Supporting information

Zeolitic imidazolate framework-derived composites with SnO_2 and ZnO phase components for electrocatalytic carbon dioxide reduction

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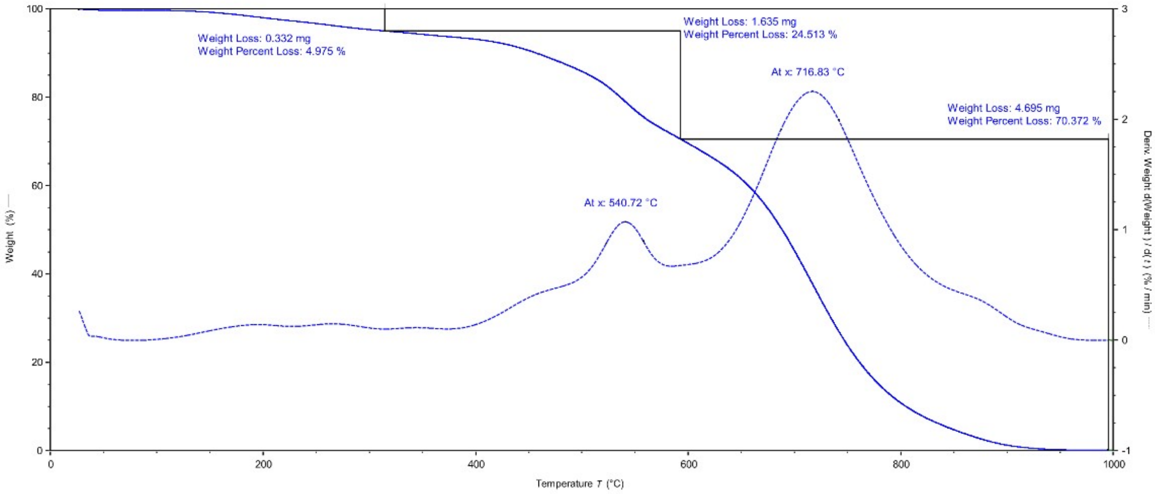

Fig. S1 TGA patterns of ZIF-8.

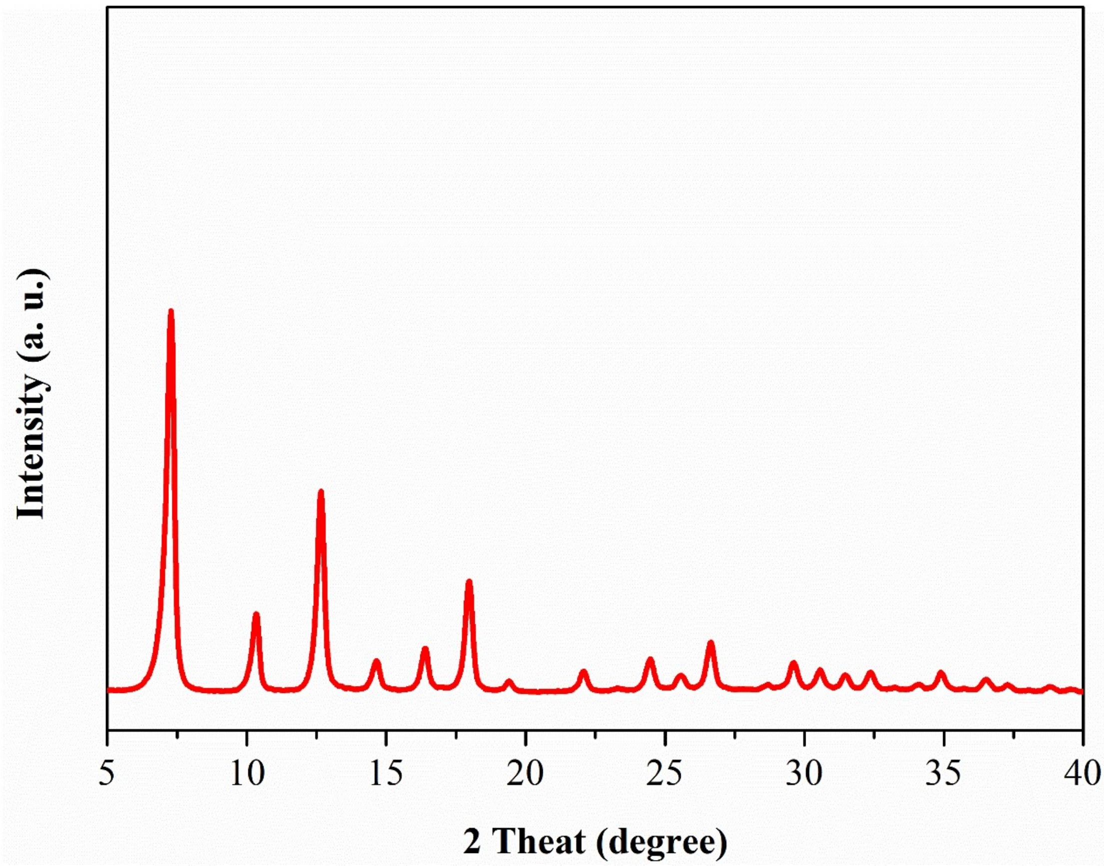

Fig. S2 XRD of ZIF-8.

