Table S1. Metallic Cu

Electromaterial description	Catalyst type	Majority elements	Polymeric / (in-) organic additives	Membrane	Membrane type	Reactant	E	j	FE C2H4 (max)	Reference
Commercial 70 nm Cu NPs with chitosan bio-based polymeric binder, on Toray TGP-H-60 GDL	Metallic Cu	Cu	Chitosan	Sustainion X-37 50 grade	(AEM)	CO2	-0.53 V vs. RHE	-10 mA/cm2	94	A. Marcos-Madrazo, C. Casado-Coterillo, J. Iniesta, A. Irabien, Use of Chitosan as Copper Binder in the Continuous Electrochemical Reduction of CO2 to Ethylene in Alkaline Medium. Membranes 12, 783 (2022).
Commercial Cu NPs (25 nm), on a GDL with custom MPL, hotpressed onto a Nafion membrane	Metallic Cu	Cu	Nafion	Nafion 117	(CEM)	CO2	-1.7 V vs. Ag/AgCl	-7.5 mA/cm2	93	I. Merino-Garcia, J. Albo, A. Irabien, Tailoring gas-phase CO2 electroreduction selectivity to hydrocarbons at Cu nanoparticles. Nanotechnology 29, 014001 (2018).
60 nm step site-rich Cu NPs blow-dried with Ar, on GDL	Metallic Cu	Cu	Sustainion XA-9	Fumasep FAA-3-PK-75	(AEM)	CO2	-0.58 V - iR vs. RHE	-710 mA/cm2	80	X. She et al., Pure-water-fed, electrocatalytic CO2 reduction to ethylene beyond 1,000 h stability at 10 A. Nature Energy, (2024).
CO2RR pre-activated defective Cu NWs, on glassy carbon (tested in semi-pulsed electrolysis mode)	Metallic Cu	Cu	Nafion	Nafion	(CEM)	CO2	-1.01 V - iR vs. RHE	-22 mA/cm2	77	C. Choi et al., Highly active and stable stepped Cu surface for enhanced electrochemical CO2 reduction to C2H4. Nature Catalysis 3, 804-812 (2020).
Right bipyramidal {100}-rich Cu NPs with stacking faults, on GDL	Metallic Cu	Cu	Nafion	FAA-3-PK-75	(AEM)	CO2	-0.63 V - iR vs. RHE	-325 mA/cm2	67	Z. Li et al., Planar defect-driven electrocatalysis of CO2-to-C2H4 conversion. Journal of Materials Chemistry A 9, 19932-19939 (2021).
Metallic Cu NPs mixed with PTFE, dropcast on GDL	Metallic Cu	Cu	Nafion, PTFE	Selemion DSVN	(AEM)	CO	-1.38 V - iR vs. RHE	-600 mA/cm2	67	M. Liu et al., Potential Alignment in Tandem Catalysts Enhances CO2-to-C2H4 Conversion Efficiencies. Journal of the American Chemical Society 146, 468-475 (2024).
25 nm-thick Cu layer, evaporated on GDL	Metallic Cu	Cu	-	Fumasep FAB-PK-130	(AEM)	CO2	-0.54 V - iR vs. RHE	-275 mA/cm2	66	C.-T. Dinh et al., CO2 electroreduction to ethylene via hydroxide-mediated copper catalysis at an abrupt interface. Science 360, 783-787 (2018).
25 nm-thick Cu layer, evaporated on GDL	Metallic Cu	Cu	-	Fumasep FAB-PK-130	(AEM)	CO2	-0.62 V - iR vs. RHE	-500 mA/cm2	65	C.-T. Dinh et al., CO2 electroreduction to ethylene via hydroxide-mediated copper catalysis at an abrupt interface. Science 360, 783-787 (2018).
Ultrasonically detached N2 atmosphere/high current density-electroplated Cu dendrites, on GDL	Metallic Cu	Cu	Nafion	? (X37–50 Grade 60)	(AEM)	CO2	-1.24 V vs. RHE	-37 mA/cm2	60	Z. Gu et al., Efficient Electrocatalytic CO2 Reduction to C2+ Alcohols at Defect-Site-Rich Cu Surface. Joule 5, 429-440 (2021).
{100}-rich Cu NCs, on GDL	Metallic Cu	Cu	-	Fumasep FAB-PK-130	(AEM)	CO2	-0.70 V - iR vs. RHE	-200 mA/cm2	60	G. L. De Gregorio et al., Facet-Dependent Selectivity of Cu Catalysts in Electrochemical CO2 Reduction at Commercially Viable Current Densities. ACS Catal 10, 4854-4862 (2020).
Cu NCs, on GDL	Metallic Cu	Cu	-	Fumasep FAB-PK-130	(AEM)	CO2	-0.47 V - iR vs. RHE	-75 mA/cm2	60	Y. Wang et al., Copper Nanocubes for CO2 Reduction in Gas Diffusion Electrodes. Nano Letters 19, 8461-8468 (2019).
Metallic Cu NPs, on GDL	Metallic Cu	Cu	Nafion	NEOSEPTA, AHA	(AEM)	CO	-0.69 V - iR vs. RHE	?	60	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angew Chem Int Ed 61, e202213423 (2022).
Cu NPs, on GDL	Metallic Cu	Cu	Nafion	FAA-3-50	(AEM)	CO2	-0.99 V - iR vs. RHE	-1250 mA/cm2	59	W. Ren, A. Xu, K. Chan, X. Hu, A Cation Concentration Gradient Approach to Tune the Selectivity and Activity of CO2 Electroreduction. Angewandte Chemie International Edition 61, e202214173 (2022).
Cu NWs after 15 h synthesis, on GDL	Metallic Cu	Cu	Nafion	?	(AEM)	CO2	-1.08 V vs. RHE	-123 mA/cm2	59	Y. Zhang et al., Selective CO2 Reduction to Ethylene Over a Wide Potential Window by Copper Nanowires with High Density of Defects. Inorganic Chemistry 61, 20666-20673 (2022).
Ultrasonically detached N2 atmosphere/high current	Metallic Cu	Cu	Nafion	X37–50 Grade 60	(AEM)	CO2	-1.0 V	-134	58	Z. Gu et al., Efficient Electrocatalytic CO2 Reduction to C2+ Alcohols at Defect-Site-Rich Cu

density-electroplated Cu dendrites, on GDL							vs. RHE	mA/cm2		Surface. Joule 5, 429-440 (2021).
Cu nanorods (control sample), on GDL (poorly described synthesis, inaccurate reference)	Metallic Cu	Cu	Nafion	Fumapem FAA-3-PK-130	(AEM)	CO2	-0.59 V - iR vs. RHE	?	57	H. Huo, J. Wang, Q. Fan, Y. Hu, J. Yang, Cu-MOFs Derived Porous Cu Nanoribbons with Strengthened Electric Field for Selective CO2 Electroreduction to C2+ Fuels. Advanced Energy Materials 11, 2102447 (2021).
Commercial Cu NPs, on GDL	Metallic Cu	Cu	Nafion	Sustainion, X37-50 Grade T	(AEM)	CO	?	-150 mA/cm2	56	H. Phong Duong et al., Silver and Copper Nitride Cooperate for CO Electroreduction to Propanol. Angewandte Chemie International Edition n/a, e202310788 (2023).
Commercial Cu NPs (100 nm), on GDL	Metallic Cu	Cu	Nafion	Fumasep FAA-PK-130	(AEM)	CO	-0.69 V - iR vs. RHE	-934 mA/cm2	56	J. Li et al., Enhanced multi-carbon alcohol electroproduction from CO via modulated hydrogen adsorption. Nature Communications 11, 3685 (2020).
1000 nm-thick Cu layer, sputtered on GDL	Metallic Cu	Cu	-	"Fumasep"	(BPM [rev])	CO2	-4.23 V vs. Ag/AgCl	-250 mA/cm2	56	C. A. Obasanjo et al., In situ regeneration of copper catalysts for long-term electrochemical CO2 reduction to multiple carbon products. Journal of Materials Chemistry A 10, 20059-20070 (2022).
Cu electrosputtered on electrospun PVDF-HFP-based GDL with 0.2 µm pore size	Metallic Cu	Cu	poly-(vinyliden-fluoride-co-hexafluorpropylene)	Nafion 117	(CEM)	CO2	-1 V - iR vs. RHE	-200 mA/cm2	55	F. Bernasconi, A. Senocrate, P. Kraus, C. Battaglia, Enhancing C≥2 product selectivity in electrochemical CO2 reduction by controlling the microstructure of gas diffusion electrodes. EES Catalysis 1, 1009-1016 (2023).
25 nm-thick Cu layer, evaporated on GDL	Metallic Cu	Cu	-	Nafion 117	(CEM)	CO2	-0.88 V - iR vs. RHE	-106 mA/cm2	55	H. Zhang, J. Gao, D. Raciti, A. S. Hall, Promoting Cu-catalysed CO2 electroreduction to multicarbon products by tuning the activity of H2O. Nature Catalysis 6, 807-817 (2023).
In-house metallic Cu NPs, on mesoporous carbon/PTFE-modified carbon paper	Metallic Cu	Cu	Nafion	?	(AEM)	CO	-0.70 V vs. RHE	-22 mA/cm2	53	R. Chen et al., Highly Selective Production of Ethylene by the Electroreduction of Carbon Monoxide. Angewandte Chemie 132, 160-166 (2020).
Cu layer sporting 50-80 nm Cu NPs, sputtered on GDL	Metallic Cu	Cu	-	Fumasep FKS-50	(AEM)	CO2	-0.63 V - iR vs. RHE	-247 mA/cm2	53	J. Gao et al., Electrochemical synthesis of propylene from carbon dioxide on copper nanocrystals. Nat Chem, (2023).
Commercial Cu NPs (60-80 nm), on GDL	Metallic Cu	Cu	Nafion	Nafion 117	(CEM)	CO	?	-300 mA/cm2	52	N. S. Romero Cuellar, K. Wiesner-Fleischer, M. Fleischer, A. Rucki, O. Hinrichsen, Advantages of CO over CO2 as reactant for electrochemical reduction to ethylene, ethanol and n-propanol on gas diffusion electrodes at high current densities. Electrochimica Acta 307, 164-175 (2019).
{100}-rich Cu NCs, on GDL	Metallic Cu	Cu	-	Fumasep FAB-PK-130	(AEM)	CO2	-0.80 V - iR vs. RHE	-200 mA/cm2	52	G. L. De Gregorio et al., Facet-Dependent Selectivity of Cu Catalysts in Electrochemical CO2 Reduction at Commercially Viable Current Densities. ACS Catal 10, 4854-4862 (2020).
Electropolished (i.e., defective) Cu(911) single crystal	Metallic Cu	Cu	-	-	(n/a)	CO2	-1.36 V vs. RHE	-5 mA/cm2	51	Y. Hori, I. Takahashi, O. Koga, N. Hoshi, Electrochemical reduction of carbon dioxide at various series of copper single crystal electrodes. J Mol Catal A: Chem 199, 39-47 (2003).
Star decahedron-shaped 30 nm Cu NPs, on glassy carbon RDE	Metallic Cu	Cu	-	?	(AEM)	CO2	-0.98 V - iR vs. RHE	-17 mA/cm2	51	C. Choi et al., A Highly Active Star Decahedron Cu Nanocatalyst for Hydrocarbon Production at Low Overpotentials. Advanced Materials 31, 1805405 (2019).
275 nm-thick Cu layer, evaporated on e-PTFE GDL	Metallic Cu	Cu	-	"Sustanion"	(AEM)	CO2	-0.96 V - iR vs. RHE	-214 mA/cm2	51	D. Corral et al., Advanced manufacturing for electrosynthesis of fuels and chemicals from CO2. Energy & Environmental Science 14, 3064-3074 (2021).
EDTA-assisted electrodeposited hollow porous copper microspheres, on carbon paper	Metallic Cu	Cu	-	Nafion 117	(CEM)	CO2	-0.82 V - iR vs. RHE	-8 mA/cm2	50	J. Liu et al., Controlled Synthesis of EDTA-Modified Porous Hollow Copper Microspheres for High-Efficiency Conversion of CO2 to Multicarbon Products. Nano Letters 20, 4823-4828 (2020).
60 nm step site-rich Cu NPs blow-dried with Ar, on GDL (6-cell stack)	Metallic Cu	Cu	Sustainion XA-9	Home-made BPM	(BPM [for])	CO2	-4.35 V vs. ANODE	-56 mA/cm2	50	X. She et al., Pure-water-fed, electrocatalytic CO2 reduction to ethylene beyond 1,000 h stability at 10 A. Nature Energy, (2024).

Mechanically polished and electropolished (i.e., defective) Cu(100) single crystal	Metallic Cu	Cu	-	Selemion CMV	(CEM)	CO2	-1.18 V - iR vs. RHE	-7 mA/cm2	49[=]	Y. Huang, C. W. Ong, B. S. Yeo, Effects of Electrolyte Anions on the Reduction of Carbon Dioxide to Ethylene and Ethanol on Copper (100) and (111) Surfaces. ChemSusChem 11, 3299-3306 (2018).
Electropolished Cu plate	Metallic Cu	Cu	-	"Selemion"	(CEM)	CO2	-1.40 V - iR vs. NHE	-5 mA/cm2	48	Y. Hori, A. Murata, R. Takahashi, S. Suzuki, Enhanced formation of ethylene and alcohols at ambient temperature and pressure in electrochemical reduction of carbon dioxide at a copper electrode. J Chem Soc, Chem Commun, 17-19 (1988).
Electropolished Cu plate	Metallic Cu	Cu	-	"Selemion"	(CEM)	CO2	-1.44 V - iR vs. SHE	-5 mA/cm2	48	M. Akira, H. Yoshio, Product Selectivity Affected by Cationic Species in Electrochemical Reduction of CO2 and CO at a Cu Electrode. Bulletin of the Chemical Society of Japan 64, 123-127 (1991).
Commercial metallic Cu NWs, on GDL	Metallic Cu	Cu	?	?	(n/a)	CO	-0.7 V vs. RHE	-92 mA/cm2	48	A. Guan et al., Steric effect induces CO electroreduction to CH4 on Cu–Au alloys. Journal of Materials Chemistry A 9, 21779-21784 (2021).
Cu sputtered on PTFE GDL	Metallic Cu	Cu	-	X37-50 Grade RT	(AEM)	CO	-2.2 V vs. ANODE	-25 mA/cm2	48	M. A. Adnan, S. K. Nabil, K. Kannimuthu, M. G. Kibria, Modulating Cation and Water Transports for Enhanced CO Electrolysis via Ionomer Coating. ChemSusChem n/a, e202301425.
Commercial Cu NPs, on GDL	Metallic Cu	Cu	Nafion	FKB-PK-130	(CEM)	CO	-0.67 V - iR vs. RHE	-500 mA/cm2	47	M. P. Schellekens, S. J. Raaijman, M. T. M. Koper, P. J. Corbett, Temperature-dependent selectivity for CO electroreduction on copper-based gas-diffusion electrodes at high current densities. Chemical Engineering Journal 483, 149105 (2024).
Commercial 50 nm Cu NPs, on GDL	Metallic Cu	Cu	Nafion	Nafion 117	(CEM)	CO	-1.04 V - iR vs. RHE	-300 mA/cm2	46	N. S. Romero Cuellar et al., Two-step electrochemical reduction of CO2 towards multi-carbon products at high current densities. Journal of CO2 Utilization 36, 263-275 (2020).
Electropolished (i.e., defective) Cu(100) single crystal	Metallic Cu	Cu	-	Selemion AMV	(AEM)	CO2	-1.0 V vs. RHE	?	45	R. M. Arán-Ais, F. Scholten, S. Kunze, R. Rizo, B. Roldan Cuenya, The role of in situ generated morphological motifs and Cu(i) species in C2+ product selectivity during CO2 pulsed electroreduction. Nature Energy 5, 317-325 (2020).
Cu overlayer sputtered on GDL	Metallic Cu	Cu	-	Fumasep FAA-3-PK-75	(AEM)	CO2	-1.61 V - iR vs. SHE	-300 mA/cm2	45	M. Ma et al., Insights into the carbon balance for CO2 electroreduction on Cu using gas diffusion electrode reactor designs. Energy & Environmental Science 13, 977-985 (2020).
Magnetron sputtered Cu layer on GDL	Metallic Cu	Cu	-	Fumasep FAA-3-PK-75	(AEM)	CO	-1.44 V - iR vs. SHE	-100 mA/cm2	45	M. Ma et al., Local reaction environment for selective electroreduction of carbon monoxide. Energy & Environmental Science 15, 2470-2478 (2022).
Cu electrosputtered on electrospun PVDF-HFP-based GDL with 0.2 µm pore size	Metallic Cu	Cu	poly-(vinyliden-fluoride-co-hexafluorpropylene)	Nafion 117	(CEM)	CO	?	-30 mA/cm2	44	F. Bernasconi, A. Senocrate, P. Kraus, C. Battaglia, Enhancing C≥2 product selectivity in electrochemical CO2 reduction by controlling the microstructure of gas diffusion electrodes. EES Catalysis 1, 1009-1016 (2023).
Commercial Cu NPs (25 nm) mixed with PTFE, on GDL	Metallic Cu	Cu	PTFE	"Sustanion"	(AEM)	CO	-0.60 V vs. RHE	-600 mA/cm2	44	T. Zhang et al., The Conventional Gas Diffusion Electrode May Not Be Resistant to Flooding during CO2/CO Reduction. Journal of The Electrochemical Society 169, 104506 (2022).
Metallic Cu layer, evaporated on GDL	Metallic Cu	Cu	-	Fumasep FAA-PK-130)	(AEM)	CO	-0.64 V - iR vs. RHE	?	43	Y. Pang et al., Efficient electrocatalytic conversion of carbon monoxide to propanol using fragmented copper. Nature Catalysis 2, 251-258 (2019).
60 nm step site-rich Cu NPs blow-dried with Ar, on GDL	Metallic Cu	Cu	Sustainion XA-9	Home-made BPM	(BPM [for])	CO2	-4.3 V vs. ANODE	-300 mA/cm2	43	X. She et al., Pure-water-fed, electrocatalytic CO2 reduction to ethylene beyond 1,000 h stability at 10 A. Nature Energy, (2024).
In-house Cu NPs, on GDL	Metallic Cu	Cu	Nafion	FAB-PK-130,	(AEM)	CO	-0.88 V - iR vs. RHE	-818 mA/cm2	43	Y. Ji et al., Selective CO-to-acetate electroreduction via intermediate adsorption tuning on ordered Cu–Pd sites. Nature Catalysis 5, 251-258 (2022).
Oleylamine-stabilized Cu-NWs on glassy carbon, cleaned (ligand removal) via photonic curing method	Metallic Cu	Cu	-	Nafion 117	(CEM)	CO2	-1.1 V - iR vs. RHE	-19 mA/cm2	42	Y. Hou et al., Photonic Curing: Activation and Stabilization of Metal Membrane Catalysts (MMCs) for the Electrochemical Reduction of CO2. ACS Catal 9, 9518-9529 (2019).

