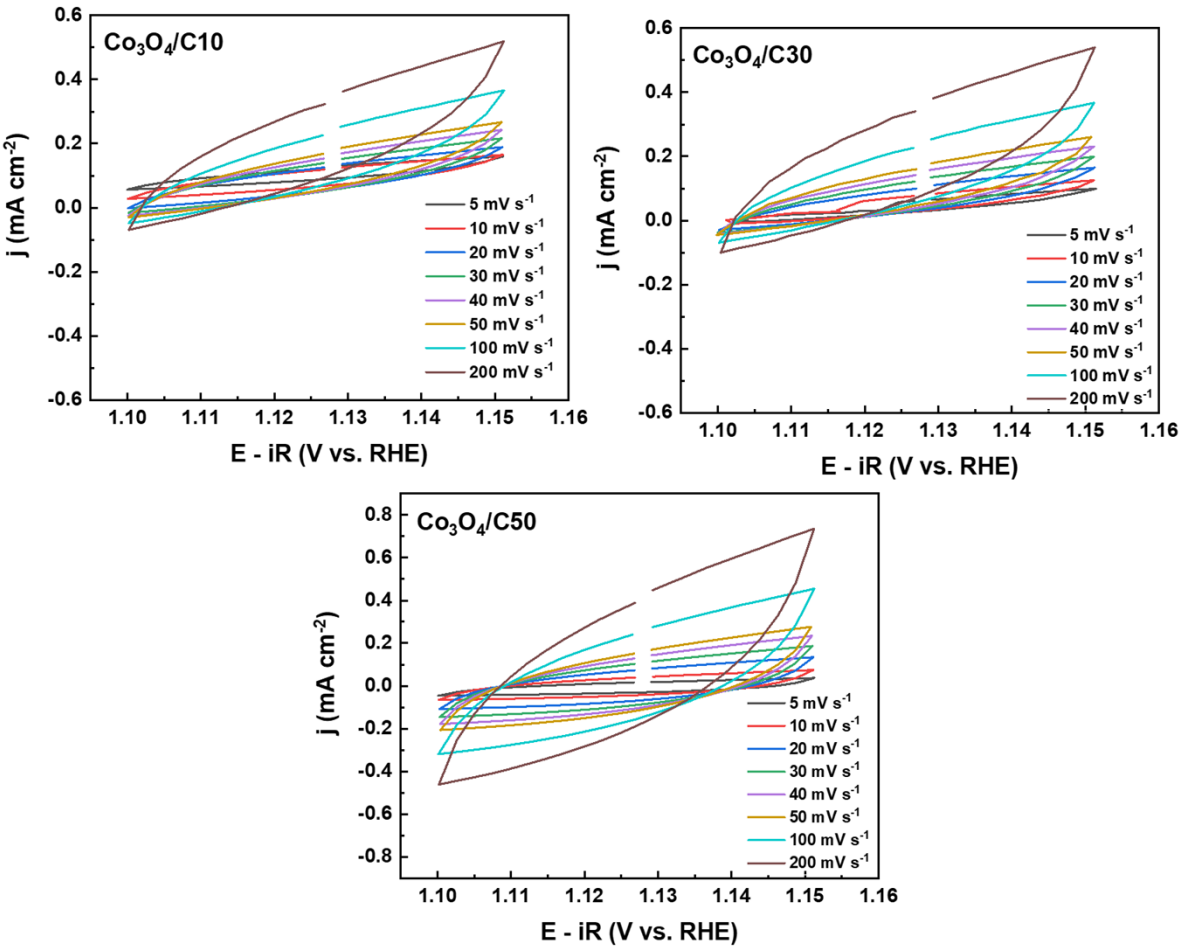

Figure S11: CV curves of Co_3O_4/C composites.