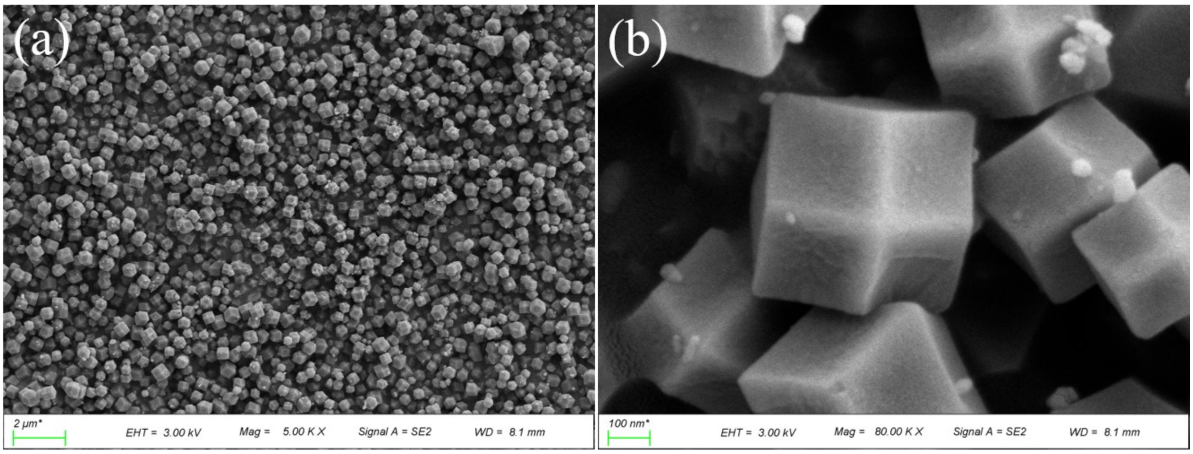

Fig. S3 SEM of ZIF-8.

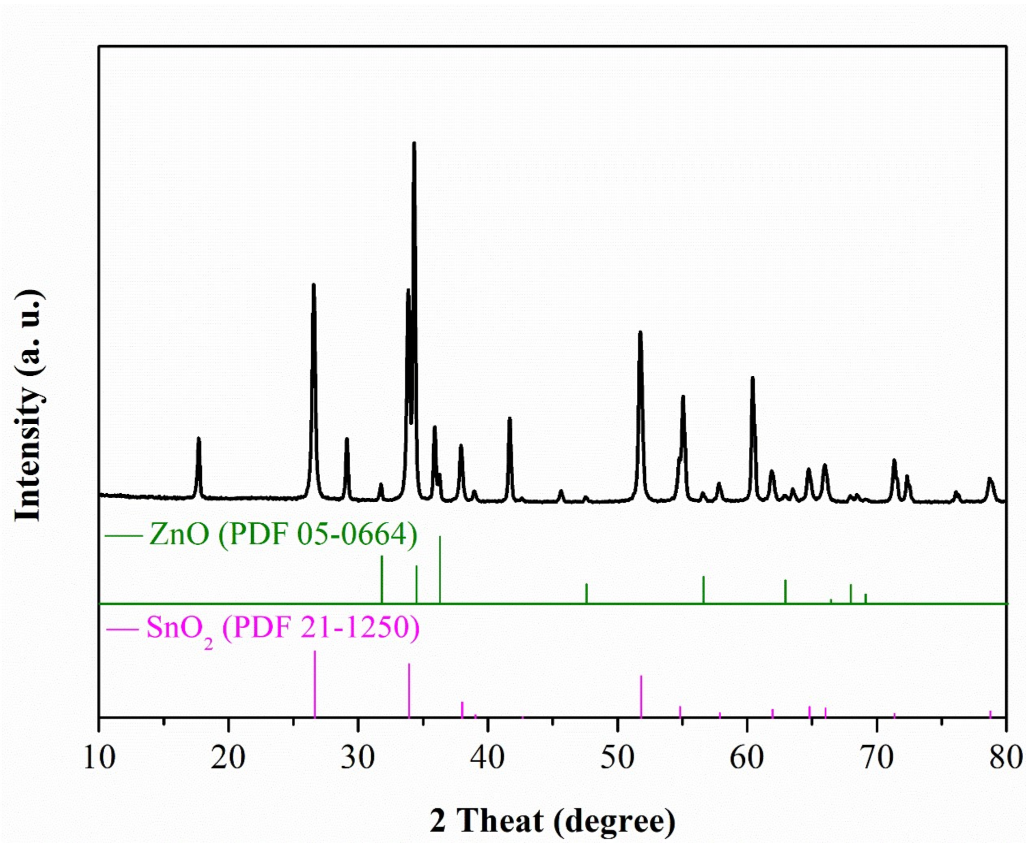

Fig. S4 XRD of ZSO-2/9 catalyst.