44 nm Cu NCs, on glassy carbon	Metallic Cu	Cu	-	Selemion AMV	(AEM)	CO2	-1.1 V vs. RHE	-3 mA/cm2	41	A. Loiudice et al., Tailoring Copper Nanocrystals towards C2 Products in Electrochemical CO2 Reduction. Angewandte Chemie International Edition 55, 5789-5792 (2016).
Magnetron sputtered Cu layer (100 nm) on GDL	Metallic Cu	Cu	-	Nafion 212	(CEM)	CO2	-3.4 V vs. RHE	-200 mA/cm2	40	M. Sassenburg et al., Characterizing CO2 Reduction Catalysts on Gas Diffusion Electrodes: Comparing Activity, Selectivity, and Stability of Transition Metal Catalysts. ACS Applied Energy Materials 5, 5983-5994 (2022).
Cu(100) crystal prepared via PVD of Cu on Si(100) crystal	Metallic Cu	Cu	-	Selemion AMV	(AEM)	CO2	-0.97 V - iR vs. RHE	-4 mA/cm2	39	C. Hahn et al., Engineering Cu surfaces for the electrocatalytic conversion of CO2: Controlling selectivity toward oxygenates and hydrocarbons. Proceedings of the National Academy of Sciences 114, 5918-5923 (2017).
Well-defined porous copper layer with controlled pore size (30 nm), depth (40 nm) and interspacing, on stainless steel	Metallic Cu	Cu	-	Selemion AMV	(AEM)	CO2	-1.7 V - iR vs. RHE	-15 mA/cm2	37	K. D. Yang et al., Morphology-Directed Selective Production of Ethylene or Ethane from CO2 on a Cu Mesopore Electrode. Angewandte Chemie 129, 814-818 (2017).
Cu layer magnetron-sputtered on GDL	Metallic Cu	Cu	-	?	(AEM)	CO2	-1.17 V vs. RHE	-222 mA/cm2	37	Y. Yang, H. Fu, C. Xiao, X. Du, Z. Song, Efficient electrochemical CO2 reduction to C2+ hydrocarbons on Zn-doped Cu films. Applied Surface Science 646, 158866 (2024).
60 nm step site-rich Cu NPs blow-dried with Ar, on GDL	Metallic Cu	Cu	Sustainion XA-9	Fumasep FAA-3-PK-75	(AEM)	CO	-0.43 V - iR vs. RHE	-67 mA/cm2	29	X. She et al., Pure-water-fed, electrocatalytic CO2 reduction to ethylene beyond 1,000 h stability at 10 A. Nature Energy, (2024).
"We report here the highest C2H4 value with a total FE close to 100% (being 49 % as opposed to 50 %)										

Table S2. Oxide-derived Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Template-assisted electroplated nanoporous (20 nm pore diameter) CuOx overlayer on Cu foam	Oxide-derived	Cu, O	-	X37-50 Grade 60	(AEM)	CO2	-3.0 V vs. ANODE	-368 mA/cm2	86	J. Han et al., Structuring Cu Membrane Electrode for Maximizing Ethylene Yield from CO2 Electroreduction. Advanced Materials n/a, 2313926.
Amorphous CuOx film evaporation-deposited on GDL	Oxide-derived	Cu, O	-	"Nafion"	(CEM)	CO2	-1.3 V - iR vs. RHE	-32 mA/cm2	85	R. Wang et al., Selective Generation of Electroreduction C1–C2 Products Through Self-Regulation of Catalytically Active Cu Sites on the Same Coordination Cluster Catalyst. CCS Chemistry 5, 2237-2250 (2023).
KOH anodization-derived CuO nanoplate on Cu-sputtered GDL	Oxide-derived	Cu, O	-	Sustainion X37-50	(AEM)	CO2	-0.81 V - iR vs. RHE	-100 mA/cm2	84	W. Liu et al., Electrochemical CO2 reduction to ethylene by ultrathin CuO nanoplate arrays. Nature Communications 13, 1877 (2022).
Defective CuO-derived Cu nanosheets, on glassy carbon	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-1.18 V - iR vs. RHE	-60 mA/cm2	83	B. Zhang et al., Highly Electrocatalytic Ethylene Production from CO2 on Nanodefective Cu Nanosheets. Journal of the American Chemical Society 142, 13606-13613 (2020).
Calcined (in Al foil!) electroplated Cu dendrites, on GDL	Oxide-derived	Cu, O, Al (?)	Nafion	Sustainion X37-50 Grade T	(AEM)	CO	?	-100 mA/cm2	78	H. P. Duong et al., Highly Selective Copper-Based Catalysts for Electrochemical Conversion of Carbon Monoxide to Ethylene Using a Gas-Fed Flow Electrolyzer. ACS Catal 12, 10285-10293 (2022).
Amorphous CuOx film evaporation-deposited on GDL	Oxide-derived	Cu, O	-	FBAPK-13	(AEM)	CO2	-1.75 V vs. ANODE	-113 mA/cm2	78	R. Wang et al., Selective Generation of Electroreduction C1–C2 Products Through Self-Regulation of Catalytically Active Cu Sites on the Same Coordination Cluster Catalyst. CCS Chemistry 5, 2237-2250 (2023).
Porous Cu2O microparticles, on PTFE-modified GDL	Oxide-derived	Cu, O	Nafion	Nafion 115	(CEM)	CO	?	-800 mA/cm2	76	Y. Wang, Q. Cheng, H. Zhang, L. Ma, H. Yang, Cobalt(II) tetraphenylporphyrin trapped in the pores of Cu2O to enhance the C2+ selectivity towards acidic CO2 electroreduction. Chemical Engineering Journal 492, 152254 (2024).
Star shaped {322}-rich Cu2O large NPs, on glassy carbon	Oxide-derived	Cu, O	Nafion D-521	Nafion	(CEM)	CO2	-1.2 V vs. RHE	-11 mA/cm2	74	H. Luo, B. Li, J.-G. Ma, P. Cheng, Surface Modification of Nano-Cu2O for Controlling CO2 Electrochemical Reduction to Ethylene and Syngas. Angewandte Chemie International Edition 61, e202116736 (2022).
N-doped CuOx NPs derived from calcination of Cu(OH)3NO3 precursor at 350 °C, on GDL	Oxide-derived	Cu, O, N	Nafion	Fumasep-FAA-3-PK-130	(AEM)	CO2	-1.09 V - iR vs. RHE	-962° mA/cm2	73	H. Tao, F. Wang, Z. Zhang, S. Min, Surface N-coordinated Cu catalysts for CO2 electroreduction to ethylene at industry-level current densities. Sustainable Energy & Fuels 7, 2991-2996 (2023).
{220}-facet rich CuI nanodots (5.3 nm) prepared via in-situ reduction of (Cu(OH)2) NPs on carbon paper GDL in 0.1 M KHCO3 + 0.1 M KI	Oxide-derived	Cu, O, I	Nafion	FAA-3-PK -130	(AEM)	CO2	-2.1 V vs. RHE	-800 mA/cm2	72	W. Xue et al., Operando reconstruction towards stable CuI nanodots with favorable facets for selective CO2 electroreduction to C2H4. Science China Chemistry 66, 1834-1843 (2023).
Grainboundary-rich Cu2CO3(OH)2-derived Cu nanoribbons with Carbon NP midlayer and graphite toplayer, on PTFE GDL	Oxide-derived	Cu, O, C	-	Fumapem FAA-3-PK-130	(AEM)	CO2	-1.6 V vs. RHE	-700 mA/cm2	71	L. Bian et al., Grain boundary-abundant copper nanoribbons on balanced gas-liquid diffusion electrodes for efficient CO2 electroreduction to C2H4. Chinese Journal of Catalysis 54, 199-211 (2023).
Sputtered Cu with Carbon NP midlayer and graphite toplayer, on PTFE GDL	Oxide-derived	Cu, C	-	Fumasep FAB-PK-130	(AEM)	CO2	-0.57 V - iR vs. RHE	-100 mA/cm2	70	A. Thevenon, A. Rosas-Hernández, J. C. Peters, T. Agapie, In-Situ Nanostructuring and Stabilization of Polycrystalline Copper by an Organic Salt Additive Promotes Electrocatalytic CO2 Reduction to Ethylene. Angewandte Chemie 131, 17108-17114 (2019).
Cu3(PO4)2 particles, on glassy carbon	Oxide-derived	Cu, O, P	Nafion	Nafion 117	(CEM)	CO2	-1.45 V vs. RHE	-23 mA/cm2	70	X. Y. Zhang et al., Direct OC-CHO coupling towards highly C2+ products selective electroreduction over stable Cu0/Cu2+ interface. Nature Communications 14, 7681 (2023).
Iodine-doped copper oxychloride NPs, on glassy carbon	Oxide-derived	Cu, O, Cl, I	Nafion	-	(n/a)	CO2	-1.71 V vs. RHE	-29 mA/cm2	70	H. Bai et al., Controllable CO adsorption determines ethylene and methane productions from CO2 electroreduction. Science Bulletin 66, 62-68 (2021).
Wet-chemical induced (NaOH / (NH4)2S2O8) high	Oxide-derived	Cu, O	-	"Nafion"	(CEM)	CO	-0.8 V	-130	70	W. Yang et al., Boosting C–C coupling to multicarbon products via high-pressure CO

roughness nanoporous CuOx layer on Cu plate							vs. RHE	mA/cm2		electroreduction. Journal of Energy Chemistry 85, 102-107 (2023).
Template-assisted electroplated nanoporous (20 nm pore diameter) CuOx overlayer on Cu plate	Oxide-derived	Cu, O	-	Nafion 117	(CEM)	CO2	-0.99 V vs. RHE	-63 mA/cm2	70	J. Han et al., Structuring Cu Membrane Electrode for Maximizing Ethylene Yield from CO2 Electroreduction. Advanced Materials n/a, 2313926.
80-100 nm Cu2−xS NPs, on glassy carbon	Oxide-derived	Cu, S	-	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-51 mA/cm2	69	C. He et al., Cu2−xS derived copper nanoparticles: A platform for unraveling the role of surface reconstruction in efficient electrocatalytic CO2-to-C2H4 conversion. Nano Research 16, 4494-4498 (2021).
Cu nanoneedles electrodeposited on Cu-sputtered PTFE GDL	Oxide-derived	Cu, O	-	Nafion 117	(CEM)	CO2	-2 V -iR vs. RHE	-1200 mA/cm2	69	X. Zi et al., Breaking K+ Concentration Limit on Cu Nanoneedles for Acidic Electrocatalytic CO2 Reduction to Multi-Carbon Products. Angewandte Chemie International Edition n/a, e202309351.
Branched/'spikey' CuO NPs derived from NH3-treated Cu2O NCs supported on Ketjen black, on on glassy carbon	Oxide-derived	Cu, O, C	Nafion (top-coat)	Nafion 117	(CEM)	CO2	-1.05 V -iR vs. RHE	-26 mA/cm2	68	J. Kim et al., Branched Copper Oxide Nanoparticles Induce Highly Selective Ethylene Production by Electrochemical Carbon Dioxide Reduction. Journal of the American Chemical Society 141, 6986-6994 (2019).
Calcined (in Al foil!) electroplated Cu dendrites, on GDL	Oxide-derived	Cu, O, Al (?)	Nafion	Sustainion X37-59 Grade 60	(AEM)	CO	-3.1 V vs. ANODE	-100 mA/cm2	68	N.-H. Tran et al., Selective Ethylene Production from CO2 and CO Reduction via Engineering Membrane Electrode Assembly with Porous Dendritic Copper Oxide. ACS Applied Materials & Interfaces 14, 31933-31941 (2022).
Electrochemical-assisted iodine-reconstructed Cu foil	Oxide-derived	Cu, O, I	-	Nafion 117	(CEM)	CO	-0.56 V vs. RHE	-8 mA/cm2	68	J. Han et al., A reconstructed porous copper surface promotes selectivity and efficiency toward C2 products by electrocatalytic CO2 reduction. Chemical Science 11, 10698-10704 (2020).
Cu3(PO4)2-derived Cu NPs on glassy carbon	Oxide-derived	Cu	Nafion	Nafion 117	(CEM)	CO2	-1.48 V vs. RHE	-33 mA/cm2	67	B. Zhang et al., Steering CO2 electroreduction toward methane or ethylene production. Nano Energy 88, 106239 (2021).
Grainboundary-rich Cu2CO3(OH)2-derived Cu nanoribbons, on carbon paper	Oxide-derived	Cu, O, C	-	Fumapem FAA-3-PK-130	(AEM)	CO2	-1.27 V vs. RHE	-700 mA/cm2	67	L. Bian et al., Grain boundary-abundant copper nanoribbons on balanced gas-liquid diffusion electrodes for efficient CO2 electroreduction to C2H4. Chinese Journal of Catalysis 54, 199-211 (2023).
{111}-facet rich octahedral Cu2O NPs supported on hydroxl-rich acetylene black carbon, on glassy carbon	Oxide-derived	Cu, O, C	Nafion	?	(AEM)	CO2	-1.1 V vs. RHE	-67 mA/cm2	67	Y. Gao et al., Promoting Electrocatalytic Reduction of CO2 to C2H4 Production by Inhibiting C2H5OH Desorption from Cu2O/C Composite. Small 18, 2105212 (2022).
Electroplated (1 C/cm2) Cu2O from lactic-acid containing bath, on GDL	Oxide-derived	Cu, O	-	-	(n/a)	CO2	-0.8 V vs. RHE	-183 mA/cm2	67	D. Anastasiadou, M. Schellekens, M. de Heer, S. Verma, E. Negro, Electrodeposited Cu2O Films on Gas Diffusion Layers for Selective CO2 Electroreduction to Ethylene in an Alkaline Flow Electrolyzer. ChemElectroChem 6, 3928-3932 (2019).
25 nm-thick Cu layer, evaporated on GDL	Oxide-derived	Cu	-	Fumasep FAB-PK-130	(AEM)	CO2	-0.54 V - iR vs. RHE	-275 mA/cm2	66	A. Thevenon, A. Rosas-Hernández, J. C. Peters, T. Agapie, In-Situ Nanostructuring and Stabilization of Polycrystalline Copper by an Organic Salt Additive Promotes Electrocatalytic CO2 Reduction to Ethylene. Angewandte Chemie 131, 17108-17114 (2019).
Cu3N-derived Cu NWs, on copper foam	Oxide-derived	Cu, N	-	Nafion 115	(CEM)	CO2	-1.0 V vs. RHE	-51 mA/cm2	66	Y. Mi et al., Selective Electroreduction of CO2 to C2 Products over Cu3N-Derived Cu Nanowires. ChemElectroChem 6, 2393-2397 (2019).
CuOx NPs electrodeposited in the presence of CTAB, on Cu plate	Oxide-derived	Cu, O	-	Nafion 115	(CEM)	CO2	-1.0 V vs. RHE	-18 mA/cm2	66	A. Stalinraja, K. Gopalram, Electrochemical reduction of CO2 to C2 products—effect of surfactant on copper electrodeposition. Journal of Solid State Electrochemistry, (2023).
Cu(OH)F-derived Cu/F, on GDL	Oxide-derived	Cu, O, F	-	NEOSEPTA	(AEM)	CO2	-0.89 V - iR vs. RHE	-1600 mA/cm2	65	W. Ma et al., Electrocatalytic reduction of CO2 to ethylene and ethanol through hydrogen-assisted C–C coupling over fluorine-modified copper. Nature Catalysis 3, 478-487 (2020).
Non-swelling anion exchange ionomer (AEI)-modified electroreduced CuO nanosheets, on GDL	Oxide-derived	Cu, O	AEI: Xenergy Pention D 18, PTFE	Fumasep FAA PK 130	(AEM)	CO2	-0.78 V - iR vs. RHE	-800 mA/cm2	65	Y. Zhao et al., Industrial-Current-Density CO2-to-C2+ Electroreduction by Anti-swelling Anion-Exchange Ionomer-Modified Oxide-Derived Cu Nanosheets. Journal of the American Chemical Society 144, 10446-10454 (2022).