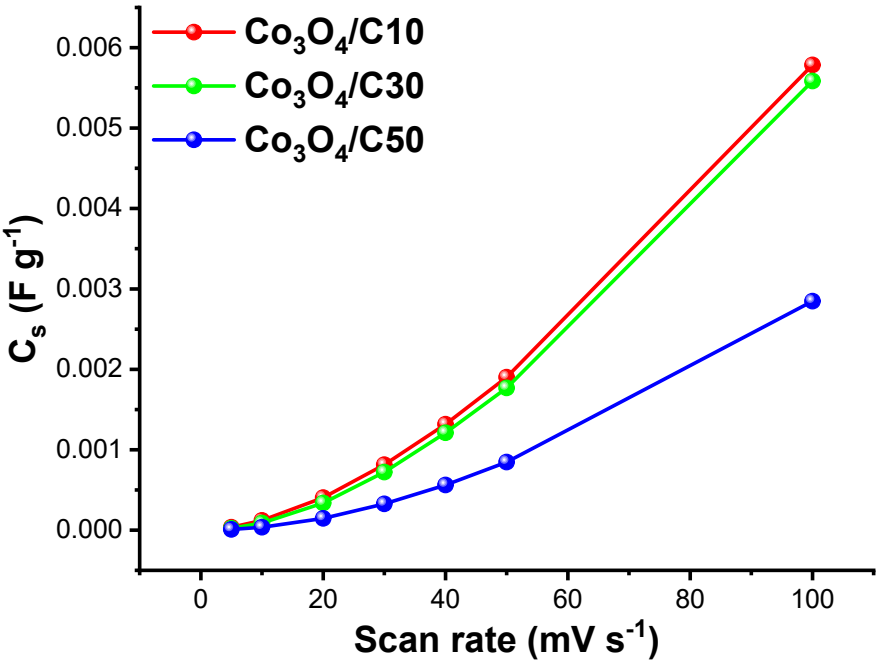

Figure S12: Specific capacitances from CV data.

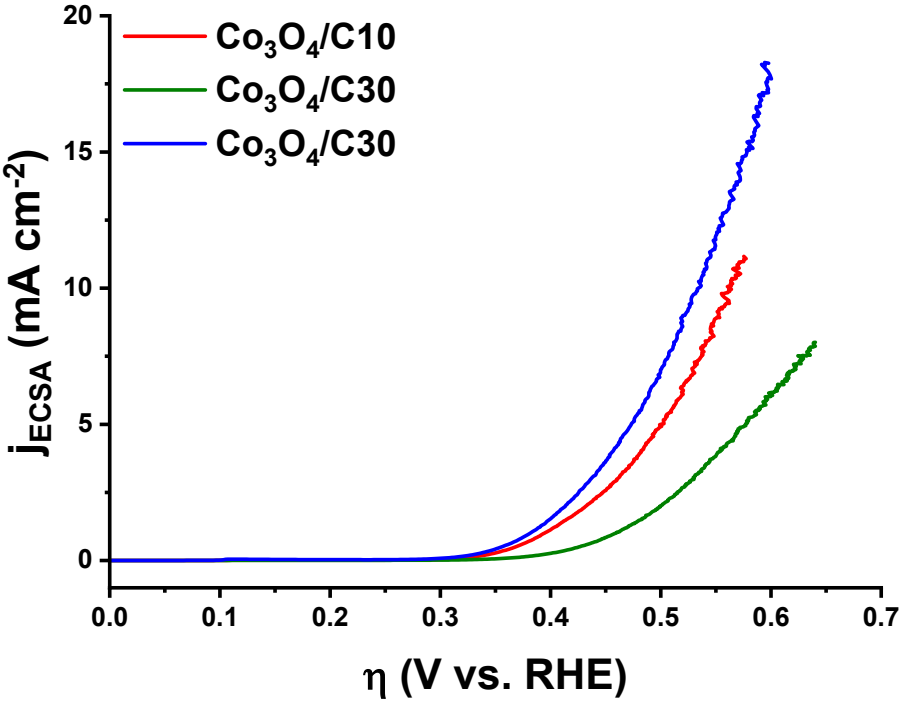

Figure S13: ECSA normalized LSV data.