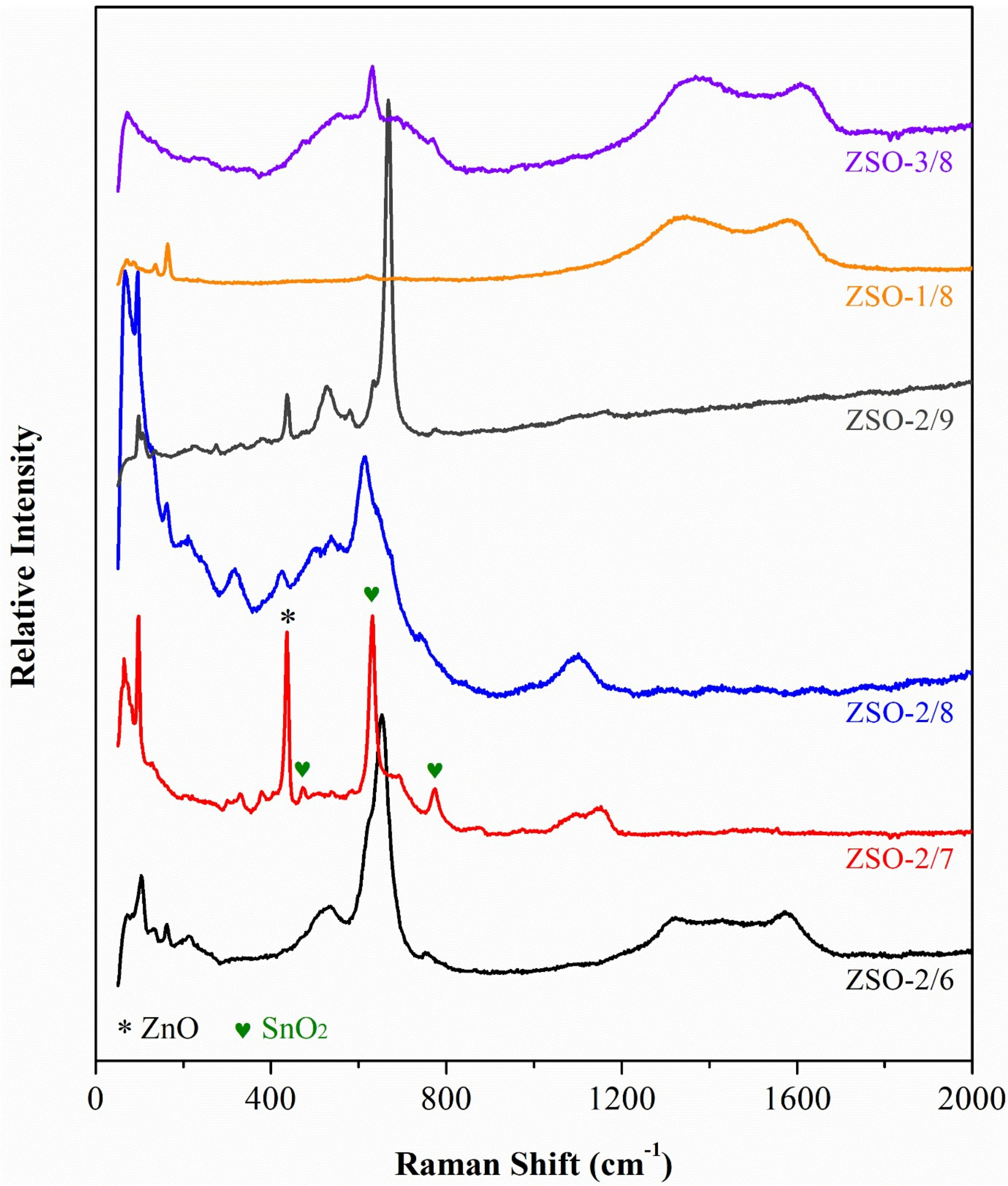

Fig. S5 Comparison of Raman spectra for different catalysts.

