Electrochemical CO_2 reduction to C_{2+} products over Cu/Zn intermetallic compounds synthesized by electrodeposition

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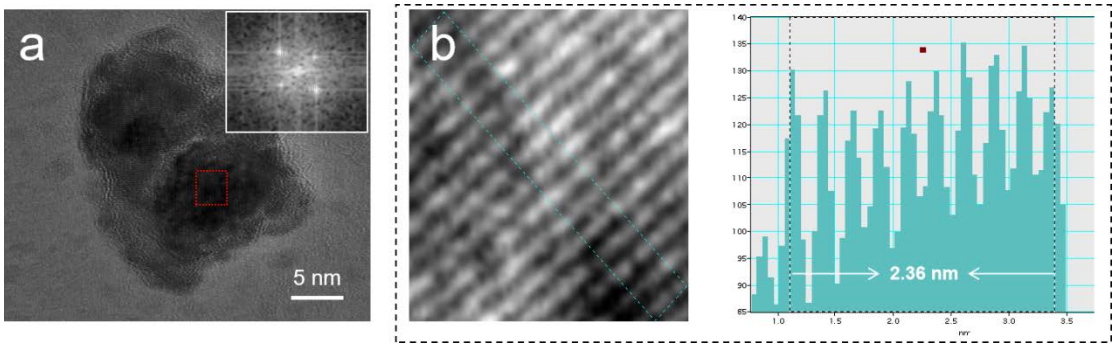

Fig. S1 (a) HR-TEM image of as-synthesized $Cu_{100}Zn_{4.9}$ IMCs catalyst (live FFT of as-synthesized $Cu_{100}Zn_{4.9}$ IMCs catalyst with the selected area); (b) Profile of IFFT of as-synthesized $Cu_{100}Zn_{4.9}$ IMCs catalyst with the selected area.

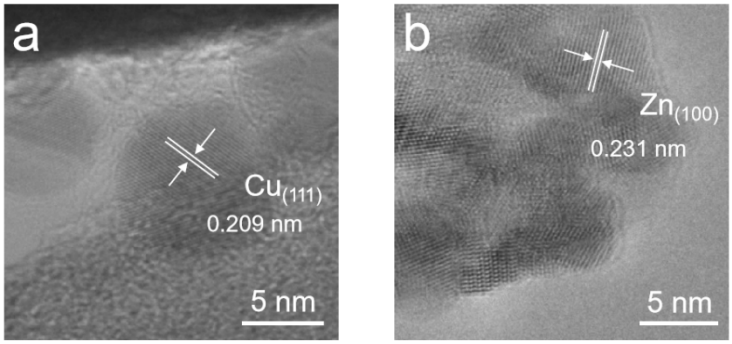

Fig. S2 HR-TEM images of (a) pure Cu and (b) pure Zn catalyst.

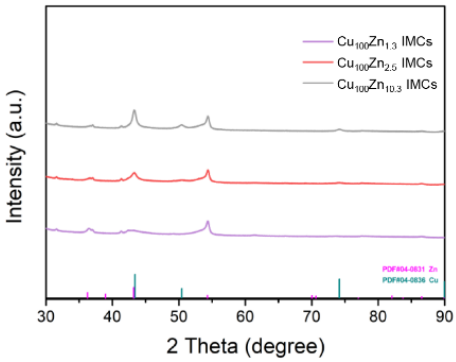

Fig. S3 XRD patterns of Cu_xZn_y IMCs obtained by electrodeposition at a constant potential of 3 V for 2 min.

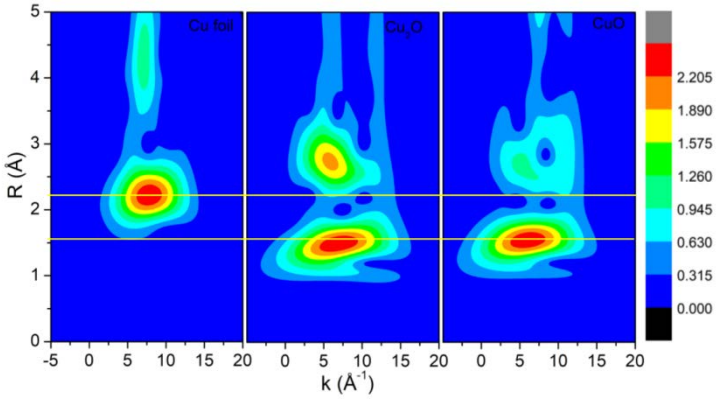

Fig. S4 Morlet WT of the k^3-weighted EXAFS data of Cu foil, Cu_2O, and CuO standard samples.