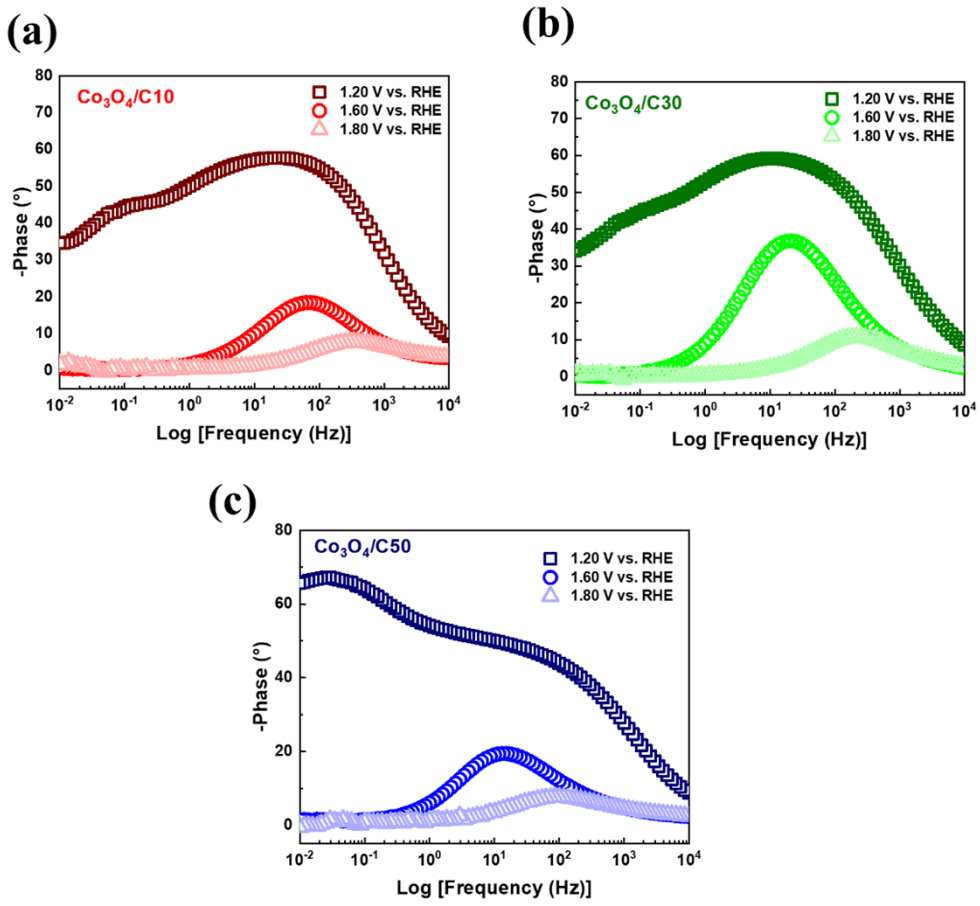

Figure S14: Bode plots obtained from EIS data for Co_3O_4/C composites.

Table S3: XPS deconvolution parameters for sample ZIF-67/C10.

Peak assignment	Position (eV)	FWHM	Area/(RSF x T x MFP) (eV s^{-1})
Co^{3+} $2p_{3/2}$	780.48	4.46	255.702
Co^{3+} $2p_{1/2}$	795.78	4.91	248.001
Co^{2+} $2p_{3/2}$	778.28	1.75	127.757
Co^{2+} $2p_{1/2}$	793.58	1.93	123.907
sat2	787.11	2.99	12.1062
sat4	804.1	4.5	23.4103
sat1	783.03	5.52	106.429
Co Auger	778.99	2.19	98.9171
sat 3	800.05	4.74	20.6222
Co Auger	776.22	1.5	10.2545

Table S4: XPS deconvolution parameters for sample Co_3O_4/C10.

Peak assignment	Position (eV)	FWHM	Area/(RSF x T x MFP) (eV s^{-1})
Co^{3+} $2p_{3/2}$	780.25	3.8	919.04
Co^{3+} $2p_{1/2}$	795.55	4.18	877.003
Co^{2+} $2p_{3/2}$	778.44	2.51	460.109
Co^{2+} $2p_{1/2}$	793.74	2.76	439.075
sat2	788.44	4.32	153.245
sat4	802	5.36	184.78
sat1	784.62	4.78	409.185
Co Auger	778.7	2.86	155.401
sat 3	800.97	2.93	26.2153
Co Auger	775.94	3.56	103.6