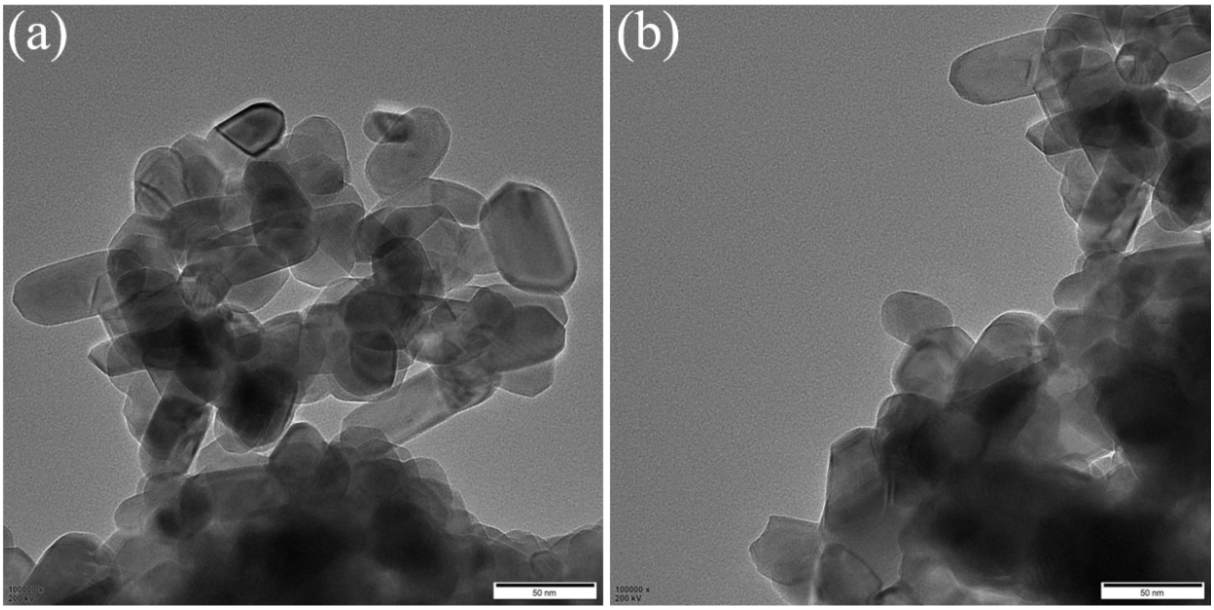

Fig. S6 TEM of ZSO-2/8 catalyst.

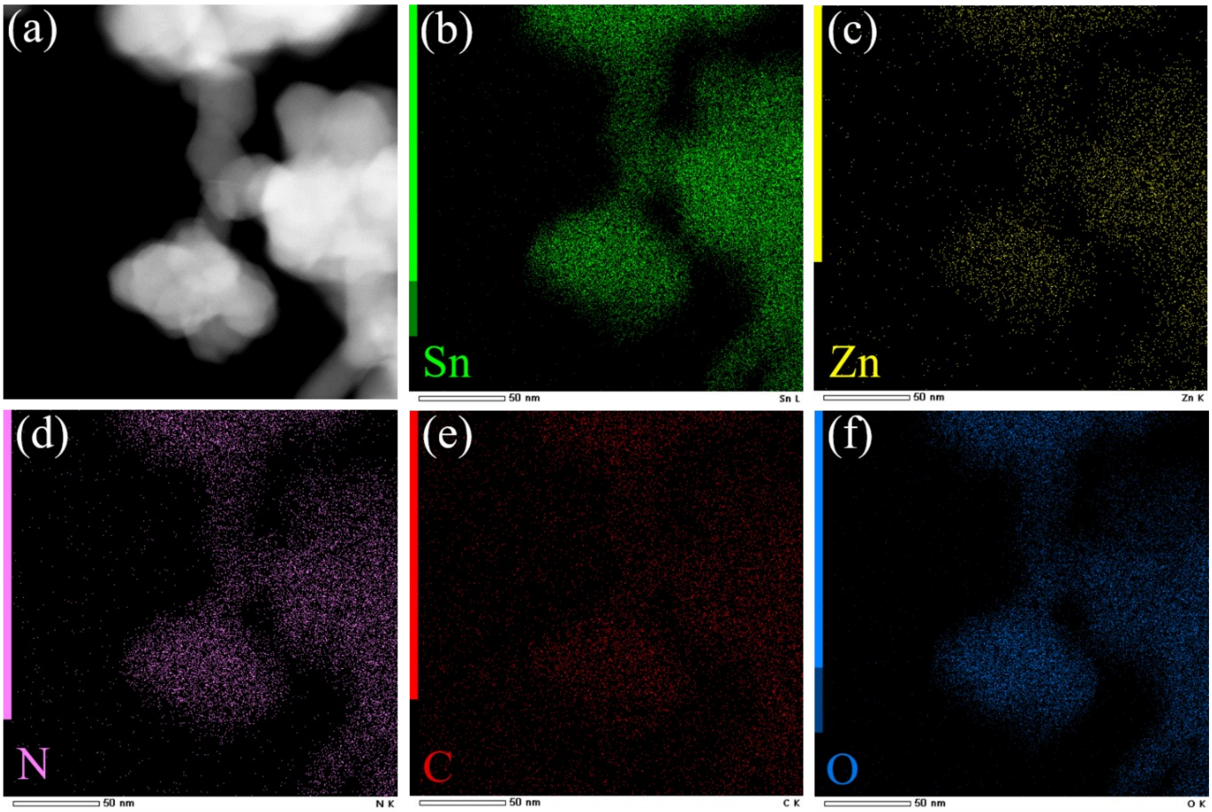

Fig. S7 EDS patterns of ZSO-2/8 catalyst.

