

Supporting Information

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Table S1. Rietveld refinement results for $\text{Sr}_{1-x}\text{Ca}_x\text{CoO}_{3-\delta}$ ($x = 0, 0.1, 0.2, 0.3, 0.4, 0.5$) refined using GSAS-II.

Sample	x	Space group	2 θ range (°)	Step (°)	a (Å)	b (Å)	c (Å)	V (Å ³)	Rp (%)	Rwp (%)	χ^2	Notes
SCO	0.0	P6 ₃ /mmc	10-90	0.02	9.49764	9.49764	12.39560	968.344	1.38	2.04	1.99	single phase
SC _{0.1} CO	0.1	P6 ₃ /mmc	10-90	0.02	9.49764	9.49764	12.39560	968.344	1.76	2.84	1.42	single phase
SC _{0.2} CO	0.2	P6 ₃ /mmc +Imma	10-90	0.02	5.44286	15.58128	5.55804	471.359	1.21	1.6	1.79	two-phase refinement (see Table S3)
SC _{0.3} CO	0.3	Imma	10-90	0.02	5.45790	15.63880	5.56430	474.941	1.84	3.81	1.91	single phase
SC _{0.4} CO	0.4	Imma	10-90	0.02	5.46672	15.44113	5.44788	459.868	2.74	5.81	2.88	single phase
SC _{0.5} CO	0.5	Imma	10-90	0.02	5.38580	15.37230	5.51063	456.237	1.3	1.86	1.93	single phase

Fig. S1.

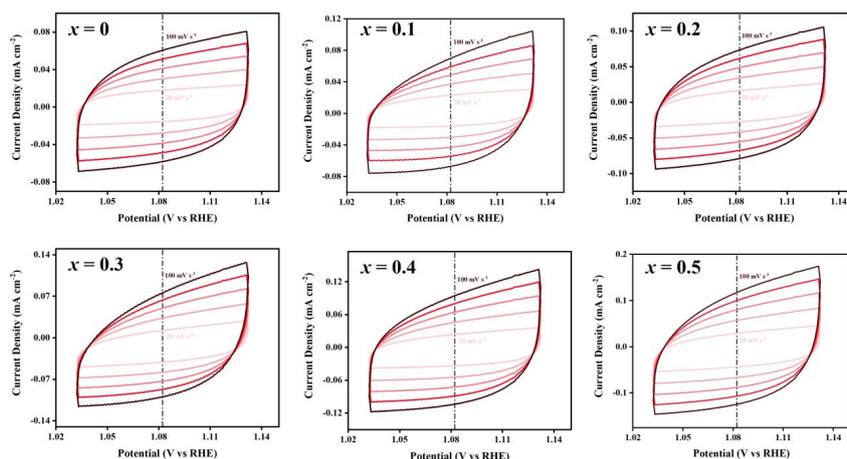


Figure S1. CV curves of the SC_xCO ($x = 0-0.5$) series catalytic materials under different scan rates (20-100 $mV s^{-1}$)

Fig. S2.

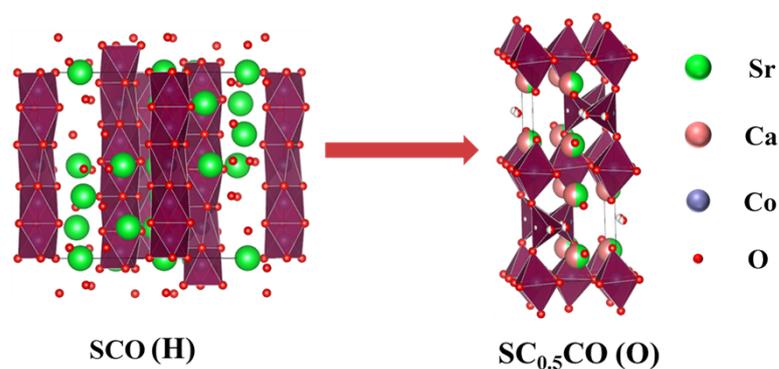


Figure S2. Schematic diagram of the phase structure evolution of the SCO doped with Ca

Fig. S3.