25 nm-thick Cu layer, evaporated on GDL	Oxide-derived	Cu	-	Fumasep FAB-PK-130	(AEM)	CO2	-0.62 V - iR vs. RHE	-500 mA/cm2	65	A. Thevenon, A. Rosas-Hernández, J. C. Peters, T. Agapie, In-Situ Nanostructuring and Stabilization of Polycrystalline Copper by an Organic Salt Additive Promotes Electrocatalytic CO2 Reduction to Ethylene. Angewandte Chemie 131, 17108-17114 (2019).
CuOx NP nanospheres, on GDL	Oxide-derived	Cu, O	Nafion	Fumasep FAA-PK-130	(AEM)	CO	-0.72 V - iR vs. RHE	-1250 mA/cm2	65	J. Li et al., Constraining CO coverage on copper promotes high-efficiency ethylene electroproduction. Nature Catalysis 2, 1124-1131 (2019).
Anodization-dirived Cu2O NWs on Cu-sputtered FTO glass	Oxide-derived	Cu, O	-	-	(n/a)	CO2	-0.8 V vs. RHE	-2 mA/cm2	65	A. H. Shah et al., New aspects of C2 selectivity in electrochemical CO2 reduction over oxide-derived copper. Physical Chemistry Chemical Physics 22, 2046-2053 (2020).
Electrochemical-assisted chlorine-reconstructed Cu NCs on hollow tubular novelty GDE	Oxide-derived	Cu, O, Cl	-	Fumasep FAB-PK-130	(AEM)	CO	-0.8 V vs. RHE	-740 mA/cm2	65	H. Rabiee et al., Tuning flow-through cu-based hollow fiber gas-diffusion electrode for high-efficiency carbon monoxide (CO) electroreduction to C2+products. Applied Catalysis B: Environmental 330, 122589 (2023).
Cu2P2O7 particles, on glassy carbon	Oxide-derived	Cu, O, P	Nafion	Nafion 117	(CEM)	CO2	-1.40 V vs. RHE	-18 mA/cm2	64	X. Y. Zhang et al., Direct OC-CHO coupling towards highly C2+ products selective electroreduction over stable Cu0/Cu2+ interface. Nature Communications 14, 7681 (2023).
Partially reduced, thermally annealed/oxidized electroplated Cu nanodendrites, on carbon paper	Oxide-derived	Cu, O	-	Nafion 115	(CEM)	CO2	-1.4 V (no iR) vs. RHE	-27 mA/cm2	63	Z. Gu et al., Oxygen Vacancy Tuning toward Efficient Electrocatalytic CO2 Reduction to C2H4. Small Methods 3, 1800449 (2019).
Ultrasonic-assisted defective CuO-derived Cu nanosheets, on GDL	Oxide-derived	Cu, O	-	Fumasep FAA-3-PK-75	(AEM)	CO2	-0.52 V - iR vs. RHE	-300 mA/cm2	63	J. Zhang et al., Grain Boundary-Derived Cu+/Cu0 Interfaces in CuO Nanosheets for Low Overpotential Carbon Dioxide Electroreduction to Ethylene. Advanced Science 9, 2200454 (2022).
In-situ formed Cu NPs supported on CuO nanosheets, on hydrophobic carbon cloth	Oxide-derived	Cu, O	Nafion	"from Fumasep"	(CEM)	CO2	-2.82 V vs. RHE	-700 mA/cm2	63	C. Kang et al., Acidic chloride electrolyte mediates the high conversion ratio of CO2-to-C2H4 and direct production of Cl2. Sustainable Energy & Fuels 8, 1730-1739 (2024).
In-situ reconstruction-driven (2D) defective CuO NWs, on GDL	Oxide-derived	Cu, O	Nafion	Fumasep FAA-3-PK-75	(AEM)	CO2	-0.56 V - iR vs. RHE	-324 mA/cm2	62	J. Zhang et al., Reconstructing two-dimensional defects in CuO nanowires for efficient CO2 electroreduction to ethylene. Chemical Communications 57, 8276-8279 (2021).
In-situ reconstructed defective CuO NWs, on carbon paper	Oxide-derived	Cu, O	Nafion	FAA-3-PK-75	(AEM)	CO2	-0.56 V - iR vs. RHE	-524 mA/cm2	62	J. Zhang et al., Reconstructing two-dimensional defects in CuO nanowires for efficient CO2 electroreduction to ethylene. Chemical Communications 57, 8276-8279 (2021).
Chloride-derived CuOx NPs prepared via chemical oxidation (H2O2), on Cu-sputtered GDL	Oxide-derived	Cu, O, Cl	-	?	(AEM)	CO2	-0.68 V -iR vs. RHE	-400 mA/cm2	61	M. G. Kibria et al., A Surface Reconstruction Route to High Productivity and Selectivity in CO2 Electroreduction toward C2+ Hydrocarbons. Advanced Materials 30, 1804867 (2018).
Metal–organic polyhedra-derived hollow CuOx NP based spheres	Oxide-derived	Cu, O	Nafion	?	(n/a)	CO2	-0.9 V - iR vs. RHE	-143 mA/cm2	61	R.-X. Yang et al., Self-Assembly of Hydroxyl Metal–Organic Polyhedra and Polymer into Cu-Based Hollow Spheres for Product-Selective CO2 Electroreduction. Small Structures 2, 2100012 (2021).
Cu3N NPs, on glassy carbon	Oxide-derived	Cu, N	Nafion	Nafion 117	(CEM)	CO2	-0.8 V vs. RHE	-60 mA/cm2	61	H. Wang et al., Cu3N nanoparticles with both (100) and (111) facets for enhancing the selectivity and activity of CO2 electroreduction to ethylene. New Journal of Chemistry 46, 12523-12529 (2022).
Polystyrene template-assisted interconnected mesoporous Cu2O NPs, on GDL	Oxide-derived	Cu, O	Nafion	Fumatech, FAA-3PK-130	(AEM)	CO2	?	-1000 mA/cm2	61	L. Fan et al., Evoking C2+ production from electrochemical CO2 reduction by the steric confinement effect of ordered porous Cu2O. Chemical Science 14, 13851-13859 (2023).
O2 plasma-treated (2 min, 20 W) Cu plate	Oxide-derived	Cu, O	-	Nafion	(CEM)	CO2	-0.9 V -iR vs. RHE	-10 mA/cm2	60	H. Mistry et al., Highly selective plasma-activated copper catalysts for carbon dioxide reduction to ethylene. Nature Communications 7, 12123 (2016).
Cu3N NCs_20nm supported on Ketjen Carbon, on carbon paper	Oxide-derived	Cu, N, C	Polyvinylidene fluoride (PVDF)	Nafion 212	(CEM)	CO2	-1.6 V vs. RHE	-30 mA/cm2	60	Z. Yin et al., Cu3N Nanocubes for Selective Electrochemical Reduction of CO2 to Ethylene. Nano Letters 19, 8658-8663 (2019).

Hybrid material composed of graphene oxide nanodots on CuO nanosheets, on GDL	Oxide-derived	Cu, O, C	Nafion	Fumasep FAA–PK–130)	(AEM)	CO2	-0.82 V - iR vs. RHE	-500 mA/cm2	60	R. Du et al., Cu-C(O) Interfaces Deliver Remarkable Selectivity and Stability for CO2 Reduction to C2+ Products at Industrial Current Density of 500 mA cm−2. Small 19, 2301289 (2023).
Nitridized Cu NPs, on GDL	Oxide-derived	Cu, N	Nafion	Sustainion, X37-50 Grade T	(AEM)	CO	?	-100 mA/cm2	60	H. Phong Duong et al., Silver and Copper Nitride Cooperate for CO Electroreduction to Propanol. Angewandte Chemie International Edition n/a, e202310788 (2023).
Electrochemical-assisted iodine-reconstructed Cu foil	Oxide-derived	Cu, O, I	-	Nafion 117	(CEM)	CO2	-1.09 V vs. RHE	-26 mA/cm2	60	J. Han et al., A reconstructed porous copper surface promotes selectivity and efficiency toward C2 products by electrocatalytic CO2 reduction. Chemical Science 11, 10698-10704 (2020).
Cu2(OH)2CO3 NPs, on glassy carbon	Oxide-derived	Cu, O	Nafion	?	(AEM)	CO2	-0.9 V vs. RHE	-50 mA/cm2	60	Y. Gao et al., Revealing the Lattice Carbonate Mediated Mechanism in Cu2(OH)2CO3 for Electrocatalytic Reduction of CO2 to C2H4. Advanced Science n/a, 2308949.
Plasma-fluorinated Cu sputter-deposited on PTFE GDL	Oxide-derived	Cu, F	Nafion	FAA-3-PK-130	(AEM)	CO2	-0.57 V -iR vs. RHE	-250 mA/cm2	60	Z. Zhou, X. Hu, J. Li, H. Xie, L. Wen, Enhanced CO2 Electroreduction to Multi-Carbon Products on Copper via Plasma Fluorination. Advanced Science n/a, 2309963.
Truncated octahedral Cu2O NPs having both {100} and {111} exposed facets supported on Carbon Black, on glassy carbon	Oxide-derived	Cu, O, C	Nafion	?	(AEM)	CO2	-1.1 V vs. RHE	-23 mA/cm2	59	Y. Gao et al., Cu2O Nanoparticles with Both {100} and {111} Facets for Enhancing the Selectivity and Activity of CO2 Electroreduction to Ethylene. Advanced Science 7, 1902820 (2020).
{100}-rich sputtered Cu in presence of gaseous O2, on GDL	Oxide-derived	Cu, O	-	Fumatech FAA-3-PK-75	(AEM)	CO2	-0.75 V vs. RHE	-122 mA/cm2	59	G. Zhang et al., Efficient CO2 electroreduction on facet-selective copper films with high conversion rate. Nature Communications 12, 5745 (2021).
Multi-shelled ("4.4") Cu2O spheres, on a GDL	Oxide-derived	Cu, O	Nafion	?	(AEM)	CO2	-0.85 V - iR vs. RHE	-900 mA/cm2	59	Y. Xiao et al., Multi-Shell Copper Catalysts for Selective Electroreduction of CO2 to Multicarbon Chemicals. Advanced Energy Materials 14, 2302556 (2024).
Electroreduced KOH-derived Cu(OH)2 nanorods on Cu-sputtered carbon paper	Oxide-derived	Cu, O	-	?	(AEM)	CO2	-0.54 V - iR vs. RHE	-250 mA/cm2	58	D. Zhong et al., Coupling of Cu(100) and (110) Facets Promotes Carbon Dioxide Conversion to Hydrocarbons and Alcohols. Angewandte Chemie International Edition 60, 4879-4885 (2021).
Porous/partially hollow core/shell Cu2O microparticles, on GDL	Oxide-derived	Cu, O	Nafion	Fumasep FAA-PK-130	(AEM)	CO2	-1.1 V - iR vs. RHE	-260 mA/cm2	58	J. Lu et al., Nanoconfinement Effects of Yolk–Shell Cu2O Catalyst for Improved C2+ Selectivity and Cu+ Stability in Electrocatalytic CO2 Reduction. ACS Applied Nano Materials 6, 20746-20756 (2023).
O2-driven oxidized Cu NWs, on glassy carbon	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-1.03 V - iR vs. RHE	-34 mA/cm2	58	Z. Lyu et al., Controlling the Surface Oxidation of Cu Nanowires Improves Their Catalytic Selectivity and Stability toward C2+ Products in CO2 Reduction. Angewandte Chemie International Edition 60, 1909-1915 (2021).
{111}/{100} grain boundary-rich hexagonal-polyhedral Cu2O MPs (ca. 2 µm), on carbon paper	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-25 mA/cm2	58	Z.-x. Yang et al., Facilitating CO2 electroreduction to C2H4 through facile regulating {100} & {111} grain boundary of Cu2O. Catalysis Communications 174, 106595 (2023).
Crystalline CuO NPs embedded in amorphous CuO nanoflakes, on glassy carbon	Oxide-derived	Cu, O	Nafion	Nafion 115	(CEM)	CO2	-1.08 V vs. RHE	-16 mA/cm2	58	D. Zhao et al., Amorphous-Confined Crystalline CuO Nanoflakes for Enhanced Ethylene Production from CO2 Electroreduction. ChemCatChem 15, e202201413 (2023).
Fragmented Cu2O NPs of originally 20 nm supported on carbon black, on glassy carbon	Oxide-derived	Cu, O, C	Nafion	Selemion AMV	(AEM)	CO2	-1.1 V -iR vs. RHE	-18 mA/cm2	57	H. Jung et al., Electrochemical Fragmentation of Cu2O Nanoparticles Enhancing Selective C–C Coupling from CO2 Reduction Reaction. Journal of the American Chemical Society 141, 4624-4633 (2019).
Cu(OH)Cl-derived Cu/Cl, on GDL	Oxide-derived	Cu, O, Cl	-	NEOSEPTA	(AEM)	CO2	-0.6 V - iR vs. RHE	-380 mA/cm2	57	W. Ma et al., Electrocatalytic reduction of CO2 to ethylene and ethanol through hydrogen-assisted C–C coupling over fluorine-modified copper. Nature Catalysis 3, 478-487 (2020).
Grainboundary-rich defective Cu NCs derived from CO-assisted thermally reduced Cu2O NCs supported on	Oxide-derived	Cu, O, C	Nafion	Fumasep FAB-PK-130	(AEM)	CO2	-1 V - iR vs. RHE	-500 mA/cm2	57	Q. Wu et al., Nanograin-Boundary-Abundant Cu2O-Cu Nanocubes with High C2+ Selectivity and Good Stability during Electrochemical CO2 Reduction at a Current Density of 500

carbon black (XC-72R), on GDL										mA/cm2. ACS Nano 17, 12884-12894 (2023).
In-situ electroplated CuOx in Br-containing electrolyte, on GDL	Oxide-derived	Cu, O	-	Nafion 117	(CEM)	CO2	-4.3 V vs. ANODE	-170 mA/cm2	57[TT]	C. Reller et al., Selective Electroreduction of CO2 toward Ethylene on Nano Dendritic Copper Catalysts at High Current Density. Advanced Energy Materials 7, 1602114-n/a (2017).
Chloride-derived CuOx NPs prepared via chemical oxidation (H2O2), on Cu foil	Oxide-derived	Cu, O, Cl	-	?	(AEM)	CO2	-2.6 V -iR vs. Ag/AgCl	-16 mA/cm2	56	M. G. Kibria et al., A Surface Reconstruction Route to High Productivity and Selectivity in CO2 Electroreduction toward C2+ Hydrocarbons. Advanced Materials 30, 1804867 (2018).
Oxygen-assisted plasma induced N-doped CuO NPs supported on Ketjen Black, on glassy carbon	Oxide-derived	Cu, O, C, N	-	Selemion AMVN	(AEM)	CO2	-1.1 V - iR vs. RHE	-25 mA/cm2	56	D. G. Park et al., Increasing CO Binding Energy and Defects by Preserving Cu Oxidation State via O2-Plasma-Assisted N Doping on CuO Enables High C2+ Selectivity and Long-Term Stability in Electrochemical CO2 Reduction. ACS Catal 13, 9222-9233 (2023).
Electrodeposited Cu(OH)x dendrites (-200 mA/cm2 for 10 min from 0.05 M H2SO4/2.5 M KCl/7 mM CuSO4 bath with active CO2 flow), on Cu-sputtered PTFE GDL	Oxide-derived	Cu, O	-	Nafion 117	(CEM)	CO2	?	-200 mA/cm2	56	Y. Cao et al., Surface hydroxide promotes CO2 electrolysis to ethylene in acidic conditions. Nature Communications 14, 2387 (2023).
Nitrogen vacancy-rich Cu3Nx NPs prepared via controlled lithiation/delithiation, on GDL	Oxide-derived	Cu, N, Li	Nafion	X37-50 Grade T	(AEM)	CO2	-1.15 V vs. RHE	-375 mA/cm2	56	C. Peng et al., Lithiation-Enabled High-Density Nitrogen Vacancies Electrocatalyze CO2 to C2 Products. Advanced Materials 33, 2103150 (2021).
CuO NSs, on glassy carbon, pre-reduced in halide-containing electrolyte (0.1 M KHCO3 + 0.01 M KBr)	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-0.98 V - iR vs. RHE	-31 mA/cm2	56	R. Du et al., In Situ Engineering of the Cu+/Cu0 Interface to Boost C2+ Selectivity in CO2 Electroreduction. ACS Applied Materials & Interfaces 14, 36527-36535 (2022).
Chloride-derived CuOx NPs prepared via chemical oxidation (H2O2), on Cu-sputtered GDL	Oxide-derived	Cu, O, Cl	-	?	(AEM)	CO2	-1.8 V -iR vs. RHE	-450 mA/cm2	55	M. G. Kibria et al., A Surface Reconstruction Route to High Productivity and Selectivity in CO2 Electroreduction toward C2+ Hydrocarbons. Advanced Materials 30, 1804867 (2018).
Branched/'spikey' Cu NPs obtained from KOH addition to catalyst ink, on GDL	Oxide-derived	Cu, O	Nafion, KOH	X37–50	(AEM)	CO2	-3.25 V vs. ANODE	-281 mA/cm2	55	Q. Fan et al., Manipulating Cu Nanoparticle Surface Oxidation States Tunes Catalytic Selectivity toward CH4 or C2+ Products in CO2 Electroreduction. Advanced Energy Materials 11, 2101424 (2021).
Grainboundary-rich defective Cu NCs derived from CO-assisted thermally reduced Cu2O NCs supported on carbon black (XC-72R), on glassy carbon	Oxide-derived	Cu, O, C	Nafion	Nafion 117	(CEM)	CO2	-1.0 V - iR vs. RHE	-3 mA/cm2	55	Q. Wu et al., Nanograin-Boundary-Abundant Cu2O-Cu Nanocubes with High C2+ Selectivity and Good Stability during Electrochemical CO2 Reduction at a Current Density of 500 mA/cm2. ACS Nano 17, 12884-12894 (2023).
Cu2O/Cu(OH)2 spherical and porous nanocages, on carbon paper	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-1.15 V vs. RHE	-31 mA/mg	55	T.-K. Cheng et al., Spherical and porous Cu2O nanocages with Cu2O/Cu(OH)2 Surface: Synthesis and their promising selectivity for catalysing CO2 electroreduction to C2H4. Applied Surface Science 660, 159978 (2024).
Cu(OH)2-derived Cu NPs without additives (?), on GDL	Oxide-derived	Cu, O	Nafion	FAB-PK-130	(AEM)	CO2	-0.9 V -iR vs. RHE	-440 mA/cm2	55	Y. Wang et al., Alkyl sulfonate surfactant mediates electroreduction of carbon dioxide to ethylene or ethanol over hydroxide-derived copper catalysts. Chemical Science, (2024).
Electrodeposited Cu(100), on GDL	Oxide-derived	Cu, O	-	FAB-PK-130	(AEM)	CO2	-1.26 V vs. RHE	-200 mA/cm2	54	M. Wu et al., Sequential *CO management via controlling in situ reconstruction for efficient industrial-current-density CO2-to-C2+ electroreduction. Proceedings of the National Academy of Sciences 120, e2302851120 (2023).
Cu3(PO4)2 particles, on Cu-sputtered PTFE GDL	Oxide-derived	Cu, O, P	Nafion	?	(AEM)	CO2	-2.4 V vs. RHE	-350 mA/cm2	53	X. Y. Zhang et al., Direct OC-CHO coupling towards highly C2+ products selective electroreduction over stable Cu0/Cu2+ interface. Nature Communications 14, 7681 (2023).
Commercial oxygen-passivated Cu NPs (<100 nm), on GDL	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO	?	-300 mA/cm2	53	N. S. Romero Cuellar, K. Wiesner-Fleischer, M. Fleischer, A. Rucki, O. Hinrichsen, Advantages of CO over CO2 as reactant for electrochemical reduction to ethylene, ethanol and n-propanol on gas diffusion electrodes at high current densities. Electrochimica Acta 307, 164-175 (2019).
Mixed valency CuOx/Cu NPs, on glassy carbon	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-18 mA/cm2	53	F. Yang, W. Fang, Q. Wang, P. Deng, B. Y. Xia, Optimizing Copper Oxidation State to Promote Ethylene Generation in Efficient Carbon Dioxide Conversion. ACS Sustainable Chemistry & Engineering 10, 4677-4682 (2022).