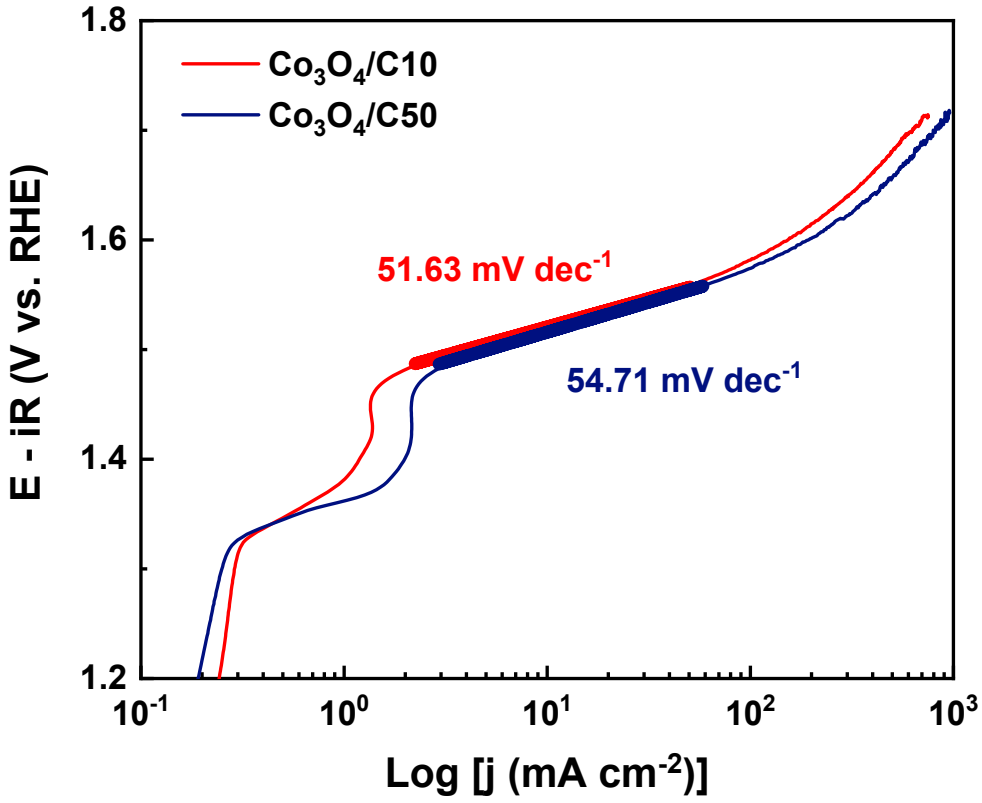

Figure S15: Tafel slopes for Co_3O_4/C10 and Co_3O_4/C50 samples after chronopotentiometry experiments.