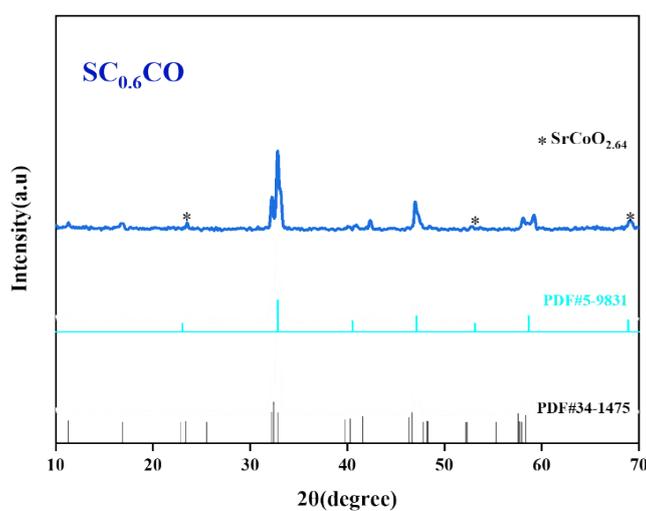


Figure S3. XRD patterns of the $SC_{0.6}CO$

Table S2. The average grain size, r_A and t of the SC_xCO ($x = 0-0.5$) series catalytic materials

SC_xCO	Main diffraction peak (2θ , °)	FWHM (β , rad)	Average crystallite size (nm)	$r_A(\text{\AA})$	t
$x = 0$	32.7	0.24	34.49	1.44	1.007
$x = 0.1$	32.84	0.28	29.58	1.43	0.9972
$x = 0.2$	32.66	0.24	34.49	1.42	0.9937
$x = 0.3$	32.68	0.22	37.63	1.41	0.9902
$x = 0.4$	32.82	0.26	31.85	1.40	0.9867
$x = 0.5$	33.02	0.58	14.28	1.39	0.9832

Table S3. Phase fractions for the $SC_{0.2}CO$ obtained from two-phase Rietveld refinement.

Sample	Phase 1 (space group)	wt%	Phase 2 (space group)	wt%
$SC_{0.2}CO$	Imma (orthorhombic)	96.63	$P6_3/mmc$ (hexagonal)	3.37

Table S4. Surface and lattice distributions of Sr, Ca, Co, and highly oxidative oxygen species (XPS) in SC_xCO catalysts

SC_xCO	Sr		Ca		Co		O
	lattice Sr (%)	surface Sr species (%)	lattice Ca (%)	surface Ca species (%)	Co^{3+} (%)	Co^{4+} (%)	O_2^{2-}/O^- (%)
$x = 0$	25.79	74.21	-	-	55	45	11.95
$x = 0.1$	19.66	80.34	43.45	56.55	57	43	13.56
$x = 0.2$	32.9	67.1	35.18	64.82	62	38	17.74
$x = 0.3$	38.78	61.22	34.89	65.11	63.4	36.6	19.48
$x = 0.4$	44.14	55.86	32.5	67.5	65	35	21.57
$x = 0.5$	49.08	50.92	30.85	69.15	70	30	24.64

Fig. S4.