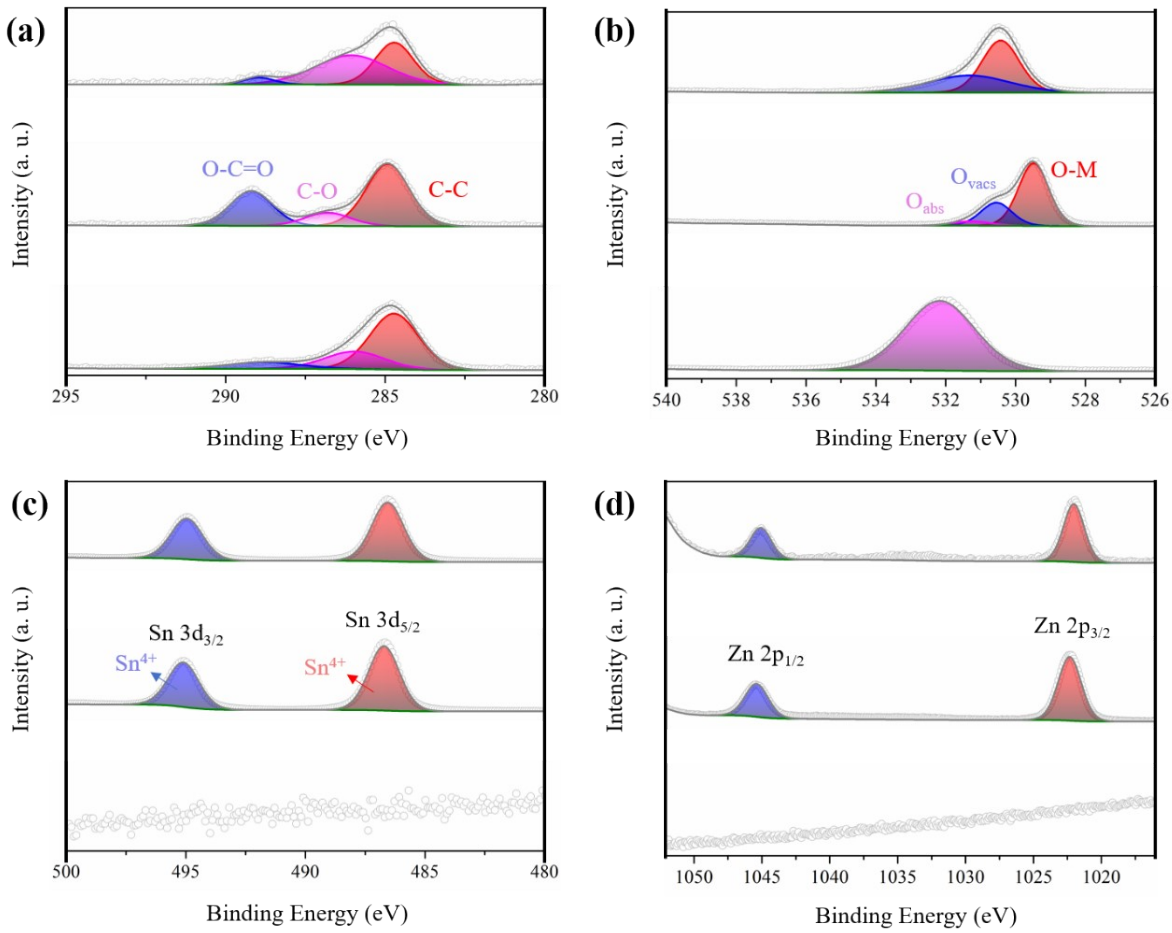

Fig. S8 Comparison of XPS spectra of different catalysts for (a) C 1s, (b) O 1s, (c) Sn 3d, and (d) Zn 2p. (Each figure is ZSO-1/8, ZSO-2/8, and ZSO-3/8 from bottom to top).