Cu(OH)F-derived Cu/F, on GDL	Oxide-derived	Cu, O, F	-	NEOSEPTA	(AEM)	CO	-0.6 V - iR vs. RHE	-440 mA/cm2	52	W. Ma et al., Electrocatalytic reduction of CO2 to ethylene and ethanol through hydrogen-assisted C–C coupling over fluorine-modified copper. Nature Catalysis 3, 478-487 (2020).
Electrochemical-assisted chlorine-reconstructed Cu nanocrystals on a 920 nm-thick Cu layer, sputtered on GDL	Oxide-derived	Cu, O, Cl	-	Fumasep FKS-50	(AEM)	CO2	-0.55 V - iR vs. RHE	-184 mA/cm2	52	J. Gao et al., Electrochemical synthesis of propylene from carbon dioxide on copper nanocrystals. Nat Chem, (2023).
Multi-shelled CuO microboxes, on carbon paper	Oxide-derived	Cu, O	Nafion D-521	Nafion 117	(CEM)	CO2	-1.05 V vs. RHE	-28 mA/cm2	51	D. Tan et al., Multi-shelled CuO microboxes for carbon dioxide reduction to ethylene. Nano Research 13, 768-774 (2020).
Li-deficient Li2CuO2 microparticles	Oxide-derived	Cu, O, Li	Nafion	X37-50 Grade T	(AEM)	CO2	-0.85 V vs. RHE	-195 mA/cm2	51	C. Peng et al., Lithium Vacancy-Tuned [CuO4] Sites for Selective CO2 Electroreduction to C2+ Products. Small 18, 2106433 (2022).
Octahedral 500 nm Cu2O particles, on glassy carbon	Oxide-derived	Cu, O	Nafion D-521	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-25 mA/cm2	51	Y. Wu et al., Effect of the coordination environment of Cu in Cu2O on the electroreduction of CO2 to ethylene. Green Chemistry 22, 6340-6344 (2020).
Partially thermally reduced electroplated Cu2Ox with NH4Cl-induced high step density, on plate	Oxide-derived	Cu, O	-	Nafion 117	(CEM)	CO2	-0.76 V - iR vs. RHE	-31 mA/cm2	51	X. Ren, X. Zhang, X. Cao, Q. Wang, Efficient electrochemical reduction of carbon dioxide into ethylene boosted by copper vacancies on stepped cuprous oxide. Journal of CO2 Utilization 38, 125-131 (2020).
Electrochemical-assisted bromine-reconstructed Cu foil	Oxide-derived	Cu, O, Br	-	Nafion 117	(CEM)	CO2	-1.10 V - iR vs. RHE	-43 mA/cm2	51	T. Kim, G. T. R. Palmore, A scalable method for preparing Cu electrocatalysts that convert CO2 into C2+ products. Nature Communications 11, 3622 (2020).
Vacancy-rich delithiated Li2-xCuO2 NPs, on GDL	Oxide-derived	Cu, Li, O	Nafion	X37-50 Grade T	(AEM)	CO2	-0.85 V vs. RHE	-200 mA/cm2	51	C. Peng et al., Lithium Vacancy-Tuned [CuO4] Sites for Selective CO2 Electroreduction to C2+ Products. Small 18, 2106433 (2022).
Spherical Cu(OH)2 nanorod (250 nm individual diameters) aggregates, on GDL	Oxide-derived	Cu, O	Nafion	Nafion 115	(CEM)	CO2	-1.08 V vs. RHE	-28 mA/cm2	51	M. Li et al., Strong electric field at the sharp tips of Cu(OH)2 nanochrysanthemums for selective electrochemical CO2 conversion into ethylene. Materials Today Energy 42, 101568 (2024).
Commercial Cu NPs, on GDL with custom-tailored MPL	Oxide-derived	Cu	Nafion, Pention-D72 (Xergy)	FAA-3-50	(AEM)	CO2	-1.44 V - iR vs. RHE	-1360 mA/cm2	51	L. Yuan et al., Converting CO2 to multi-carbon products at >1 A/cm2 using gas diffusion electrode based on commercial materials via transfer process engineering. Electrochimica Acta 475, 143662 (2024).
Electroplated CuOx catalyst forming highly porous structure during in-situ reduction, on glassy carbon	Oxide-derived	Cu, O	-	FAA-3-PK-75	(AEM)	CO2	-0.8 V vs. RHE	-4 mA/cm2	51	Z.-Y. Zhang et al., Nanocavity enriched CuPd alloy with high selectivity for CO2 electroreduction toward C2H4. Rare Metals, (2024).
Cu(OH)Br-derived Cu/Br, on GDL	Oxide-derived	Cu, O, Br	-	NEOSEPTA	(AEM)	CO2	-0.6 V - iR vs. RHE	-345 mA/cm2	50	W. Ma et al., Electrocatalytic reduction of CO2 to ethylene and ethanol through hydrogen-assisted C–C coupling over fluorine-modified copper. Nature Catalysis 3, 478-487 (2020).
Spherical 20 nm CuO NPs with loading of 1.7 mg/cm2, on GDL	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-1.02 V vs. RHE	-1600 mA/cm2	50	A. Inoue, T. Harada, S. Nakanishi, K. Kamiya, Ultra-high-rate CO2 reduction reactions to multicarbon products with a current density of 1.7 A cm−2 in neutral electrolytes. EES Catalysis 1, 9-16 (2023).
Electrochemical-assisted iodine-reconstructed Cu foil	Oxide-derived	Cu, O, I	-	Nafion 117	(CEM)	CO2	-1.09 V - iR vs. RHE	-40 mA/cm2	50	T. Kim, G. T. R. Palmore, A scalable method for preparing Cu electrocatalysts that convert CO2 into C2+ products. Nature Communications 11, 3622 (2020).
Electrochemical-assisted chlorine-reconstructed Cu foil	Oxide-derived	Cu, O, Cl	-	Nafion 117	(CEM)	CO2	-1.11 V - iR vs. RHE	-40 mA/cm2	50	T. Kim, G. T. R. Palmore, A scalable method for preparing Cu electrocatalysts that convert CO2 into C2+ products. Nature Communications 11, 3622 (2020).
O2 plasma (400 mTorr / 20 W / 2 min) treated Cu foil	Oxide-derived	Cu, O	-	Nafion 211	(CEM)	CO2	-1.04 V - iR vs. RHE	-53 mA/cm2	50	D. Gao, F. Scholten, B. Roldan Cuenya, Improved CO2 Electroreduction Performance on Plasma-Activated Cu Catalysts via Electrolyte Design: Halide Effect. ACS Catal 7, 5112-5120

										(2017).
Electrochemical-assisted chlorine-reconstructed Cu nanocrystals on a 920 nm-thick Cu layer, sputtered on GDL	Oxide-derived	Cu, O, Cl	-	Fumasep FKS-50	(AEM)	CO	-0.60 V - iR vs. RHE	-100 mA/cm2	50	J. Gao et al., Electrochemical synthesis of propylene from carbon dioxide on copper nanocrystals. Nat Chem, (2023).
"Cu10Cs1" (wt%/at.% not reported) co-catalyst electroplated on carbon paper	Oxide-derived	Cu, Cs	-	Nafion 117	(CEM)	CO2	-1.4 V vs. RHE	-45 mA/cm2	50	S. Jia et al., Preparation of trimetallic electrocatalysts by one-step co-electrodeposition and efficient CO2 reduction to ethylene. Chemical Science 13, 7509-7515 (2022).
Porous iodine-doped (0.02 % I, ICP) CuO MPs, on carbon paper	Oxide-derived	Cu, O, I	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-15 mA/cm2	50	B. Shen et al., Enhanced electrochemical CO2 reduction for high ethylene selectivity using iodine-doped copper oxide catalysts. Journal of Alloys and Compounds 980, 173550 (2024).
Electrochemical-assisted carbonate-reconstructed Cu foil	Oxide-derived	Cu, O	-	Selemion AMV	(AEM)	CO2	-0.96 V - iR vs. RHE	-3 mA/cm2	49	D. Gao et al., Selective CO2 Electroreduction to Ethylene and Multicarbon Alcohols via Electrolyte-Driven Nanostructuring. Angewandte Chemie International Edition 58, 17047-17053 (2019).
O2 plasma (400 mTorr / 20 W) treated Cu foil	Oxide-derived	Cu, O	-	Selemion AMV	(AEM)	CO2	-0.96 V - iR vs. RHE	-41 mA/cm2	49	D. Gao et al., Activity and Selectivity Control in CO2 Electroreduction to Multicarbon Products over CuOx Catalysts via Electrolyte Design. ACS Catal 8, 10012-10020 (2018).
Cu2O/CuO NPs, on GDL	Oxide-derived	Cu, O	Nafion	?	(AEM)	CO2	?	-400 mA/cm2	49	H. Shi et al., Stabilizing Cu+ Species in Cu2O/CuO Catalyst via Carbon Intermediate Confinement for Selective CO2RR. Advanced Functional Materials n/a, 2310913.
N-doped Cu (Cu3N) NCs, on GDL	Oxide-derived	Cu, N, O	Nafion	FAB-PK-130	(AEM)	CO2	-1.13 V -iR vs. RHE	-1100 mA/cm2	49	M. Zheng et al., Electrocatalytic CO2-to-C2+ with Ampere-Level Current on Heteroatom-Engineered Copper via Tuning *CO Intermediate Coverage. Journal of the American Chemical Society 144, 14936-14944 (2022).
Microwave-assisted additional Cu-induced activity enhanced CuO nanosheets, on glassy carbon	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-1.2 V - iR vs. RHE	-29 mA/cm2	47	J. Jang et al., Facile design of oxide-derived Cu nanosheet electrocatalyst for CO2 reduction reaction. EcoMat n/a, e12334 (2023).
Defective CuO-derived Cu nanosheets, on GDL	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-1.45 V - iR vs. RHE	-560 mA/cm2	47	Z. Ma et al., CO2 electroreduction to multicarbon products in strongly acidic electrolyte via synergistically modulating the local microenvironment. Nature Communications 13, 7596 (2022).
30 nm CuO NPs, on GDL	Oxide-derived	Cu, O	Nafion	Sustainion X37-50 grade T	(AEM)	CO	-2.44 V vs. ANODE	-1000 mA/cm2	47	W. Ren, W. Ma, X. Hu, Tailored water and hydroxide transport at a quasi-two-phase interface of membrane electrode assembly electrolyzer for CO electroreduction. Joule 7, 2349-2360 (2023).
P-doped CuOx nm-sized spherical agglomerates, on GDL	Oxide-derived	Cu, O, P	Nafion	3PK-130	(AEM)	CO2	-1.4 V vs. RHE	-350 mA/cm2	47	L. Zhang et al., Highly Ethylene-Selective Electroreduction CO2 Over Cu Phosphate Nanostructures with Tunable Morphology. Topics in Catalysis 66, 1527-1538 (2023).
CuBaCO3 NPs, on Cu-sputtered PTFE GDL	Oxide-derived	Cu, Ba, O	Nafion	?	(AEM)	CO2	-0.65 V vs. RHE	-400 mA/cm2	47	F.-Y. Wu et al., Copper–barium-decorated carbon-nanotube composite for electrocatalytic CO2 reduction to C2 products. Journal of Materials Chemistry A 11, 13217-13222 (2023).
F-doped CuO large NPs	Oxide-derived	Cu, O, F	Nafion	Fumasep FAA-3-PK-130	(AEM)	CO2	-1.05 V - iR vs. RHE	-320 mA/cm2	46	X. Yan et al., Boosting CO2 electroreduction to C2+ products on fluorine-doped copper. Green Chemistry 24, 1989-1994 (2022).
15 nm Cu2O NPs, on GDL	Oxide-derived	Cu, O	Nafion	Fumatech	(AEM)	CO2	-0.79 V - iR vs. RHE	-300 mA/cm2	46	S. Ma et al., One-step electrosynthesis of ethylene and ethanol from CO2 in an alkaline electrolyzer. Journal of Power Sources 301, 219-228 (2016).
CuOx MPs electrodeposited on carbon paper	Oxide-derived	Cu, O	-	FAA-3-PK-75	(AEM)	CO2	-0.75 V - iR vs. RHE	-601 mA/cm2	46	J. Zhang et al., Switching CO2 Electroreduction Selectivity Between C1 and C2 Hydrocarbons on Cu Gas-Diffusion Electrodes. ENERGY & ENVIRONMENTAL MATERIALS 6, e12307 (2023).

Ultrathin porous Cu foil chemically converted into Cu(OH)2 nanoneedles, reduced by H2 under slow temperature ramp. Hydrophobic, full-metal GDE	Oxide-derived	Cu, O	-	Nafion 117	(CEM)	CO2	-1.82 V vs. RHE	-600 mA/cm2	46	M. Sun, J. Cheng, M. Yamauchi, Gas diffusion enhanced electrode with ultrathin superhydrophobic macropore structure for acidic CO2 electroreduction. Nature Communications 15, 491 (2024).
P-doped pulse-electroplated Cu (Cu0.92P0.08) on carbon paper	Oxide-derived	Cu, P	-	Nafion 115	(CEM)	CO2	-0.72 V -iR vs. RHE	-210 mA/cm2	46	X. Kong et al., Enhance the activity of multi-carbon products for Cu via P doping towards CO2 reduction. Science China Chemistry 64, 1096-1102 (2021).
O2 plasma-treated (20 s, 20 W) chloride-derived CuOx NCs, on Cu plate	Oxide-derived	Cu, O, Cl	-	Nafion 115	(CEM)	CO2	-1.05 V -iR vs. RHE	-50 mA/cm2	45	D. Gao et al., Plasma-Activated Copper Nanocube Catalysts for Efficient Carbon Dioxide Electroreduction to Hydrocarbons and Alcohols. ACS Nano 11, 4825-4831 (2017).
Electrochemically reduced CuO micropore nanowire-modified Cu foam; oxygen-bearing copper micropore NWs	Oxide-derived	Cu, O	-	Nafion 117	(CEM)	CO2	-1.0 V - iR vs. RHE	-100 mA/cm2	45	W. Zhang et al., Atypical Oxygen-Bearing Copper Boosts Ethylene Selectivity toward Electrocatalytic CO2 Reduction. Journal of the American Chemical Society 142, 11417-11427 (2020).
Electrochemically restructured Cu by cycling in 0.1 M KHCO3 + 16 mM KCl as per [insert Robert Sloan ref], on Cu plate	Oxide-derived	Cu, O, Cl	-	Selemion AMV	(AEM)	CO2	-1 V - iR vs. RHE	-14 mA/cm2	45	Y. Lum, B. Yue, P. Lobaccaro, A. T. Bell, J. W. Ager, Optimizing C–C Coupling on Oxide-Derived Copper Catalysts for Electrochemical CO2 Reduction. J Phys Chem C 121, 14191-14203 (2017).
Pre-reduced (CO2RR conditions) CuO NSs, on glassy carbon	Oxide-derived	Cu, O	Nafion	Selemion AMV	(AEM)	CO2	-1.1 V - iR vs. RHE	-35 mA/cm2	45	Z. Xu et al., Dynamic restructuring induced Cu nanoparticles with ideal nanostructure for selective multi-carbon compounds production via carbon dioxide electroreduction. Journal of Catalysis 383, 42-50 (2020).
Porous Cu2O nanosphere superparticle, on GDL	Oxide-derived	Cu, O	Nafion	Fumasep FAB-PK-130	(AEM)	CO2	-0.75 V - iR vs. RHE	-700 mA/cm2	45	X. Lv et al., Grain refining enables mixed Cu+/Cu0 states for CO2 electroreduction to C2+ products at high current density. Applied Catalysis B: Environmental 324, 122272 (2023).
{100}-rich Cu NPs derived from in-situ reduction of phosphate-doped copper oxychloride pre-cursor, on GDL	Oxide-derived	Cu, O, P, Cl	Nafion	FAA-3-PK-130	(AEM)	CO	-2.23 V vs. ANODE	-700 mA/cm2	45	K. Yao et al., In situ copper faceting enables efficient CO2/CO electrolysis. Nature Communications 15, 1749 (2024).
Cu2(PO4)(OH) microrods, on GDL	Oxide-derived	Cu, O, P	Nafion	?	(AEM)	CO2	-1.38 V vs. RHE	-265 mA/cm2	44	Y. Zhang et al., Direct reduction of diluted CO2 gas to C2 products by copper hydroxyphosphate microrods. AIChE Journal n/a, e18233 (2023).
CuO nanoneedles, on Toray Carbon Paper (TGP-H-60)	Oxide-derived	Cu, O	Fluorinated ethylene propylene	?	?	CO2	-0.76 V - iR vs. RHE	-975 mA/cm2	44	T. H. M. Pham et al., Enhanced Electrocatalytic CO2 Reduction to C2+ Products by Adjusting the Local Reaction Environment with Polymer Binders. Advanced Energy Materials 12, 2103663 (2022).
CuOX NPs electrodeposited from 0.1 M CuCOOH + 0.1 M KHCO3 + sodium tartrate dibasic dihydrate under constant CO2 bubbling, on GDL (?)	Oxide-derived	Cu, O	-	"Sustainion"	(AEM)	CO2	-2.7 V vs. ANODE	-300 mA/cm2	44	M. Fang et al., Hydrophobic, Ultrastable Cuδ+ for Robust CO2 Electroreduction to C2 Products at Ampere-Current Levels. Journal of the American Chemical Society 145, 11323-11332 (2023).
Mixed CuOx MP catalyst containing Cu4O3 phase, on GDL	Oxide-derived	Cu, O	Sustainion XA-9	Nafion 117	(CEM)	CO2	-0.64 V vs. RHE	-300 mA/cm2	43	N. Martić et al., Paramelaconite-Enriched Copper-Based Material as an Efficient and Robust Catalyst for Electrochemical Carbon Dioxide Reduction. Advanced Energy Materials 9, 1901228 (2019).
{100}-rich Cu NPs derived from in-situ reduction of phosphate-doped copper oxychloride pre-cursor, on GDL	Oxide-derived	Cu, O, P, Cl	Nafion	FAA-3-PK-130	(AEM)	CO2	-3.26 V vs. ANODE	-400 mA/cm2	43	K. Yao et al., In situ copper faceting enables efficient CO2/CO electrolysis. Nature Communications 15, 1749 (2024).
Cu2O NPs , on GDL	Oxide-derived	Cu, O	Nafion	Nafion 115	(CEM)	CO2	?	-300 mA/cm2	43	X. Lv et al., Iodine-Mediated C–C Coupling in Neutral Flow Cell for Electrochemical CO2 Reduction. Advanced Functional Materials n/a, 2311236.
Water-quenced 500 C-warm CuO particles, on GDL	Oxide-derived	Cu, O	Nafion	FAB-PK-130	(AEM)	CO2	-0.84 V - iR vs. RHE	-40 mA/cm2	42[+] (50)	C. Yang et al., Fast cooling induced grain-boundary-rich copper oxide for electrocatalytic carbon dioxide reduction to ethanol. Journal of Colloid and Interface Science 570, 375-381 (2020).
CuO nanosheet-functionalized Cu GDL prepared via thermal evaporation	Oxide-derived	Cu, O	-	Selemion AMVN	(AEM)	CO	-2.25 V - iR vs. NHE	-200 mA/cm2	42[FF]	M. Wang, L. Wan, J. Cheng, J. Luo, Scalable preparation of a CuO nanosheet array via corrosion engineering for selective C–C coupling in CO2 electroreduction. Journal of