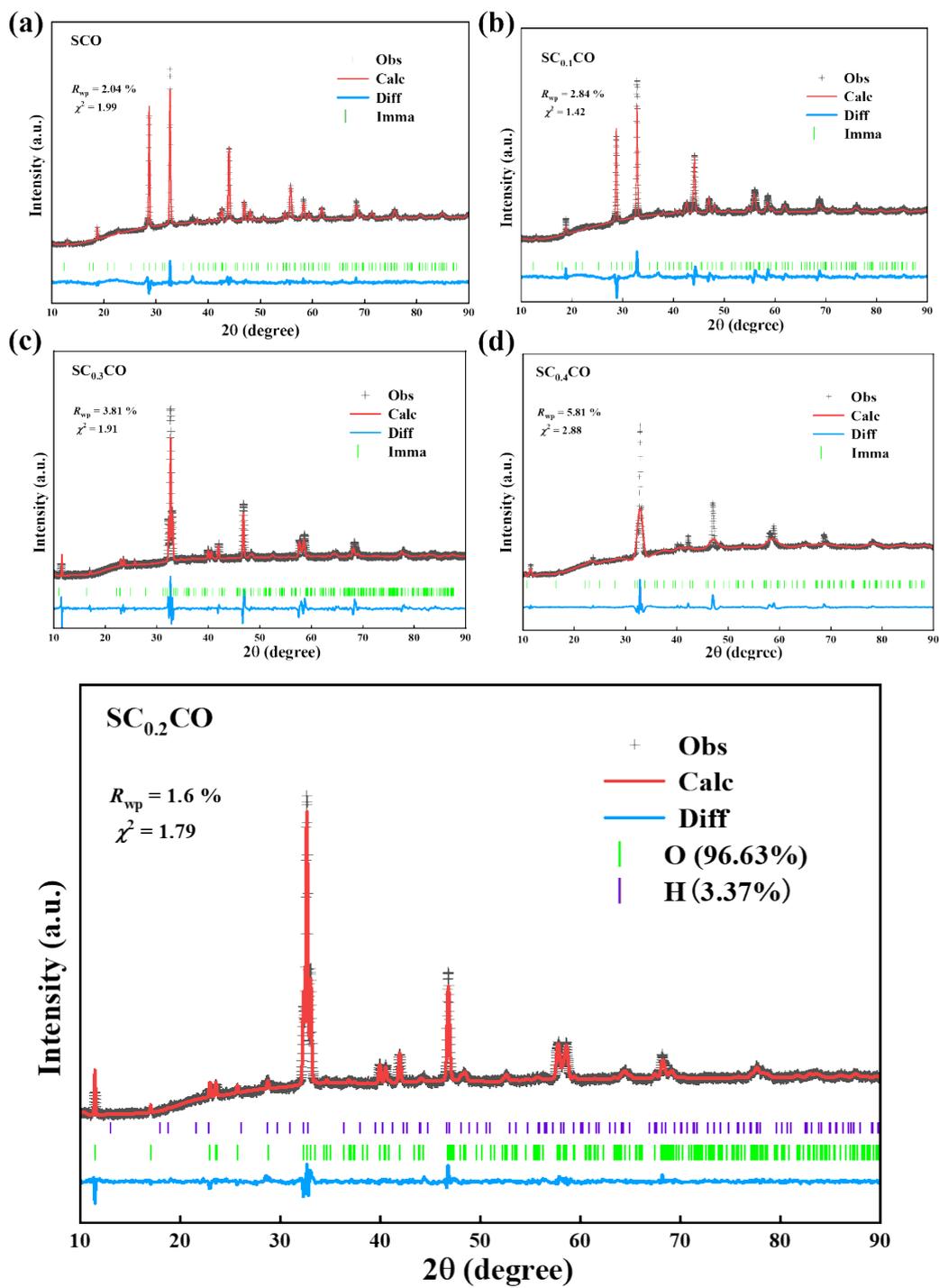


Figure S4. Rietveld structure refinement pattern of SC_xCO ($x = 0-0.4$)

Fig. S5.