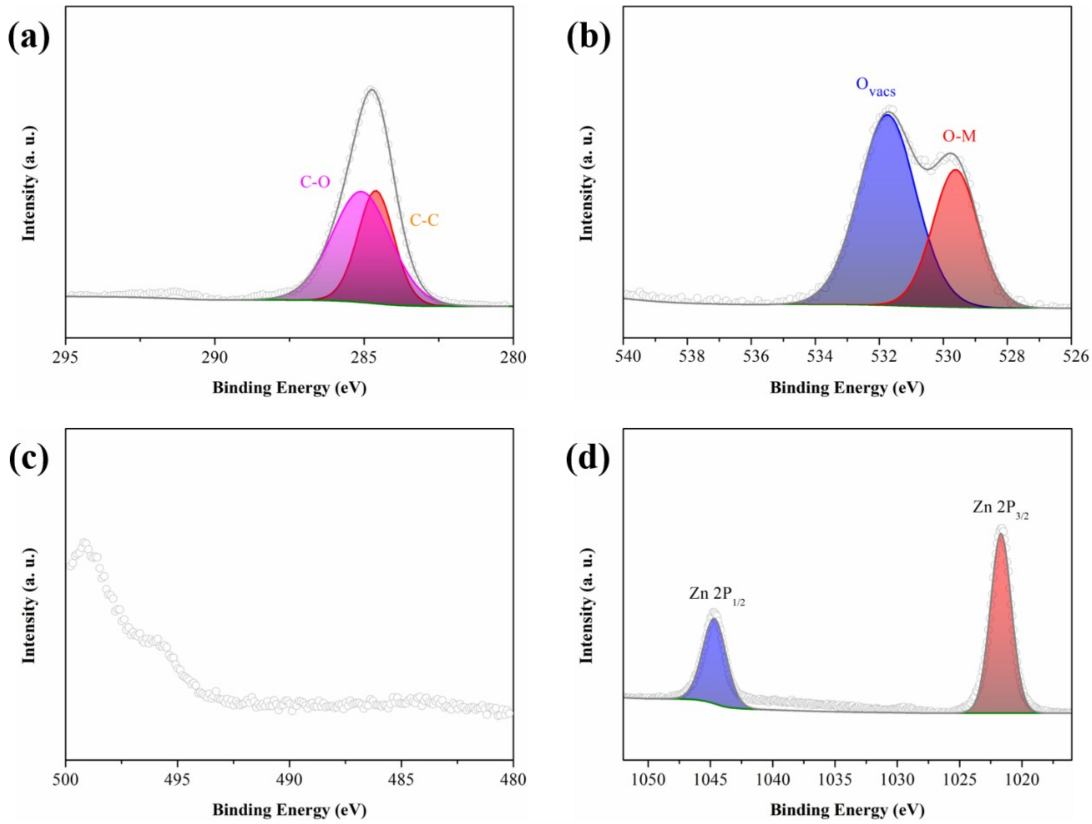

Fig. S9 XPS spectra of different catalysts of ZSO-2/0: (a) C 1s, (b) O 1s, (c) Sn 3d, and (d) Zn 2p.