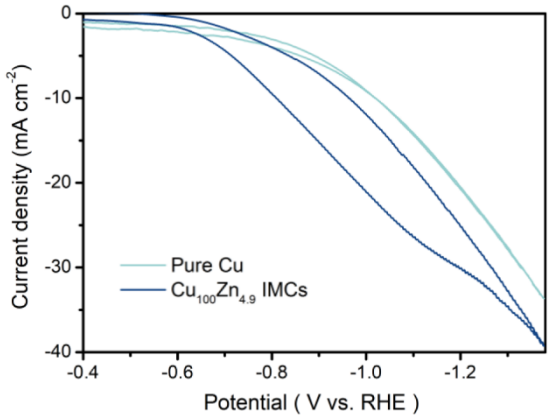

Fig. S5 CV curves of the as-prepared pure Cu and $Cu_{100}Zn_{4.9}$ IMCs electrodes in CO_2-saturated electrolyte.

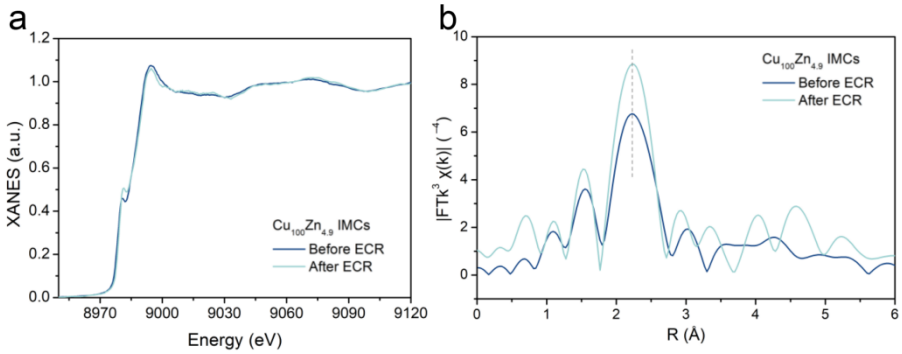

Fig. S6 (a) Cu K-edge XANES data and (b) FT Cu K-edge EXAFS data of $Cu_{100}Zn_{4.9}$ IMCs catalysts in before and after ECR.

Table S1 Elemental composition in (w/w) of the Cu and Zn investigated samples determined by ICP-OES (Cu_xZn_y IMCs; *x/y*: mole ratio of Cu/Zn and the values of *x* and y were determined by the ICP-OES).

Electrocatalyst	Cu (wt%)	Zn (wt%)
$Cu_{100}Zn_{1.3}$ IMCs	98.7	1.3
$Cu_{100}Zn_{2.5}$ IMCs	97.5	2.5
$Cu_{100}Zn_{4.9}$ IMCs	95.2	4.8
$Cu_{100}Zn_{10.3}$ IMCs	90.5	9.5

Table S2 Comparison of the results of CO_2 electroreduction to C_{2+} products over various bimetallic electrocatalysts in H-cell.

Electrocatalyst	Potential/ V vs. RHE	Electrolyte	FE (C_{2+}) /%	*j* (C_{2+})/ (mA cm^{-2})	Ref.
$Cu_{100}Zn_{4.9}$ IMCs	−1.28	0.1 M CsI	75.0	30.0	**This work**
AgI-CuO	−1.00	1 M KOH	68.9	18.2	Angewandte Chemie International Edition, 2022, 61: e202116706
Ag NPs on Cu NWs	−0.90	0.1 M $KHCO_3$	50.0	6.5	Angewandte Chemie International Edition, 2019, 58(40): 14100-14103
$Cu_{99.3}Au_{0.7}$ NWs	−1.25	0.1 M $KHCO_3$ +0.1 M KCl	65.3	12.1	Nano Research, 2023, 16: 7777-7783
Pd-Cu pentagonal bipyramids	−1.00	0.5 M $KHCO_3$	50.3	20	Journal of the American Chemical Society, 2021, 143: 149-162
Au-bipy-Cu NW	−1.10	0.1 M $KHCO_3$	55.0	12	Angewandte Chemie International Edition, 2019, 131: 14238-14241
Cu_5Zn_8	−0.80	0.1 M $KHCO_3$	58.0	4.0	Applied Catalysis B:

					Environmental, 2020, 269: 118800
CuAg	−1.05	0.1 M $KHCO_3$	76.0	18.1	Journal of the American Chemical Society, 2019, 141: 18704-18714
CuAu	−1.05	0.1 M $KHCO_3$	70.0	30.0	Faraday Discussions, 2019, 215: 282-296