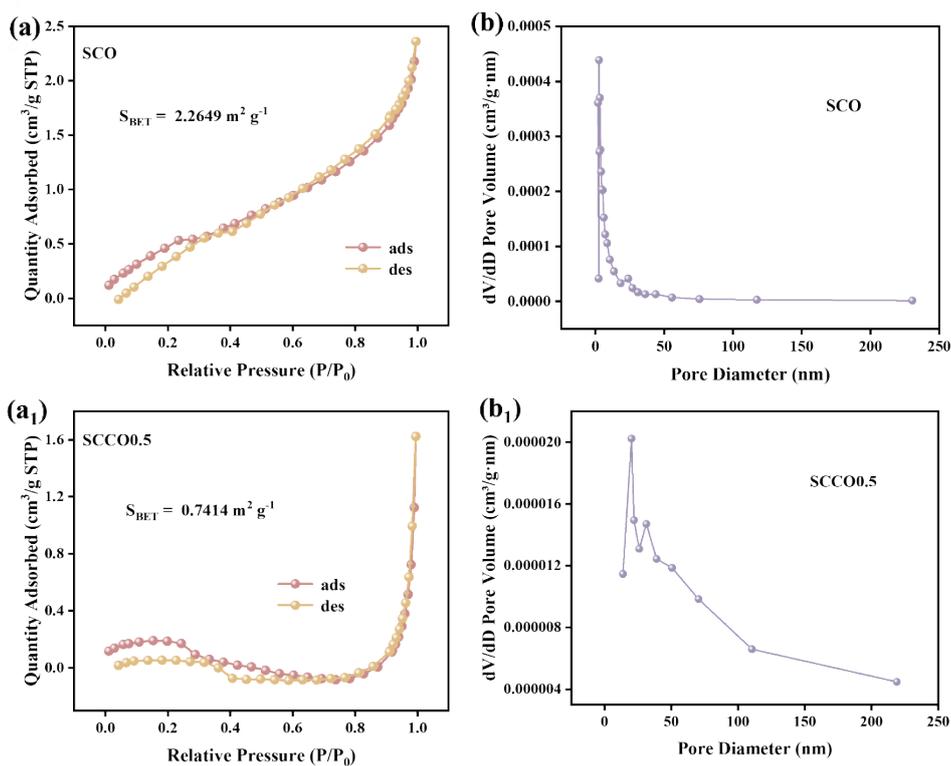


Figure S5. The nitrogen adsorption/desorption isotherms of (a) SCO and (a₁) SC_{0.5}CO; The pore size distribution diagrams of (b) SCO and (b₁) SC_{0.5}CO

Fig. S6.

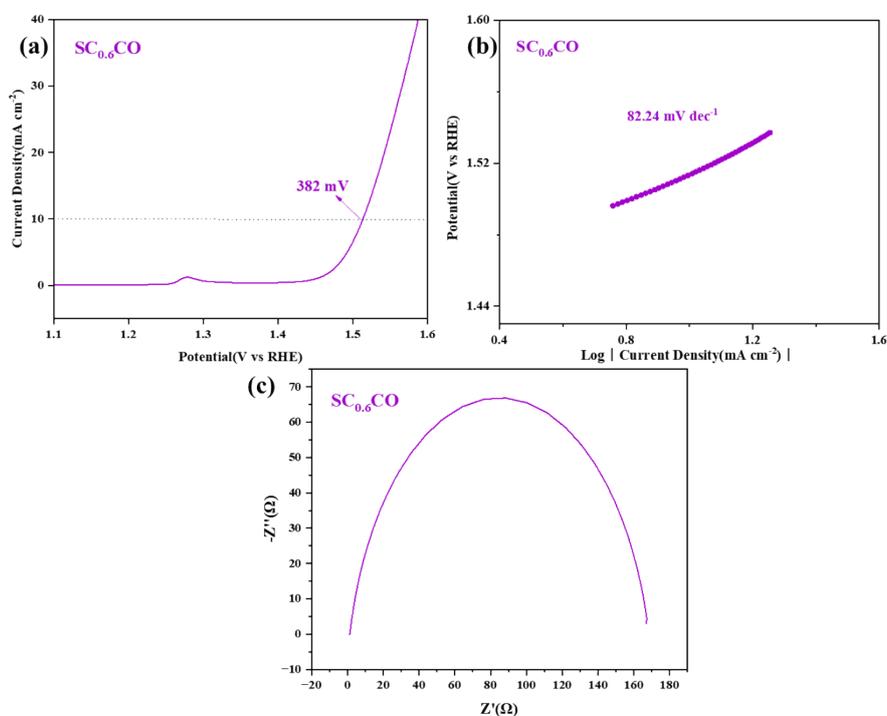


Figure S6. The OER activity of the SC_{0.6}CO: (a) LSV curves; (b) Tafel slope; (c) EIS diagram
Table S5. Comparison of OER performances for SC_{0.5}CO Comparison with reported SrCoO_{3-δ} based materials and representative Co/Ni-based oxide catalysts in 1.0 M KOH.