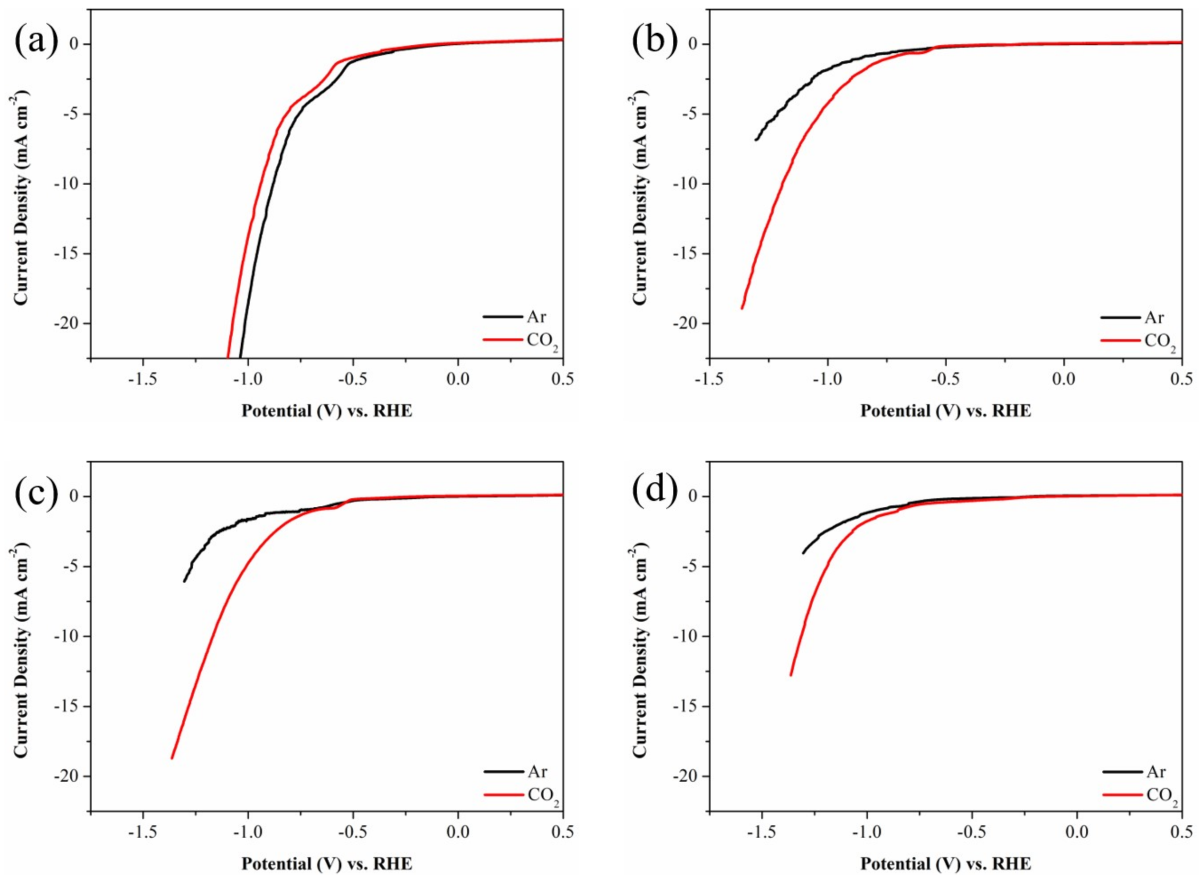

Fig. S10 Comparison of LSV curves under Ar and CO_2 atmosphere saturation for (a) ZIF-8, (b) ZSO-1/8, (c) ZSO-2/8, and (d) ZSO-3/8.

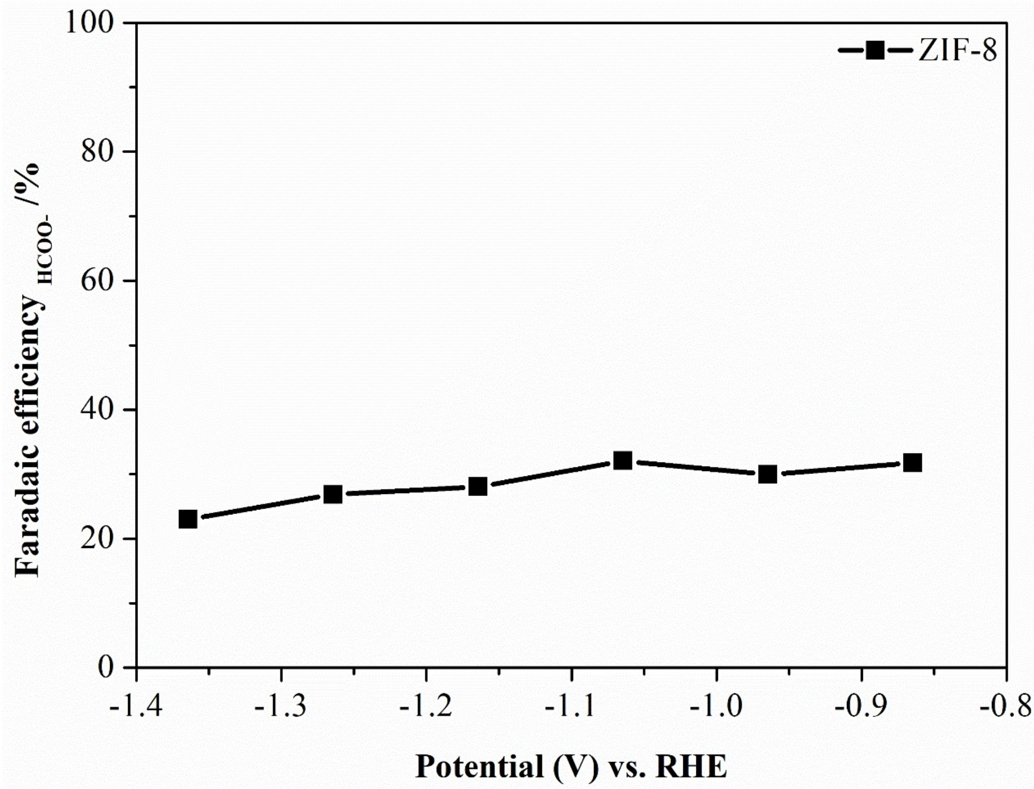

Fig. S11 Faradaic efficiency diagram of $HCOO^-$ at different potentials for ZIF-8.

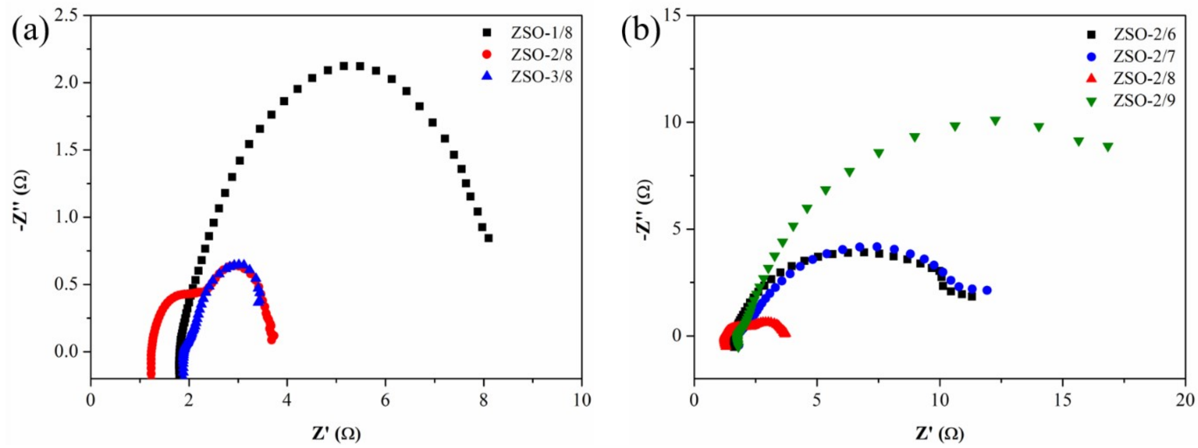

Fig. S12 EIS for (a): ZSO-1/8, ZSO-2/8, and ZSO-3/8; (b) ZSO-2/6, ZSO-2/7, ZSO-2/8, and ZSO-2/9.