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Partially oxidized Cu NPs, on GDL	Oxide-derived	Cu, O	Nafion	Nafion 117	(CEM)	CO	?	-200 mA/cm2	41	R. Kurihara et al., Carbon Monoxide Reduction Reaction to Produce Multicarbon Products in Acidic Electrolytes Using Gas Diffusion Electrode Loaded with Copper Nanoparticles. Advanced Materials Interfaces n/a, 2300731 (2023).
Pre-reduced {100}/{111}-interface rich CuOx NPs on GDL	Oxide-derived	Cu, O	Nafion	?	(AEM)	CO2	-1 V - iR vs. RHE	-300 mA/cm2	41	Z.-Z. Wu et al., Identification of Cu(100)/Cu(111) Interfaces as Superior Active Sites for CO Dimerization During CO2 Electroreduction. Journal of the American Chemical Society 144, 259-269 (2022).
Mixed valency CuOx/Cu aerogel, on carbon paper	Oxide-derived	Cu, O	Nafion	"Nafion"	(CEM)	CO2	-1.1 V - iR vs. RHE	-79 mA/cm2	40	C. Kim et al., Cu/Cu2O Interconnected Porous Aerogel Catalyst for Highly Productive Electrosynthesis of Ethanol from CO2. Advanced Functional Materials 31, 2102142 (2021).
Highly defective 150 nm Cu3N-derived CuOx NPs, on GDL	Oxide-derived	Cu, O, N	Nafion	Sustainion 37-50	(AEM)	CO	-4.6 V vs. ANODE	-500 mA/cm2	40	C. Zhao et al., In Situ Topotactic Transformation of an Interstitial Alloy for CO Electroreduction. Advanced Materials 32, 2002382 (2020).
'Highly fragmented' CuO NPs, on GDL	Oxide-derived	Cu, O	Nafion	Fumasep FAA-PK-130)	(AEM)	CO	-0.66 V - iR vs. RHE	-175 mA/cm2	40	Y. Pang et al., Efficient electrocatalytic conversion of carbon monoxide to propanol using fragmented copper. Nature Catalysis 2, 251-258 (2019).
In-situ reduced, highly porous Cu2P2O7, on custom GDL	Oxide-derived	Cu, P, O	Nafion	QAPPT	(AEM)	CO2	-3.36 V vs. ANODE	-350 mA/cm2	40	J. Sang et al., A Reconstructed Cu2P2O7 Catalyst for Selective CO2 Electroreduction to Multicarbon Products. Angewandte Chemie International Edition 61, e202114238 (2022).
Commercial um-sized CuCl reduced in-situ, on carbon paper	Oxide-derived	Cu, Cl	Nafion	Selemion AMV	(AEM)	CO2	-1.06 V -iR vs. RHE	-39 mA/cm2	39	T. Qin, Y. Qian, F. Zhang, B.-L. Lin, Cloride-derived copper electrode for efficient electrochemical reduction of CO2 to ethylene. Chinese Chemical Letters 30, 314-318 (2019).
'Fragment' CuOx-derived Cu NPs, on GDL	Oxide-derived	Cu, O	Nafion	Fumasep FAB-PK-130	(AEM)	CO	-0.76 V vs. RHE	-59 mA/cm2	38	T.-T. Zhuang et al., Copper nanocavities confine intermediates for efficient electrosynthesis of C3 alcohol fuels from carbon monoxide. Nature Catalysis 1, 946-951 (2018).
In-situ electroplated Cu NCs, prepared via oxidative/reductive cycling in Cl- containing solution, on carbon paper	Oxide-derived	Cu, O	-	"Selemion"	(AEM)	CO2	-0.97 V - iR vs. RHE	-20 mA/cm2	35	P. Grosse et al., Dynamic Changes in the Structure, Chemical State and Catalytic Selectivity of Cu Nanocubes during CO2 Electroreduction: Size and Support Effects. Angewandte Chemie 130, 6300-6305 (2018).
Co-plated P-doped Cu NPs, on Cu substrate	Oxide-derived	Cu, O, P	-	Nafion 117	(CEM)	CO2	-1.15 V - iR vs. RHE	-16 mA/cm2	34	H. Li et al., Changing the Product Selectivity for Electrocatalysis of CO2 Reduction Reaction on Plated Cu Electrodes. ChemCatChem 11, 6139-6146 (2019).
P-doped Cu NPs (P/Cu of 0.075), on carbon paper	Oxide-derived	Cu, P	Nafion	Nafion 115	(CEM)	CO2	-1.6 V vs. RHE	-58 mA/cm2	31	H. Chen et al., Promotion of electrochemical CO2 reduction to ethylene on phosphorus-doped copper nanocrystals with stable Cuδ+ sites. Applied Surface Science 544, 148965 (2021).
°Derived from FE(C2H4) and j(C2H4) as opposed to the reported LSV										
MMSi table states 0.1 M KHCO3 without KBr, but text states with KBr										
FFDisagreement between numbers in main text and SI, report here number provided in main text										
TTHighly unstable signal due to continuous in-situ electrodeposition of Cu										
GGText denotes specifically that "L-ascorbic acid sodium" is used, although not mentioned in SI table										

Table S3. Al-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
CNP and graphite layer on top of chemically etched co-sputtered Cu/Al layer on PTFE GDL	Overlayer, Alloyed/Doped	Cu, Al, C	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.67 V - iR vs. RHE	-400 mA/cm2	80	M. Zhong et al., Accelerated discovery of CO2 electrocatalysts using active machine learning. Nature 581, 178-183 (2020).
CuO NPs supported on Al2CuO4 nanosheets, on glassy carbon	Mixed-phase/Janus, atomically mixed/crystalline, A-supports-B	Cu, Al, O	Nafion	Selemion AMV	(AEM)	CO2	-0.99 V - iR vs. RHE	-2 mA/cm2	79[yy]	S. Sultan et al., Interface rich CuO/Al2CuO4 surface for selective ethylene production from electrochemical CO2 conversion. Energy & Environmental Science, (2022).
CuOx nanocubes/rectangles supported on Al2O3 nanosheets having an Al2CuO2 interface layer, mixed with CNPs, on glassy carbon	Mixed-phase/Janus, atomically mixed/crystalline, A-supports-B	Cu, Al, O, C	Nafion	Nafion 117	(CEM)	CO2	-1.2 V - iR vs. RHE	-60 mA/cm2	71	X. Wang et al., Identifying an Interfacial Stabilizer for Regeneration-Free 300 h Electrochemical CO2 Reduction to C2 Products. Journal of the American Chemical Society 144, 22759-22766 (2022).
CuO NPs supported on Al2CuO4 nanosheets, on GDL	Mixed-phase/Janus, atomically mixed/crystalline, A-supports-B	Cu, Al, O	Nafion	FAA-3-PK-130	(AEM)	CO2	-2.03 V - iR vs. RHE	-600 mA/cm2	70	S. Sultan et al., Interface rich CuO/Al2CuO4 surface for selective ethylene production from electrochemical CO2 conversion. Energy & Environmental Science, (2022).
Al2O3 partial overlayer (0.8 nm) specifically covering the {111} facets of Cu NPs (10 nm) supported on CNPs, on Ta-sputtered PTFE GDL	Core/shell, A-supports-B	Cu, Al, C, O, Ta	Nafion	FAB-PK-130	(AEM)	CO2	-1.1 V - iR vs. RHE	-253 mA/cm2	61	H. Li et al., Facet-Selective Deposition of Ultrathin Al2O3 on Copper Nanocrystals for Highly Stable CO2 Electroreduction to Ethylene. Angewandte Chemie International Edition 60, 24838-24843 (2021).
Al2O3 partial overlayer (0.8 nm) specifically covering the {111} facets of Cu NPs (10 nm) supported on CNPs, on GDL	Core/shell, A-supports-B	Cu, Al, C, O	Nafion	Selemion AMV	(AEM)	CO2	-1.1 V - iR vs. RHE	-23 mA/cm2	54	H. Li et al., Facet-Selective Deposition of Ultrathin Al2O3 on Copper Nanocrystals for Highly Stable CO2 Electroreduction to Ethylene. Angewandte Chemie International Edition 60, 24838-24843 (2021).
Al-doped (0.09 wt% > 0.27 at.%), agglomerated CuOx nanosheets, on carbon paper	Alloyed/Doped	Cu, Al, O	Nafion	Nafion 117	(CEM)	CO2	-0.95 V - iR vs. RHE	-30 mA/cm2	54	J. Wan, L. Lin, T. Yang, Y. Li, Newly generated Cu2OCu interface for CO2 electroreduction in the presence of reconstructed aluminum hydroxide. Electrochimica Acta 421, 140488 (2022).
Al-doped CuOx NCs ("CuAl-II"), on Toray GDL	Alloyed/Doped	Cu, Al, O	Nafion	FAA-3-PK-130	(AEM)	CO2	?	-900 mA/cm2	51	P. Li et al., p–d Orbital Hybridization Induced by p-Block Metal-Doped Cu Promotes the Formation of C2+ Products in Ampere-Level CO2 Electroreduction. Journal of the American Chemical Society 145, 4675-4682 (2023).
QAPEEK (anionic ionomer) layer on top of electrochemically leached (-150 mA in KOH) Cu/Al co-sputtered midlayer on PTFE GDL	Overlayer, Alloyed/Doped	Cu, Al	QAPEEK	QAPPT	(AEM)	CO2	-3.4 V vs. ANODE	-800 mA/cm2	50	W. Li et al., Bifunctional ionomers for efficient co-electrolysis of CO2 and pure water towards ethylene production at industrial-scale current densities. Nature Energy 7, 835-843 (2022).
Electro-reduced KOH-treated Cu/Al LDHs, yielding AlOx decorated Cu NPs, supported on CNPs, on GDL (backside sealed with epoxy)	Mixed-phase/Janus, A-supports-B	Cu, Al, O, C	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.06 V - iR vs. RHE	-48 mA/cm2	50	J. Zhang et al., Surface promotion of copper nanoparticles with alumina clusters derived from layered double hydroxide accelerates CO2 reduction to ethylene in membrane electrode assemblies. Nano Research 16, 4685-4690 (2023).
Al-doped (1.9 at%, ICP) CuOx nanoflakes derived from calcining Cu MOF, on a GDL	Alloyed/Doped	Cu, Al, O	Nafion	Sustainion X37-50 Grade RT	(AEM)	CO2	?	-700 mA/cm2	49	J. Jang et al., Distinct reconstruction of aluminum-doped oxide-derived copper enhances the selectivity of C2+ products in CO2 electroreduction. Journal of Materials Chemistry A 11, 19066-19073 (2023).
CuO NPs supported on Al2CuO4 nanosheets, on GDL	Mixed-phase/Janus, atomically mixed/crystalline, A-supports-B	Cu, Al, O	Nafion	FAA-3-PK-130	(AEM)	CO	-0.56 V - iR vs. RHE	-500 mA/cm2	48	S. Sultan et al., Interface rich CuO/Al2CuO4 surface for selective ethylene production from electrochemical CO2 conversion. Energy & Environmental Science, (2022).
Al-doped (0.09 wt% > 0.27 at.%), agglomerated CuOx nanosheets, on carbon paper	Alloyed/Doped	Cu, Al, O	Nafion	FAA-3-PK-130	(AEM)	CO2	-0.88 V - iR vs. RHE	-700 mA/cm2	46	J. Wan, L. Lin, T. Yang, Y. Li, Newly generated Cu2OCu interface for CO2 electroreduction in the presence of reconstructed aluminum hydroxide. Electrochimica Acta 421, 140488 (2022).
Al-doped Cu2O microparticles, on carbon paper	Alloyed/Doped	Cu, Al, O	Nafion	Nafion 117	(CEM)	CO2	-1.23 V vs. RHE	-12 mA/cm2	45	S. Li, X. Sha, X. Gao, J. Peng, Al-Doped Octahedral Cu2O Nanocrystal for Electrocatalytic CO2 Reduction to Produce Ethylene. International Journal of Molecular Sciences 24, 12680

										(2023).
Semi-porous Cu3Al-derived wires, on carbon paper - prepared by electrospinning metal salts with PVP, followed by calcination and alkaline Zn leaching step	Alloyed/Doped	Cu, Al	Nafion	?	(AEM)	CO2	-2.1 V vs. RHE	-600 mA/cm2	44	M. Fang et al., Aluminum-Doped Mesoporous Copper Oxide Nanofibers Enabling High-Efficiency CO2 Electroreduction to Multicarbon Products. Chemistry of Materials 34, 9023-9030 (2022).
Cu100Al7.88-OD nanosheets (number representing wt%), consisting of CuOx phases and amorphous Al2O3 phase mixed homogeneously, on GDL	Mixed-phase/Janus	Cu, Al, O	Nafion	FUMA-FAA-3-PK-130	(AEM)	CO2	-1.68 V vs. RHE	-693 mA/cm2	44	H. Cheng et al., Stabilization of Cu+ sites by amorphous Al2O3 to enhance electrochemical CO2 reduction to C2+ products. Green Chemistry, (2024).
400 nm thick evaporated Cu/Al alloy (95:5), on GDL	Alloyed/Doped	Cu, Al	-	AF1-HNN8-50-X	(AEM)	CO2	?	-100 mA/cm2	37	S. E. Weitzner et al., Evaluating the stability and activity of dilute Cu-based alloys for electrochemical CO2 reduction. The Journal of Chemical Physics 155, (2021).
Electrochemically reduced nanosheet-like mixed metal Cu5Al1Ox, on GDL	Mixed-phase/Janus	Cu, Al, O	Nafion	-	(n/a)	CO2	-1.2 V vs. RHE	-75 mA/cm2	36	X. Wen et al., Controllable dual Cu–Cu2O sites derived from CuxAl-LDH for CO2 electroreduction to hydrocarbons. Vacuum 222, 112974 (2024).
CNP and graphite toplayers, on CuO/CuAl2O4 catalyst prepared via co-precipitation and calcination (800 °C) midlayer , on Cu-sputtered PTFE GDL	Atomically mixed/Crystalline, A-supports-B	Cu, Al, O, C	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.1 V vs. RHE	-175 mA/cm2	35	Z.-Y. Zhang et al., Cu-Zn-based alloy/oxide interfaces for enhanced electroreduction of CO2 to C2+ products. Journal of Energy Chemistry 83, 90-97 (2023).
Porous Cu MPs prepared via dealloying Al2Cu pre-cursor, on GDL	Alloyed/Doped	Cu, Al	-	AF1-HNN8[illegible] 50-X	(AEM)	CO2	-3.7 V vs. ANODE	-75 mA/cm2	34	Z. Qi et al., Scalable fabrication of high activity nanoporous copper powders for electrochemical CO2 reduction via ball milling and dealloying. Journal of CO2 Utilization 45, 101454 (2021).
Calcined (800 °C) Cu/Al LDH pre-cursor, yielding CuAl2O4/CuO NPs, on GDL	Mixed-phase/Janus	Cu, Al, O	Nafion	PK-3-K-130	(AEM)	CO2	-0.92 V vs. RHE	-200 mA/cm2	30	T. Zhang, B. Yuan, W. Wang, J. He, X. Xiang, Tailoring *H Intermediate Coverage on the CuAl2O4/CuO Catalyst for Enhanced Electrocatalytic CO2 Reduction to Ethanol. Angewandte Chemie 135, e202302096 (2023).
Thermally annealed Cu-Al LDH, on GDL	Alloyed/Doped	Cu, Al	Nafion	FAA-3-PK-130	(AEM)	CO2	-0.9 V - iR vs. RHE	-951 mA/cm2	28	L. Zhang et al., Oxophilicity-Controlled CO2 Electroreduction to C2+ Alcohols over Lewis Acid Metal-Doped Cuδ+ Catalysts. Journal of the American Chemical Society 145, 21945-21954 (2023).
yyMain text states 79.4, SI states 82.4. Report here main text value										