Catalyst	η @ 10 mA cm ⁻² (mV)	Catalyst loading (mg cm ⁻²)	Substrate	Reference
Sr _{0.5} Ca _{0.5} CoO _{3-δ}	336	0.194	Glassy carbon (GC)	This work
Sr ₂ Co _{1.5} Fe _{0.5} O _{6-δ}	318	2	GC	ACS Catal. 2021, 11, 4327–4337
SrCo _{0.8} Fe _{0.5-x} O _{3-δ} /F _{x} O _{y}	352	0.24	GC	ACS Appl. Mater. Inter. 2021, 13, 17439–17449
LaCoO ₃	470	0.2	GC	Chem. 2017, 3, 812– 821
La _{0.8} Sr _{0.2} Co _{0.8} Fe _{0.2} O _{3-δ}	365	0.24	GC	ACS Appl. Mater. Inter. 2019, 11, 47858
SrCoO ₃	290	0.25	GC	Sci. Adv. 2019, 5, eaav6262
LaNiO ₃	430	0.19	GC	Int. J. Hydrogen Energy 87 2024 890-901
La ₂ NiMnO ₆	370	0.1	GC	J. Am. Chem. Soc. 2018, 140, 11165
LaNi _{0.8} Fe _{0.2} O _{3-δ}	302	0.40	GC	Angew. Chem., Int. Ed. 2019, 58, 2316-2320
Ag/LaNiO ₃	315	0.24	GC	ACS Appl. Energy Mater. 2022, 5, 14658–14668

Fig. S7.

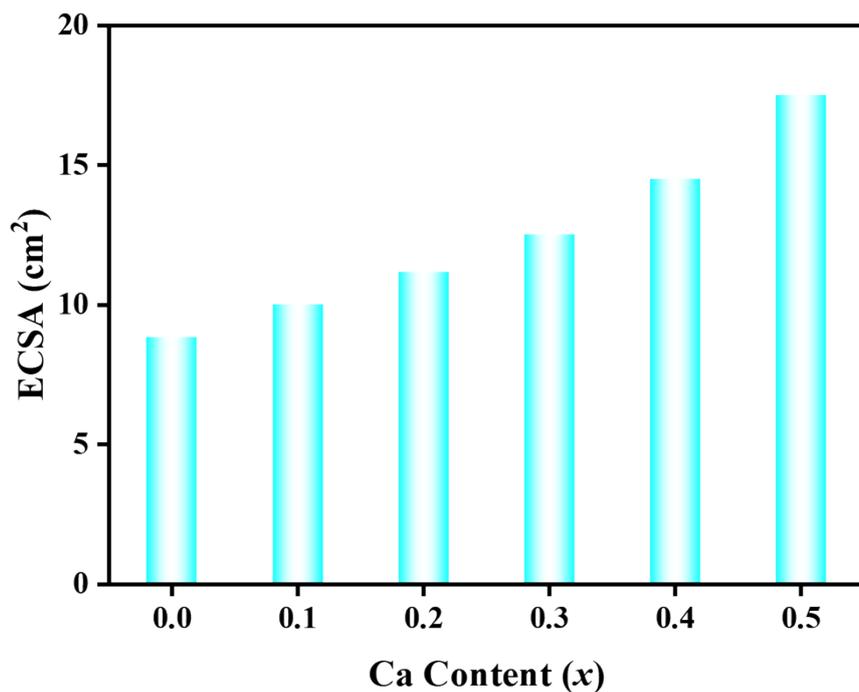


Figure S7. The ECSA of the SC_xCO ($x = 0-0.5$) series sample

Fig. S8.