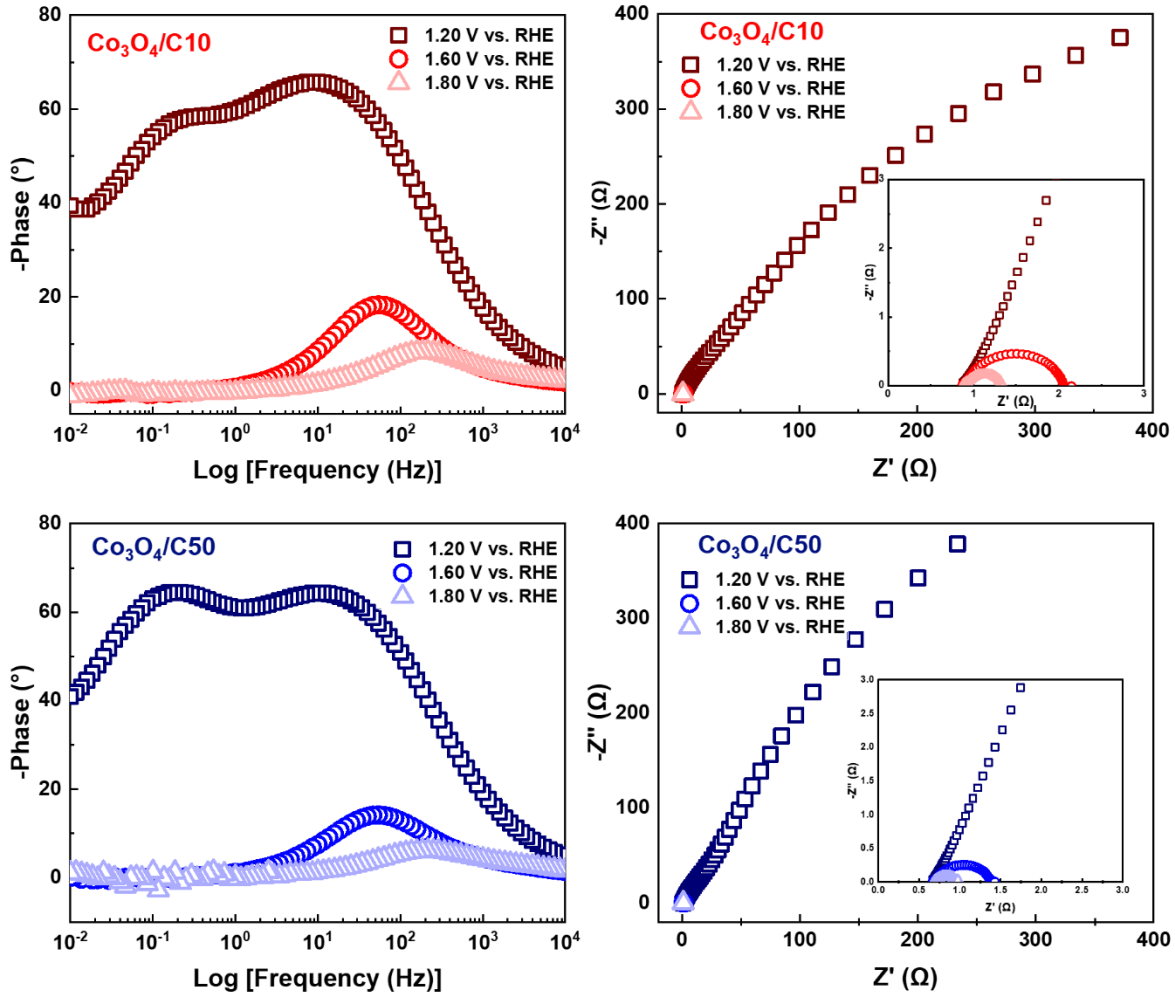

Figure S16: ESI data of the Co_3O_4/C10 and Co_3O_4/C50 samples after chronopotentiometry experiments.

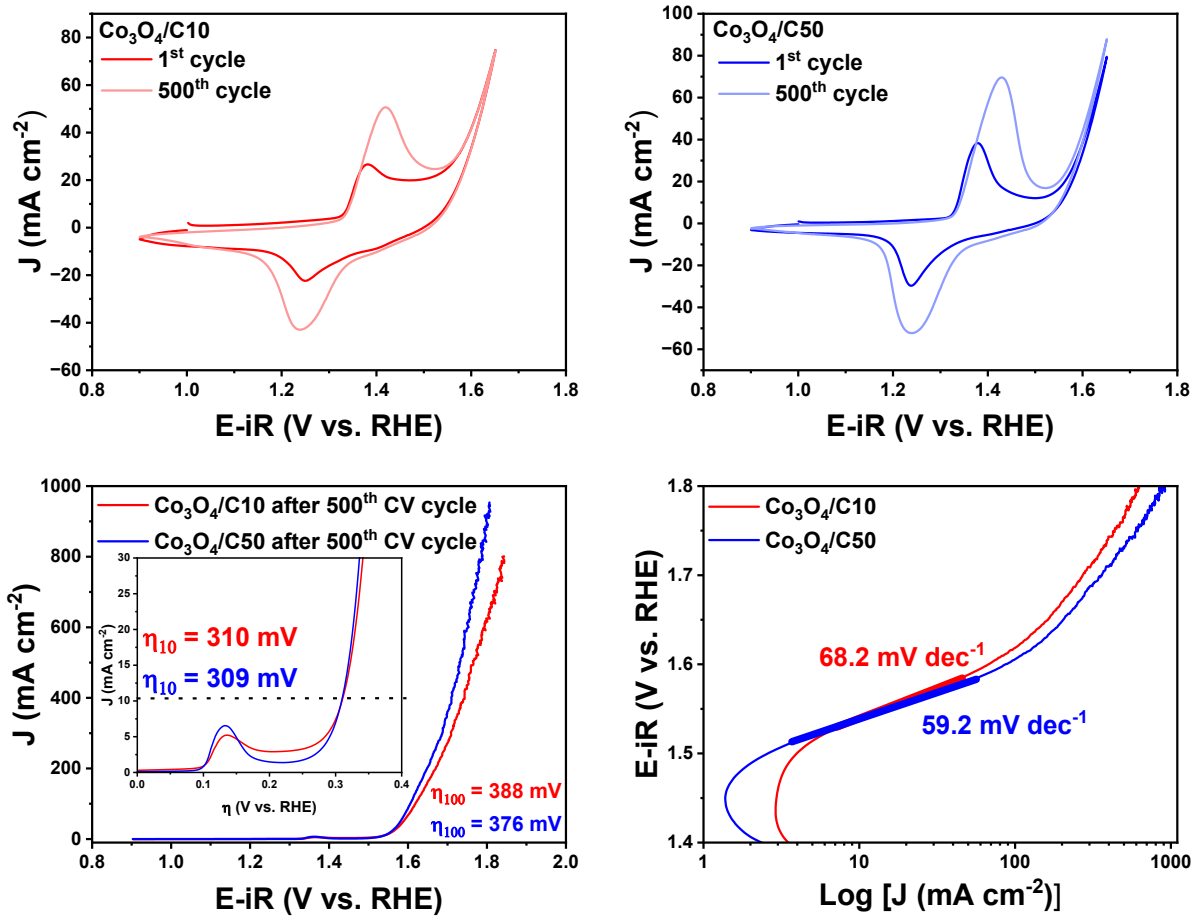

Figure S17: The first and 500th CV cycle, LSV and Tafel slope data after the 500th CV cycle.