Table S4. B-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Thin quasi-graphitic carbon-shell functionalized, B-doped Cu NPs supported on carbon fibers, on GDL	Alloyed/Doped, Core/Shell	Cu, C, B	Nafion	Sustanion X37-50	(AEM)	CO2	-0.55 V -iR vs. RHE	-300 mA/cm2	68	J.-Y. Kim et al., Quasi-graphitic carbon shell-induced Cu confinement promotes electrocatalytic CO2 reduction toward C2+ products. Nature Communications 12, 3765 (2021).
Oxygen-vacancy rich B-doped CuO 'nanobundles' (nanowires + nanosheets), on carbon paper	Alloyed/Doped	Cu, O, B	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-20 mA/cm2	58	Q. Wan et al., Boron-doped CuO nanobundles for electroreduction of carbon dioxide to ethylene. Green Chemistry 22, 2750-2754 (2020).
Fragmented Cu NPs derived from B-doped (2.1 at. %) CuOx NPs (30 nm, with 2.7 nm B-enriched shell), on carbon paper	Alloyed/Doped (gradient)	Cu, O, B	Nafion	FAA-3-PK-130	(AEM)	CO2	-0.69 V - iR vs. RHE	-300 mA/cm2	53	K. Yao et al., Mechanistic Insights into OC–COH Coupling in CO2 Electroreduction on Fragmented Copper. Journal of the American Chemical Society 144, 14005-14011 (2022).
Porous dendritic Cu with a boron gradient (higher surface B content), on glassy carbon	Alloyed/Doped (gradient)	Cu, B	Nafion	Nafion 117	(CEM)	CO2	-1.1 V -iR vs. RHE	-55 mA/cm2	52	Y. Zhou et al., Dopant-induced electron localization drives CO2 reduction to C2 hydrocarbons. Nat Chem 10, 974-980 (2018).
B-doped Cu (1.4 at. % B; NaBH4 as reductant and Boron source) NPs mixed with PTFE, on GDL	Alloyed/Doped	Cu, B	-	FAB-PK-75	(AEM)	CO2	-0.45 V -iR vs. RHE	-200 mA/cm2	49	Y. Song et al., B-Cu-Zn Gas Diffusion Electrodes for CO2 Electroreduction to C2+ Products at High Current Densities. Angewandte Chemie International Edition 60, 9135-9141 (2021).
B-doped ("5 %" > 11.9 at. % from ICP) CuOx particles (B gradient at surface), on carbon paper	Alloyed/Doped (gradient)	Cu, O, B	Nafion	Nafion 117 (?)	(CEM)	CO2	-1.0 V vs. RHE	?	49	C. Yang et al., Engineering stable Cu+-Cu0 sites and oxygen defects in boron-doped copper oxide for electrocatalytic reduction of CO2 to C2+ products. Chemical Engineering Journal 484, 149710 (2024).
Calcined B-doped Cu(OH)2 nanorods yielding B-doped (8.2 at. %) CuOx NPs, on carbon paper	Alloyed/Doped	Cu, O, B	Nafion	"Sustainion"	?	CO2	-0.62 V vs. RHE	-167 mA/cm2	48	K. K. Patra et al., Operando Spectroscopic Investigation of a Boron-Doped CuO Catalyst and Its Role in Selective Electrochemical C–C Coupling. ACS Applied Energy Materials 3, 11343-11349 (2020).
Fragmented Cu NPs derived from B-doped (2.1 at. %) CuOx NPs (30 nm, with 2.7 nm B-enriched shell), on glassy carbon	Alloyed/Doped (gradient)	Cu, O, B	Nafion	Nafion 117	(CEM)	CO2	-0.72 V - iR vs. RHE	?	46	K. Yao et al., Mechanistic Insights into OC–COH Coupling in CO2 Electroreduction on Fragmented Copper. Journal of the American Chemical Society 144, 14005-14011 (2022).
Calcined B-doped Cu(OH)2 nanorods yielding B-doped (8.2 at. %) CuOx NPs, on carbon paper	Alloyed/Doped	Cu, O, B	Nafion	Selemion AMV	(AEM)	CO2	-1.01 V vs. RHE	-115 mA/cm2	40	K. K. Patra et al., Operando Spectroscopic Investigation of a Boron-Doped CuO Catalyst and Its Role in Selective Electrochemical C–C Coupling. ACS Applied Energy Materials 3, 11343-11349 (2020).
B-doped dendritic Cu (B gradient at surface) mixed with PTFE, on GDL	Alloyed/Doped (gradient)	Cu, O, B	-	FAA-3-PK-130	(AEM)	CO2	-1.33 V vs. SHE	-200 mA/cm2	39	M. Löffelholz et al., Optimized scalable CuB catalyst with promising carbon footprint for the electrochemical CO2 reduction to ethylene. Sustainable Chemistry for Climate Action 3, 100035 (2023).
B-doped (0.15 at. %) CuO NSs,on carbon paper	Alloyed/doped	Cu, O, B	Nafion	?	(CEM)	CO2	-1.2 V vs. RHE	-31 mA/cm2	39	Z. Li et al., Boron-modified CuO as catalyst for electroreduction of CO2 towards C2+ products. Applied Surface Science 647, 158919 (2024).
Cu-SAC (<1 wt%) on hetero-atom (B) doped C3N4 lamellae, on carbon paper	Single atom, Atomically mixed/Crystalline	Cu, C, N, B	Nafion	"ion exchange membrane"	?	CO2	-0.9 V vs. RHE	-14 mA/cm2	34	Y. Shen et al., Enhanced electrochemical CO2-to-ethylene conversion through second-shell coordination on a Cu single-atom catalyst. Journal of Materials Chemistry A 12, 9075-9087 (2024).
Co-plated B-doped Cu NPs, on Cu substrate	Alloyed/Doped	Cu, O, B	-	Nafion 117	(CEM)	CO2	-1.08 V - iR vs. RHE	-10 mA/cm2	32	H. Li et al., Changing the Product Selectivity for Electrocatalysis of CO2 Reduction Reaction on Plated Cu Electrodes. ChemCatChem 11, 6139-6146 (2019).
400 nm thick evaporated Cu/B alloy (95:5), on GDL	Alloyed/Doped	Cu, B	-	AF1-HNN8-50-X	(AEM)	CO2	?	-100 mA/cm2	30	S. E. Weitzner et al., Evaluating the stability and activity of dilute Cu-based alloys for electrochemical CO2 reduction. The Journal of Chemical Physics 155, (2021).
B-doped ("5 %" > 11.9 at. % from ICP) CuOx particles (B	Alloyed/Doped (gradient)	Cu, O, B	Nafion	Nafion 117 (?)	(CEM)	CO2	-1.0 V	-35	30	C. Yang et al., Engineering stable Cu+-Cu0 sites and oxygen defects in boron-doped copper oxide for electrocatalytic reduction of CO2 to C2+ products. Chemical Engineering Journal

gradient at surface), on carbon paper							vs. RHE	mA/cm2		484, 149710 (2024).
B-doped Cu2O NWs, on Toray GDL	Alloyed/Doped	Cu, O, B	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-32 mA/cm2	26	Y. Yao et al., Restraining lattice oxygen of Cu2O by enhanced Cu–O hybridization for selective and stable production of ethylene with CO2 electroreduction. Journal of Materials Chemistry A 10, 20914-20923 (2022).

Table S5. Mg-based										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Mg surface-doped CuOx NPs (Mg0.72Cu), on GDL	Alloyed/Doped	Cu, Mg	Nafion	NEOSEPTA, AHA	(AEM)	CO	?	?	80	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angewandte Chemie International Edition 61, e202213423 (2022).
Mg surface-doped CuOx NPs (Mg0.72Cu), on GDL	Alloyed/Doped	Cu, Mg	Nafion	NEOSEPTA, AHA	(AEM)	CO2	-0.69 V - iR vs. RHE	-650 mA/cm2	70	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angewandte Chemie International Edition 61, e202213423 (2022).
Mg surface-doped CuOx NPs (Mg0.72Cu), on GDL	Alloyed/Doped	Cu, Mg	Nafion	NEOSEPTA, AHA	(AEM)	CO	?	?	61	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angewandte Chemie International Edition 61, e202213423 (2022).
Thermally annealed Cu-Mg LDH, on GDL	Alloyed/Doped	Cu, Mg	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.0 V - iR vs. RHE	-505 mA/cm2	28	L. Zhang et al., Oxophilicity-Controlled CO2 Electroreduction to C2+ Alcohols over Lewis Acid Metal-Doped Cuδ+ Catalysts. Journal of the American Chemical Society 145, 21945-21954 (2023).

Table S6. Zn-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
CuOx supported on ZnO , on carbon paper (TGP-H-60)	Mixed-phase/Janus, A-supports-B	Cu, Zn, O	Nafion	Nafion 117	(CEM)	CO2	-2.5 V vs. Ag/AgCl	-7.5 mA/cm2	91	I. Merino-Garcia, J. Albo, J. Solla-Gullón, V. Montiel, A. Irabien, Cu oxide/ZnO-based surfaces for a selective ethylene production from gas-phase CO2 electroconversion. Journal of CO2 Utilization 31, 135-142 (2019).
Brass foil (62% Cu, 37% Zn, trace amounts of Fe, Pb, Sn) with Nafion/PVDF (70:30 wt%) overlayer	Alloyed/Doped, Overlayer	Cu, Zn	Nafion, PVDF	-	(n/a)	CO2	-0.89 V vs. RHE	?	74	H. Pan, T. Akter, C. J. Barile, Electrochemical CO2 Reduction on Zinc and Brass with Modulated Proton Transfer Using Membrane-Modified Electrodes. ACS Applied Energy Materials 5, 12860-12868 (2022).
Highly porous Zn/Cu layer (10 at. % Zn) generated through partially leaching of co-sputtered Zn/Cu layer on PTFE substrate	Alloyed/Doped	Cu, Zn	-	Fumasep FAB-PK-130	(AEM)	CO2	-1.1 V vs. RHE	-150 mA/cm2	73	J. Zhang et al., Accelerating electrochemical CO2 reduction to multi-carbon products via asymmetric intermediate binding at confined nanointerfaces. Nature Communications 14, 1298 (2023).
Highly porous Zn/Cu layer (10 at. % Zn) generated through partially leaching of co-sputtered Zn/Cu layer on PTFE substrate	Alloyed/Doped	Cu, Zn	-	Nafion 117	(CEM)	CO2	-1.6 V vs. RHE	-300 mA/cm2	64	J. Zhang et al., Accelerating electrochemical CO2 reduction to multi-carbon products via asymmetric intermediate binding at confined nanointerfaces. Nature Communications 14, 1298 (2023).
Nanosheet arrays containing homogeneously mixed Zn & Cu domains (Cu:Zn ratio of 24:76 via XPS), on Cu foam	Bi-phasic/Janus	Cu, Zn	-	Nafion 211	(CEM)	CO2	-1.14 V vs. RHE	-150 mA/cm2	59	X. Zhang et al., Regulating ethane and ethylene synthesis by proton corridor microenvironment for CO2 electrolysis. Journal of Energy Chemistry 87, 368-377 (2023).
Phase-separated CuO and ZnO NPs (Cu:Zn ratio of 80:20) supported on Vulcan XC72, on GDL	Mixed-phase/Janus	Cu, Zn, O	-	FAA-3-PK-75	(AEM)	CO2	-0.75 V -iR vs. RHE	-367 mA/cm2	51	Z. Li et al., CuO/ZnO/C electrocatalysts for CO2-to-C2+ products conversion with high yield: On the effect of geometric structure and composition. Applied Catalysis A: General 606, 117829 (2020).
Cu NP layer (1 mg/cm2) with ZnO overlayer (0.2 mg/cm2), on GDL	Overlayer, Tandem catalyst	Cu, Zn, O	Nafion	"Membrane"	?	CO2	-0.73 V vs. RHE	-596 mA/cm2	49	T. Zhang, Z. Li, J. Zhang, J. Wu, Enhance CO2-to-C2+ products yield through spatial management of CO transport in Cu/ZnO tandem electrodes. Journal of Catalysis 387, 163-169 (2020).
ZnO NPs supported on highly porous aggregrates of CuO NSs, on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Zn, O	Nafion	-	(n/a)	CO2	-1.10 V vs. RHE	-21 mA/cm2	46	Z. Yang et al., *CO spillover induced by bimetallic xZnO@yCuO active centers for enhancing C–C coupling over electrochemical CO2 reduction. Separation and Purification Technology 332, 125870 (2024).
Cu NP layer (0.4 mg/cm2) with ZnO overlayer (only present near CO2 inlet, 5% of total area), on GDL	Overlayer, Tandem catalyst	Cu, Zn, O	Sustainion XA-9	"Sustainion"	(AEM)	CO2	-3.15 V vs. ANODE	-652 mA/cm2	46	T. Zhang et al., Highly selective and productive reduction of carbon dioxide to multicarbon products via in situ CO management using segmented tandem electrodes. Nature Catalysis 5, 202-211 (2022).
Chemically dezincified (through NaOH+(NH4)2S2O8 treatment) Zn-doped CuOx NWs, prepared from co-plated Zn/Cu alloy on carbon paper	Alloyed/Doped	Cu, Zn	-	FAA-PK-130	(AEM)	CO2	-0.8 V vs. RHE	-170 mA/cm2	46	S. Zhang et al., Chemically dezincified copper nanowires catalysts with competitive selectivity for ethylene production by carbon dioxide reduction reaction. Ionics 28, 4817-4824 (2022).
Cu90Zn10 alloy layer, on GDL - prepared via magnetron co-sputtering	Alloyed/Doped	Cu, Zn	-	?	(AEM)	CO2	-1.27 V vs. RHE	-180 mA/cm2	44	Y. Yang, H. Fu, C. Xiao, X. Du, Z. Song, Efficient electrochemical CO2 reduction to C2+ hydrocarbons on Zn-doped Cu films. Applied Surface Science 646, 158866 (2024).
Electrochemically cycled (e.g., oxide-derived) Cu75Zn25 alloy disk	Alloyed/Doped	Cu, Zn	-	AHO, AGC Inc.	(AEM)	CO2	-1.10 V vs. RHE	?	41	A. H. M. da Silva et al., Electrocatalytic CO2 reduction to C2+ products on Cu and CuxZny electrodes: Effects of chemical composition and surface morphology. Journal of Electroanalytical Chemistry 880, 114750 (2021).
Cu/Zn mixed catalyst (Cu100Zn4.9), on carbon paper - prepared via co-plating	Mixed-phase/Janus	Cu, Zn	-	Nafion 117	(CEM)	CO2	-1.38 V vs. RHE	-40 mA/cm2	40	T. Deng et al., Electrochemical CO2 reduction to C2+ products over Cu/Zn intermetallic catalysts synthesized by electrodeposition. Frontiers in Energy, (2023).
Cu/Zn mixed catalyst co-electroplated from single plating bath, directly onto a GDL	Mixed-phase/Janus	Cu, Zn	-	Nafion 117	(CEM)	CO2	-1.36 V vs. RHE	-79 mA/cm2	40	X. Meng et al., Cu/Zn bimetallic catalysts prepared by facial potential steps electrodeposition favoring Zn deposition and grain boundary formation for efficient CO2ER to ethylene. Fuel 369, 131775 (2024).
Cu83Zn17 catalyst, on Au substrate - prepared via co-	Alloyed/Doped	Cu, Zn	-	Selemion AMV	(AEM)	CO2	-1.8 V	?	35	J.-J. Velasco-Vélez et al., Cationic Copper Species Stabilized by Zinc during the Electrocatalytic Reduction of CO2 Revealed by In Situ X-Ray Spectroscopy. Advanced

plating							vs. Ag/AgCl			Sustainable Systems 7, 2200453 (2023).
Dual-single atom Cu/Zn (3:1 ratio) deposited on N-functionalized amorphous/graphitic carbon, on Toray carbon paper	Single atom	Cu, Zn, C	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-22 mA/cm2	35	G. Dong et al., Manipulating electrochemical CO2 reduction pathway by engineering energy level of Cu/Zn dual-metal single atom catalysts. Applied Surface Science 660, 159956 (2024).
Core/shell NPs with Cu2O shell (ca. 60 nm) and ZnO core (ca. 30 nm), on GDL	Core/shell	Cu, Zn, O	Nafion	?	(CEM)	CO2	-1.0 V vs. RHE	-33 mA/cm2	34	S. Zhu et al., Core-Shell ZnO@Cu2O as Catalyst to Enhance the Electrochemical Reduction of Carbon Dioxide to C2 Products. Catalysts 11, 535 (2021).
Laser-prepared Cu/Zn alloy NPs (7-15 nm, 4:1 ratio), on glassy carbon	Alloyed/Doped	Cu, Zn	Nafion	?	(AEM)	CO2	-1.10 V vs. RHE	-6 mA/cm2	33	Y. Feng et al., Laser-Prepared CuZn Alloy Catalyst for Selective Electrochemical Reduction of CO2 to Ethylene. Langmuir 34, 13544-13549 (2018).
Cu NWs decorated with Zn-TMC, on GDL	Core/shell, A-supports-B	Cu, Zn	Nafion	?	(AEM)	CO2	-1.0 V vs. RHE	?	30	Y. Luo et al., Cobalt phthalocyanine promoted copper catalysts toward enhanced electro reduction of CO2 to C2: Synergistic catalysis or tandem catalysis? Journal of Energy Chemistry 92, 499-507 (2024).
Semi-porous Cu3Zn-derived NPs, on carbon paper - prepared by electrospinning metal salts with PVP, followed by calcination and alkaline Zn leaching step	Alloyed/Doped	Cu, Zn	Nafion	?	(AEM)	CO2	-2.15 V vs. RHE	-600 mA/cm2	24	M. Fang et al., Aluminum-Doped Mesoporous Copper Oxide Nanofibers Enabling High-Efficiency CO2 Electroreduction to Multicarbon Products. Chemistry of Materials 34, 9023-9030 (2022).
Thermodynamically unstable Cu9Zn1 NPs prepared via thermal shock, on carbon nanotubes	Alloyed/Doped, A-supports-B	Cu, Zn	-	FAA-3	(AEM)	CO	-0.69 V -iR vs. RHE	-50 mA/cm2	22	C. Yang et al., Overcoming immiscibility toward bimetallic catalyst library. Science Advances 6, eaaz6844 (2020).
CNP and graphite layers on top of reduced CuZnO alloy catalyst prepared via co-precipitation and calcination (800 °C) midlayer, on Cu-sputtered PTFE GDL	Alloyed/Doped	Cu, Zn, C	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.15 V vs. RHE	-210 mA/cm2	17	Z.-Y. Zhang et al., Cu-Zn-based alloy/oxide interfaces for enhanced electroreduction of CO2 to C2+ products. Journal of Energy Chemistry 83, 90-97 (2023).