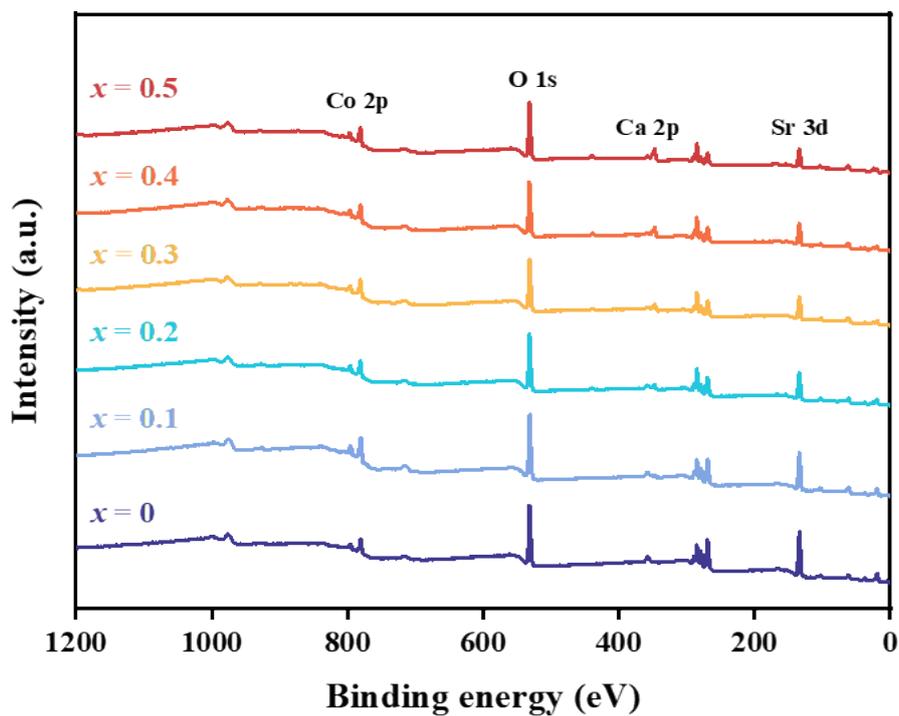


Figure S8. XPS full spectra of SC_xCO ($x = 0-0.5$) series catalytic materials

Fig. S9.

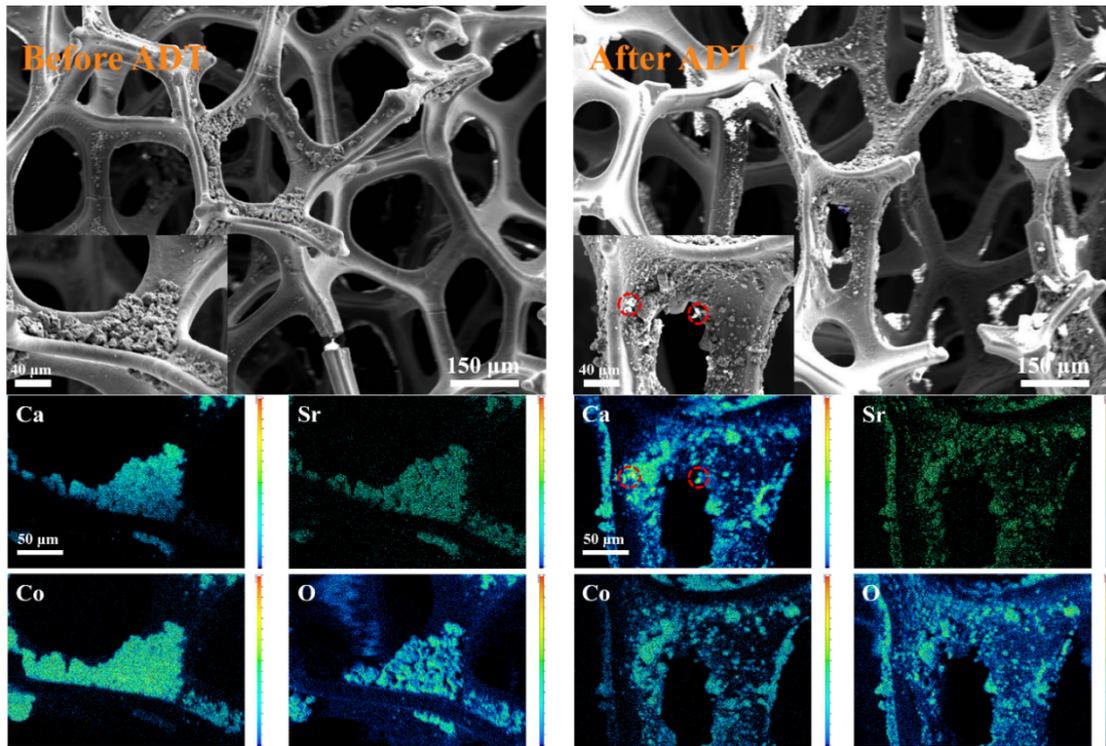


Figure S9. SEM images of the foam nickel loaded with $SC_{0.5}CO$ before and after ADT, along with WDS intensity mapping images for each element