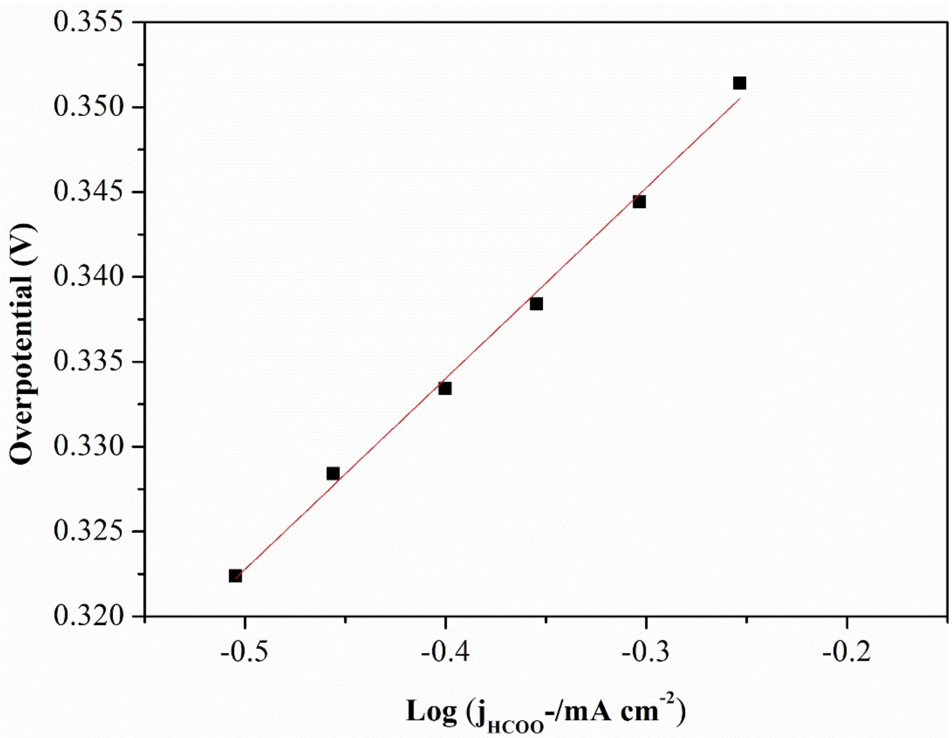

Fig. S13 Tafel curve of ZSO-2/8.

Table S1 Comparison table of metal content.

ZSO-X/0	Zn	Sn
X=1	26.32	12.73
X=2	19.42	26.98
X=3	2.81	75.70

Table S2 Comparison of recently reported performance of ZIF-based catalysts for catalytic $ERCO_2$.

Catalyst	Electrolyte	Potential (vs. RHE)	j mA cm^{-2}	$FE_{Product}$	Refs.
ZIF-8-D-ZnO	0.25 M K_2SO_4	–1.2	16.1	FE_{CO} = 86.70	1
Cu GNC-VL	0.5 M $KHCO_3$	–0.87	~7	FE_{C2H5OH} = 70.52	2
ZIF-8@Co/C-$_1$	0.25 M K_2SO_4	–1.2	-	FE_{CO} ≈ 76.00	3
ZIF-8@Co/C-$_4$	0.25 M K_2SO_4	–1.2	~5	FE_{CO} ≈ 35.00	
C-Fe_{30}-N_{30}/30	0.5 M $KHCO_3$	–0.73	14.41	FE_{CO} = 70.30	4
		–0.53	7.46	FE_{CO} = 87.70	
Fe-CNPs	1.0 M $KHCO_3$	–0.58	-	FE_{CO} = 98.80	5
		–0.88	15.1	-	
CuCo/NC	0.5 M $NaHCO_3$	–1.3	15.5	-	6
		–2	-	FE_{CH3OH} = 60.20	
MNC-D	0.1 M $KHCO_3$	–0.58	~6.8	FE_{CO} = 92.00	7
ZSO-2/8	0.5 M $KHCO_3$	–1.16	~9.81	FE_{HCOO^-} = 76.70	This work

Table S3 Comparison of electric double layer capacitance of catalyst.

Catalyst	Twice C_{dl} (mF cm^{-2})
ZSO-1/8	0.5675
ZSO-2/8	0.2539
ZSO-3/8	5.3600
ZSO-2/6	0.9819
ZSO-2/7	1.2400
ZSO-2/9	0.2541

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