Table S7. Sn-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Co-plated Cu and Sn from a 1 mM 3,5-diamino-1,2,4-triazole containing plating bath, on a 10nm Cu-sputtered GDL	Alloyed/Doped	Cu, Sn	-	-	(n/a)	CO2	-0.8 V vs. RHE	-226 mA/cm2	57	X. Chen et al., Controlling Speciation during CO2 Reduction on Cu-Alloy Electrodes. ACS Catal 10, 672-682 (2020).
Sn-doped CuO nanosheets (0.65%, 130 C), on carbon paper	Alloyed/Doped	Cu, Sn, O	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-9 mA/cm2	49	Y. Jiang et al., Enhanced electrochemical CO2 reduction to ethylene over CuO by synergistically tuning oxygen vacancies and metal doping. Cell Reports Physical Science 2, 100356 (2021).
Sn-doped oxygen vacancy-rich CuO nanoribbons, on carbon paper	Alloyed/Doped	Cu, Sn, O	Nafion	Nafion 117	(CEM)	CO2	?	-6 mA/cm2	40	W. Li et al., Lowering C−C coupling barriers for efficient electrochemical CO2 reduction to C2H4 by jointly engineering single Bi atoms and oxygen vacancies on CuO. Applied Catalysis B: Environmental 318, 121823 (2022).
SnO2-decorated (3 %) CuO nanosheets, on GDL	Mixed-phase/Janus, A-supports-B	Cu, Sn, O	Nafion	Nafion 117	(CEM)	CO2	-1.0 V vs. RHE	-8 mA/cm2	24	Y. Lan, G. Niu, F. Wang, D. Cui, Z. Hu, SnO2-Modified Two-Dimensional CuO for Enhanced Electrochemical Reduction of CO2 to C2H4. ACS Applied Materials & Interfaces 12, 36128-36136 (2020).
Cu NPs in an ionic liquid polymer impregnated with SnCl2 (1 mol% vs. Cu), on GDL	Mixed-phase/Janus	Cu, Sn, O	Polymeric ionic liquid crosslinked with divinylbenzene	FAA-3-PK-130	(AEM)	CO	?	-250 mA/cm2	23	Y.-R. Du et al., Sn-based redox cycle mediated microenvironment regulation of Cu sites on poly(ionic liquid) enhance electrocatalytic CO-to-C2+ conversion. Applied Catalysis B: Environmental 337, 122969 (2023).
Thermodynamically unstable Cu9Sn1 NPs prepared via thermal shock, on carbon nanotubes	Alloyed/Doped, A-supports-B	Cu, Sn	-	FAA-3	(AEM)	CO	-0.74 V -iR vs. RHE	-100 mA/cm2	19	C. Yang et al., Overcoming immiscibility toward bimetallic catalyst library. Science Advances 6, eaaz6844 (2020).
400 nm thick evaporated Cu/Sn alloy (95:5), on GDL	Alloyed/Doped	Cu, Sn	-	AF1-HNN8-50-X	(AEM)	CO2	?	-100 mA/cm2	16	S. E. Weitzner et al., Evaluating the stability and activity of dilute Cu-based alloys for electrochemical CO2 reduction. The Journal of Chemical Physics 155, (2021).

Table S8. Pd-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Dilute Cu/Pd alloy (1.4 at. % Pd) prepared via co-electrodeposition, on glassy carbon	Alloyed/Doped	Cu, Pd	-	FAA-3-PK-75	(AEM)	CO2	-0.7 V vs. RHE	-3 mA/cm2	76	Z.-Y. Zhang et al., Nanocavity enriched CuPd alloy with high selectivity for CO2 electroreduction toward C2H4. Rare Metals, (2024).
Pd NP-decorated (50 nm) cubic Cu2O microparticles (1 µm) supported on carbon black, on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Pd, C, O	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-22 mA/cm2	64	D. Xiao et al., Stabilizing Cu2O for enhancing selectivity of CO2 electroreduction to C2H4 with the modification of Pd nanoparticles. Chemical Engineering Journal 452, 139358 (2023).
Pd doped Cu2O NCs (0.88 at. % Pd), on Toray YLS-30T GDL	Alloyed/Doped	Cu, Pd, O	Nafion	FAB-PK-130	(AEM)	CO2	-0.87 V vs. RHE	-800 mA/cm2	54	D. Zhou et al., Cooperation of Different Active Sites to Promote CO2 Electroreduction to Multi-carbon Products at Ampere-Level. Angewandte Chemie International Edition n/a, e202400439.
Cu2O microcubes (1 µm) decorated with small Pd NPs (20 nm), prepared via galvanic displacement, mixed with carbon black, on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Pd, C	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-29 mA/cm2	53	X. Xu et al., Pd-Decorated Cu2O–Ag Catalyst Promoting CO2 Electroreduction to C2H4 by Optimizing CO Intermediate Adsorption and Hydrogenation. ACS Applied Materials & Interfaces 16, 16243-16252 (2024).
Phase-separated Cu/Pd NPs (51.3:48.7 at. ratio), on GDL	Mixed-phase/Janus, A-supports-B	Cu, Pd	Nafion	"Fumatech"	(AEM)	CO2	-0.74 V - iR vs. RHE	-361 mA/cm2	47	S. Ma et al., Electroreduction of Carbon Dioxide to Hydrocarbons Using Bimetallic Cu–Pd Catalysts with Different Mixing Patterns. Journal of the American Chemical Society 139, 47-50 (2017).
Co-electroplated Cu/Pd foam (6.83:1 at. ratio), on carbon paper	Alloyed/Doped	Cu, Pd	-	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-17 mA/cm2	45	R. Feng et al., Electrodeposited Cu–Pd bimetallic catalysts for the selective electroreduction of CO2 to ethylene. Green Chemistry 22, 7560-7565 (2020).
Pd-doped Cu/Cu2O NPs (6 at. % Pd (?)), on a GDL	Alloyed/Doped	Cu, Pd, O	Nafion	Nafion 117	(CEM)	CO2	-2.18 V vs. RHE	-615 mA/cm2	45[DD]	B. Wang, L. Song, C. Peng, X. Lv, G. Zheng, Pd-induced polarized Cu0-Cu+ sites for electrocatalytic CO2-to-C2+ conversion in acidic medium. Journal of Colloid and Interface Science 671, 184-191 (2024).
Cu1Pd0.004 NPs prepared via ultrasonic-assisted galvanic replacement of commercial Cu NPs (100 nm), on GDL	Core/shell	Cu, Pd	Nafion	FAA-PK-130	(AEM)	CO	-0.65 V - iR vs. RHE	-581 mA/cm2	44	J. Li et al., Enhanced multi-carbon alcohol electroproduction from CO via modulated hydrogen adsorption. Nature Communications 11, 3685 (2020).
CuPd NPs (1:0.576 at. ratio) prepared via galvanic replacement of Cu NPs (100 nm), on SGL 29BC GDL	Core/shell	Cu, Pd	Nafion	FAA-3-PK-130	(AEM)	CO	?	-700 mA/cm2	35	X. Li et al., Enhanced CO Affinity on Cu Facilitates CO2 Electroreduction toward Multi-Carbon Products. Small 19, 2302530 (2023).
Pd surface doped (0.002 at. %) CuN3 NCs, on carbon paper	Alloyed/Doped	Cu, Pd, N	Nafion	X37-50 grade 60	(AEM)	CO2	-1.1 V vs. RHE	-88 mA/cm2	35	Z. Zhang et al., Charge-Separated Pdδ−–Cuδ+ Atom Pairs Promote CO2 Reduction to C2. Nano Letters 23, 2312-2320 (2023).
CuPd NPs (1:0.576 at. ratio) prepared via galvanic replacement of Cu NPs (100 nm), on SGL 29BC GDL	Core/shell	Cu, Pd	Nafion	Nafion 117	(CEM)	CO2	?	-500 mA/cm2	34	X. Li et al., Enhanced CO Affinity on Cu Facilitates CO2 Electroreduction toward Multi-Carbon Products. Small 19, 2302530 (2023).
Janus catalyst composed of Cu decahedra NPs grown on Pd seed (46.2:1 at. ratio Cu/Pd), supported on Vulcan XC72, on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Pd, C	Nafion	Nafion 117	(CEM)	CO2	-1.0 V vs. RHE	-30 mA/cm2	34	Z. Lyu et al., Kinetically Controlled Synthesis of Pd–Cu Janus Nanocrystals with Enriched Surface Structures and Enhanced Catalytic Activities toward CO2 Reduction. Journal of the American Chemical Society 143, 149-162 (2021).
Phase-separated Cu/Pd NPs (98:2 wt. ratio) deposited via electroplating on GDL	Mixed-phase/Janus, A-supports-B	Cu, Pd	-	Nafion 117	(CEM)	CO2	-1.15 V - iR vs. RHE	-200 mA/cm2	34	C. Zhu et al., Cu–Pd Bimetallic Gas Diffusion Electrodes for Electrochemical Reduction of CO2 to C2+ Products. Small Structures 4, 2200328 (2023).
CuPd NPs (1:0.383 at. ratio) prepared via galvanic replacement of Cu NPs (100 nm), on SGL 29BC GDL	Core/shell	Cu, Pd	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.74 V vs. RHE	-500 mA/cm2	31	X. Li et al., Enhanced CO Affinity on Cu Facilitates CO2 Electroreduction toward Multi-Carbon Products. Small 19, 2302530 (2023).
Disordered Cu/Pd NPs (1.1:1 atomic ratio), on GDL	Alloyed/Doped	Cu, Pd	Nafion	FAB-PK-130,	(AEM)	CO	-0.54 V - iR	?	31	Y. Ji et al., Selective CO-to-acetate electroreduction via intermediate adsorption tuning on

							vs. RHE			ordered Cu–Pd sites. Nature Catalysis 5, 251-258 (2022).
"CuPd(100) interface catalyst" prepared starting from Pd NPs, supported on Kochin black, on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Pd, C	Nafion	-	(n/a)	CO_2	-0.8 V vs. RHE	-14 mA/cm2	29	L. Zhu et al., Tuning the intermediate reaction barriers by a CuPd catalyst to improve the selectivity of CO2 electroreduction to C2 products. Chinese Journal of Catalysis 42, 1500-1508 (2021).
Thermodynamically unstable Cu9Pd1 NPs prepared via thermal shock, on carbon nanotubes	Alloyed/Doped, A-supports-B	Cu, Pd	-	FAA-3	(AEM)	CO	-0.66 V -iR vs. RHE	-25 mA/cm2	27	C. Yang et al., Overcoming immiscibility toward bimetallic catalyst library. Science Advances 6, eaaz6844 (2020).
Cu NPs mixed with (in-situ formed) PdO2 NPs ‘dissolved’/dispersed in an IL polymer layer, on GDL	Mixed-phase/Janus	Cu, Pd, O	Polymeric ionic liquid crosslinked with divinylbenzene	FAA-3-PK-130	(AEM)	CO_2	-0.99 V - iR vs. RHE	-350 mA/cm2	27	X.-Q. Li, G.-Y. Duan, X.-X. Yang, L.-J. Han, B.-H. Xu, Electroreduction of carbon dioxide to multi-electron reduction products using poly(ionic liquid)-based Cu-Pd catalyst. Fundamental Research 2, 937-945 (2022).
[DD]Report the value given in main text, as opposed to SI table (45 vs. 44%)										

Table S9. Pb-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Phase-seggregated Cu/Pb bimetallic catalyst individually electroplated on polyaniline-modified carbon paper	Mixed-phase/Janus, Single atom	Cu, Pb, C	Polyaniline	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-16 mA/cm2	57	S. Han et al., CO2 Electroreduction to C2+ Products over Cu-Pb Heterojunction Catalyst. ChemCatChem n/a, e202300918.
Cu NCs with 0.7 nm Pb shell, mixed with CNPs, on glassy carbon	Core/shell, A-supports-B	Cu, Pb, C	Nafion	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-18 mA/cm2	40	P. Wang et al., Synergized Cu/Pb Core/Shell Electrocatalyst for High-Efficiency CO2 Reduction to C2+ Liquids. ACS Nano 15, 1039-1047 (2021).
Alloyed Pb/Cu NPs (Cu:Pb ratio of 0.2%, possibly phase-separated) mixed with CNPs, on GDL	Alloyed/Doped	Cu, Pb	-	Nafion 117	(CEM)	CO	-2.4 V vs. SCE	-200 mA/cm2	34	M. Schwartz, M. E. Vercauteren, A. F. Sammells, Fischer-Tropsch Electrochemical CO2 Reduction to Fuels and Chemicals. Journal of The Electrochemical Society 141, 3119 (1994).
Pb-doped (3.4 wt%) Cu2O nanosheets, on GDL	Alloyed/Doped	Cu, Pb, O	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.1 V vs. RHE	-204 mA/cm2	33	X. Ma et al., Stabilizing Cu0–Cu+ sites by Pb-doping for highly efficient CO2 electroreduction to C2 products. Green Chemistry 25, 7635-7641 (2023).

Table S10. Ni-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Ultrathin (ca. 4.8 nm) alloyed hexagonal CuNi nanosheets (ca. 1:1 atom ratio), on Ti mesh	Alloyed/Doped	Cu, Ni	Nafion	?	?	CO2	-1.5 V vs. RHE	-470 mA/cm2	81	Y. Yan et al., Ultrathin CuNi Nanosheets for CO2 Reduction and O2 Reduction Reaction in Fuel Cells. ACS Materials Letters 3, 1143-1150 (2021).
Cu NPs encapsulated in mesoporous Ni-SAC functionalized carbon, on GDL	Mixed-phase/Janus, A-supports-B	Cu, Ni, C, N	-	"Fuel Cell Store"	(AEM)	CO2	-1.1 V -iR vs. RHE	-406 mA/cm2	72	B. Chen et al., Tandem Catalysis for Enhanced CO2 to Ethylene Conversion in Neutral Media. Advanced Functional Materials n/a, 2310029.
{100}-facet rich Cu NWs mixed with Ni-SAC and CNPs, on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Ni, C, N	PVDF, NMP	-	(n/a)	CO2	-0.5 V vs. RHE	-101 mA/cm2	66	Z. Yin et al., Hybrid Catalyst Coupling Single-Atom Ni and Nanoscale Cu for Efficient CO2 Electroreduction to Ethylene. Journal of the American Chemical Society 144, 20931-20938 (2022).
Ni-SAC layer on top of sputtered Cu layer, on GDL	Overlayer, Tandem catalyst	Cu, Ni, C, N	Nafion (?)	?	?	CO2	-0.72 V -iR vs. RHE	-160 mA/cm2	63	J. Chen et al., Accelerated Transfer and Spillover of Carbon Monoxide through Tandem Catalysis for Kinetics-boosted Ethylene Electrosynthesis. Angewandte Chemie International Edition 62, e202215406 (2023).
Ni-N/C layer on top of Cu NP layer, on a GDL	Overlayer, Tandem catalyst	Cu, Ni, C	Nafion	FAA-3-PK-75	(AEM)	CO2	-0.70 V -iR vs. RHE	-593 mA/cm2	62	X. She et al., Tandem Electrodes for Carbon Dioxide Reduction into C2+ Products at Simultaneously High Production Efficiency and Rate. Cell Reports Physical Science 1, 100051 (2020).
Cu NPs supported on Ni-SAC mixed with PTFE, on GDL	Mixed-phase/Janus, A-supports-B	Cu, Ni, C, N	Nafion	Selemion DSVN	(AEM)	CO2	-1.33 V -iR vs. RHE	-600 mA/cm2	62	M. Liu et al., Potential Alignment in Tandem Catalysts Enhances CO2-to-C2H4 Conversion Efficiencies. Journal of the American Chemical Society 146, 468-475 (2024).
Cu NPs mixed with Ni-SAC, on homemade GDL	Mixed-phase/Janus	Cu, Ni, C, N	Nafion	FAB-PK-130	(AEM)	CO2	-0.58 V -iR vs. RHE	-308 mA/cm2	61	L. Li et al., Hydrophobicity graded gas diffusion electrode with enhanced CO intermediate coverage for high-performance electroreduction of CO2 to ethylene. Applied Catalysis B: Environmental 331, 122597 (2023).
Ni-doped (1.2 at.%) self-supporting Cu2O NWs arrays on Cu mesh substrate	Mixed-phase/Janus, A-supports-B	Cu, Ni, O	-	Nafion 117	(CEM)	CO2	-1.1 V -iR vs. RHE	-65 mA/cm2	58	S. Min et al., Transition metal (Fe, Co, Ni)-doped cuprous oxide nanowire arrays as self-supporting catalysts for electrocatalytic CO2 reduction reaction to ethylene. Applied Surface Science 663, 160150 (2024).
CU NPs supported on Ni-SAC layer, on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Ni, C	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-3 mA/cm2	57[xx]	D.-L. Meng et al., Highly Selective Tandem Electroreduction of CO2 to Ethylene over Atomically Isolated Nickel–Nitrogen Site/Copper Nanoparticle Catalysts. Angewandte Chemie International Edition 60, 25485-25492 (2021).
CuOx NCs supported on Ni/C,N catalyst, on GDL	Mixed-phase/Janus, A-supports-B	Cu, Ni, C, N	Nafion	FAA-3-50	(AEM)	CO2	-0.60 V -iR vs. RHE	-127 mA/cm2	55	Y.-R. Lin et al., Vapor-Fed Electrolyzers for Carbon Dioxide Reduction Using Tandem Electrocatalysts: Cuprous Oxide Coupled with Nickel-Coordinated Nitrogen-Doped Carbon. Advanced Functional Materials 32, 2113252 (2022).
Ni-doped Cu2(OH)3Cl pre-cursor reduced in-situ to form β nickel-oxide hydroxide (NiOOH)/Cu active phase, on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Ni, C, O	Nafion	FAB-PK-130	(AEM)	CO2	-1.25 V -iR vs. RHE	-400 mA/cm2	55	X. Mao et al., Sustainedly High-Rate Electroreduction of CO2 to Multi-Carbon Products on Nickel Oxygenate/Copper Interfacial Catalysts. Advanced Energy Materials n/a, 2400827.
CuO NPs supported on Ni-SAC, on GDL	Mixed-phase/Janus, A-supports-B	Cu, Ni, C, N	Nafion	Sustainion X37 50	(AEM)	CO2	-0.89 V -iR vs. RHE	-1500 mA/cm2	54	Y. Zhang et al., Multicarbons generation factory: CuO/Ni single atoms tandem catalyst for boosting the productivity of CO2 electrocatalysis. Science Bulletin 67, 1679-1687 (2022).
Cu-doped Ni MOF mixed with MWCNTs and PTFE, on GDL	Mixed-phase/Janus	Cu, Ni, C, O	PiperION-A5	PiperION-A40	(AEM)	CO2	-1.3 V vs. RHE	-527 mA/cm2	53	L. Huang et al., Enhanced CO2 Electroreduction Selectivity toward Ethylene on Pyrazolate-Stabilized Asymmetric Ni–Cu Hybrid Sites. Journal of the American Chemical Society 145, 26444-26451 (2023).
{100}-facet rich Cu NWs mixed with Ni-SAC and CNPs, on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Ni, C, N	PVDF, NMP	Nafion 212	(CEM)	CO2	-1.6 V vs. RHE	-78 mA/cm2	51	Z. Yin et al., Hybrid Catalyst Coupling Single-Atom Ni and Nanoscale Cu for Efficient CO2 Electroreduction to Ethylene. Journal of the American Chemical Society 144, 20931-20938 (2022).
Cu/Ni alloy NPs (7% Ni), co-sputtered on GDL	Alloyed/Doped	Cu, Ni	-	Sustainion 37-50	(AEM)	CO2	-0.9 V -iR	-200	41	H. Song, Y. C. Tan, B. Kim, S. Ringe, J. Oh, Tunable Product Selectivity in Electrochemical CO2 Reduction on Well-Mixed Ni–Cu Alloys. ACS Applied Materials & Interfaces 13, 55272-

							vs. RHE	mA/cm2		55280 (2021).
Cu NWs decorated with Ni-TMC, on GDL	Core/shell, A-supports-B	Cu, Ni	Nafion	?	(AEM)	CO2	-1.0 V vs. RHE	?	37	Y. Luo et al., Cobalt phthalocyanine promoted copper catalysts toward enhanced electro reduction of CO2 to C2: Synergistic catalysis or tandem catalysis? Journal of Energy Chemistry 92, 499-507 (2024).
Coral-like catalyst obtained via thermal and electrochemical treatment of Ni-based metalloporphyrin intermixed in Cu-based MOF, on carbon paper	Mixed-phase/Janus	Cu, Ni, C	Nafion	Nafion 115	(CEM)	CO2	-1.27 V vs. RHE	-49 mA/cm2	32	T. Yan, J.-H. Guo, Z.-Q. Liu, W.-Y. Sun, Metalloporphyrin Encapsulation for Enhanced Conversion of CO2 to C2H4. ACS Applied Materials & Interfaces 13, 25937-25945 (2021).
Ni clusters deposited through galvanic displacement on CuS-derived roughened Cu foam	Mixed-phase/Janus	Cu, Ni	-	Sustainion 37–50	(AEM)	CO2	-0.88 V -iR vs. RHE	-268 mA/cm2	32	X. Zhang et al., Atomic nickel cluster decorated defect-rich copper for enhanced C2 product selectivity in electrocatalytic CO2 reduction. Applied Catalysis B: Environmental 291, 120030 (2021).
Cu NPs supported on Ni-N/C , on glassy carbon	Tandem catalyst, A-supports-B	Cu, Ni, C	Nafion	Nafion 117	(CEM)	CO2	-1.09 V -iR vs. RHE	-6 mA/cm2	31	D. Choukroun et al., Bifunctional Nickel–Nitrogen-Doped-Carbon-Supported Copper Electrocatalyst for CO2 Reduction. The Journal of Physical Chemistry C 124, 1369-1381 (2020).
Thermodynamically unstable Cu9Ni1 NPs prepared via thermal shock, on carbon nanotubes	Alloyed/Doped, A-supports-B	Cu, Ni	-	FAA-3	(AEM)	CO	-0.64 V -iR vs. RHE	-25 mA/cm2	26	C. Yang et al., Overcoming immiscibility toward bimetallic catalyst library. Science Advances 6, eaaz6844 (2020).
Air-oxidized Cu/Ni alloy NPs (19% Ni), on carbon paper	Alloyed/Doped	Cu, Ni	-	-	(n/a)	CO2	-1.2 V vs. RHE	-2 mA/cm2	25	T. M. Suzuki et al., Electrochemical CO2 reduction over nanoparticles derived from an oxidized Cu–Ni intermetallic alloy. Chemical Communications 56, 15008-15011 (2020).
xxMain text states 57.3, SI states 57.8. Rounded down to 57										

Table S11. Co-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Ultrathin (ca. 46.3 nm) alloyed hexagonal CuCo nanosheets (ca. 1:1 atom ratio), on glassy carbon	Alloyed/Doped	Cu, Co	Nafion	Nafion 117	(CEM)	CO2	-1.5 V vs. RHE	-400 mA/cm2	81	Y. Yan et al., Atomic-thin hexagonal CuCo nanocrystals with d-band tuning for CO2 reduction. Journal of Materials Chemistry A 9, 7496-7502 (2021).
Co-TMC (tetraphenylporphyrin) confined within the nanopores of porous Cu2O microparticles, on PTFE-modified GDL	A-supports-B, Mixed-phase/Janus	Cu, O, Co	Nafion	Nafion 115	(CEM)	CO	?	-800 mA/cm2	76	Y. Wang, Q. Cheng, H. Zhang, L. Ma, H. Yang, Cobalt(II) tetraphenylporphyrin trapped in the pores of Cu2O to enhance the C2+ selectivity towards acidic CO2 electroreduction. Chemical Engineering Journal 492, 152254 (2024).
Cu2O NCs supported on cobalt phthalocyanine-modified-acetylene black, on GDL	A-supports-B, Mixed-phase/Janus	Cu, Co, C	Nafion	FAA-3-20	(AEM)	CO2	-0.76 V - iR vs. RHE	-317 mA/cm2	71	J. Liu et al., Integration of Cobalt Phthalocyanine, Acetylene Black and Cu2O Nanocubes for Efficient Electroreduction of CO2 to C2H4. ChemSusChem 16, e202300601 (2023).
Cold H2 plasma-treated porous mixed CoOx/CuOx, on glassy carbon	Mixed-phase/Janus	Cu, Co	Nafion	?	?	CO2	-1.0 V vs. RHE	-21 mA/cm2	70	J. Wang et al., Cold plasma activated Cu–Co multi-active centers tandem catalysts for efficient electrocatalytic CO2 into C2H4. Vacuum 222, 113017 (2024).
Vulcan XC-72 toplayer on Co-TMC midlayer, on Cu-sputtered PTFE GDL	Overlayer	Cu, Co, C	Nafion	Nafion 115	(CEM)	CO2	-0.79 V - iR vs. RHE	-420 mA/cm2	67	X. Kong et al., Understanding the Effect of *CO Coverage on C–C Coupling toward CO2 Electroreduction. Nano Letters 22, 3801-3808 (2022).
Cu2O NCs supported on cobalt phthalocyanine-modified-acetylene black, on glassy carbon	A-supports-B, Mixed-phase/Janus	Cu, Co, C	Nafion	Nafion 117	(CEM)	CO2	-1.1 V - iR vs. RHE	-51 mA/cm2	58	J. Liu et al., Integration of Cobalt Phthalocyanine, Acetylene Black and Cu2O Nanocubes for Efficient Electroreduction of CO2 to C2H4. ChemSusChem 16, e202300601 (2023).
Cu NWs decorated with Co-TMC (phthalocyanine, mass ratio of 100:1 Cu/Co-TMC), on GDL	Core/shell, A-supports-B	Cu, Co	Nafion	?	(AEM)	CO2	-1.4 V vs. RHE	-350 mA/cm2	58	Y. Luo et al., Cobalt phthalocyanine promoted copper catalysts toward enhanced electro reduction of CO2 to C2: Synergistic catalysis or tandem catalysis? Journal of Energy Chemistry 92, 499-507 (2024).
Co-TMC shell around Cu2O NCs, on carbon paper	Core/shell	Cu, Co	-	Nafion 117	(CEM)	CO2	-2.85 V vs. RHE	-500 mA/cm2	54	M. Ma et al., Metalloporphyrin Frameworks to Encapsulate Copper Oxides for Boosting Ethylene Production in Neutral Electrolyte. Advanced Functional Materials n/a, 2315667.
Co-TMC (tetraphenylporphyrin) confined within the nanopores of porous Cu2O microparticles, on PTFE-modified GDL	A-supports-B, Mixed-phase/Janus	Cu, O, Co	Nafion	Nafion 115	(CEM)	CO2	-0.93 V - iR vs. RHE	-800 mA/cm2	52	Y. Wang, Q. Cheng, H. Zhang, L. Ma, H. Yang, Cobalt(II) tetraphenylporphyrin trapped in the pores of Cu2O to enhance the C2+ selectivity towards acidic CO2 electroreduction. Chemical Engineering Journal 492, 152254 (2024).
Co-TMC surface-modified Cu NCs supported on carbon black, on GDL substrate	Core/shell, A-supports-B	Cu, Co, C	Nafion	FAB-PK-130	(AEM)	CO2	?	-200 mA/cm2	49	M. Wang, A. Loiudice, V. Okatenko, I. D. Sharp, R. Buonsanti, The spatial distribution of cobalt phthalocyanine and copper nanocubes controls the selectivity towards C2 products in tandem electrocatalytic CO2 reduction. Chemical Science 14, 1097-1104 (2023).
Co-containing (CO forming) TMC (porphyrin) coated on CuOx NW-modified Cu mesh substrate	Core/Shell, Mixed-phase/Janus	Cu, Co, O	-	Nafion 117	(CEM)	CO2	-0.8 V - iR vs. RHE	-22 mA/cm2	48	S. Min et al., Construction of Cobalt Porphyrin-Modified Cu2O Nanowire Array as a Tandem Electrocatalyst for Enhanced CO2 Reduction to C2 Products. Small n/a, 2400592.
Co (0.2 %)/CuO alloy NPs (ca. 16 nm) with single-atom Co prepared from Cu-MOF precursor, on carbon paper	Alloyed/Doped	Cu, Co	Nafion	"Selemion"	(AEM)	CO2	-1.01 V vs. RHE	-650 mA/cm2	43	B. Kim et al., Trace-Level Cobalt Dopants Enhance CO2 Electroreduction and Ethylene Formation on Copper. ACS Energy Letters 8, 3356-3364 (2023).
Co-doped (1.1 at.%) self-supporting Cu2O NWs arrays on Cu mesh substrate	Mixed-phase/Janus, A-supports-B	Cu, Co, O	-	Nafion 117	(CEM)	CO2	-1.1 V -iR vs. RHE	-58 mA/cm2	42	S. Min et al., Transition metal (Fe, Co, Ni)-doped cuprous oxide nanowire arrays as self-supporting catalysts for electrocatalytic CO2 reduction reaction to ethylene. Applied Surface Science 663, 160150 (2024).
Cu NWs decorated with Co-TMC (phthalocyanine, mass ratio of 100:1 Cu/Co-TMC), on GDL	Core/shell, A-supports-B	Cu, Co	Nafion	?	(AEM)	CO	-1.2 V vs. RHE	?	38	Y. Luo et al., Cobalt phthalocyanine promoted copper catalysts toward enhanced electro reduction of CO2 to C2: Synergistic catalysis or tandem catalysis? Journal of Energy Chemistry 92, 499-507 (2024).
Co TMC (porphyrin) coated on Cu-sputtered PTFE GDL	Overlayer	Cu, Co	-	FAA-3-PK-130	(AEM)	CO2	?	?	37	F. Li et al., Cooperative CO2-to-ethanol conversion via enriched intermediates at molecule–

										metal catalyst interfaces. Nature Catalysis 3, 75-82 (2020).
Coral-like catalyst obtained via thermal and electrochemical treatment of Co-based metalloporphyrin intermixed in Cu-based MOF, on carbon paper	Mixed-phase/Janus	Cu, Co, C	Nafion	Nafion 115	(CEM)	CO2	-1.17 V vs. RHE	-39 mA/cm2	32	T. Yan, J.-H. Guo, Z.-Q. Liu, W.-Y. Sun, Metalloporphyrin Encapsulation for Enhanced Conversion of CO2 to C2H4. ACS Applied Materials & Interfaces 13, 25937-25945 (2021).
Cu/Co (4% Co) alloy NPs prepared via co-electroplating on Cu substrate	Alloyed/Doped	Cu, Co	-	Nafion 212	(CEM)	CO2	-1.19 V - iR vs. RHE	?	22	Y. Takatsuji et al., Highly Selective Methane Production Through Electrochemical CO2 reduction by Electrolytically Plated Cu-Co Electrode. Electrocatalysis 10, 29-34 (2019).

Table S12. Ga-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Ga-doped CuOx NCs (1.67 at.% Ga), on Toray GDL	Alloyed/Doped	Cu, Ga, O	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.07 V - iR vs. RHE	-900 mA/cm2	45	P. Li et al., p–d Orbital Hybridization Induced by p-Block Metal-Doped Cu Promotes the Formation of C2+ Products in Ampere-Level CO2 Electroreduction. Journal of the American Chemical Society 145, 4675-4682 (2023).
Cu4Ga9 intermetallic alloy NPs, on a GDL	Alloyed/Doped	Cu, Ga	Nafion	FAB-PK-130	(AEM)	CO	-1.15 V vs. RHE	?	43	S. Yan et al., High-Power CO2-to-C2 Electroreduction on Ga-Spaced, Square-like Cu Sites. Journal of the American Chemical Society 145, 26374-26382 (2023).
400 nm thick evaporated Cu/Ga alloy (95:5), on GDL	Alloyed/Doped	Cu, Ga	-	AF1-HNN8-50-X	(AEM)	CO2	?	-100 mA/cm2	37	S. E. Weitzner et al., Evaluating the stability and activity of dilute Cu-based alloys for electrochemical CO2 reduction. The Journal of Chemical Physics 155, (2021).
Thermally annealed Cu-Ga LDH, on GDL	Alloyed/Doped	Cu, Ga	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.0 V - iR vs. RHE	-522 mA/cm2	31	L. Zhang et al., Oxophilicity-Controlled CO2 Electroreduction to C2+ Alcohols over Lewis Acid Metal-Doped Cuδ+ Catalysts. Journal of the American Chemical Society 145, 21945-21954 (2023).
Cu4Ga9 intermetallic alloy NPs, on a GDL	Alloyed/Doped	Cu, Ga	Nafion	FAB-PK-130	(AEM)	CO2	-1.49 V vs. RHE	-1800 mA/cm2	31	S. Yan et al., High-Power CO2-to-C2 Electroreduction on Ga-Spaced, Square-like Cu Sites. Journal of the American Chemical Society 145, 26374-26382 (2023).
Ga(OH)x overlayer on Cu-sputtered PTFE GDL	Overlayer, Mixed-phase/Janus	Cu, Ga, O	-	FAA-3-PK-130	(AEM)	CO2	?	?	27	M. Luo et al., Hydroxide promotes carbon dioxide electroreduction to ethanol on copper via tuning of adsorbed hydrogen. Nature Communications 10, 5814 (2019).
Cu/Ga alloy NPs (4 at. % Ga), on glassy carbon	Alloyed/Doped	Cu, Ga	-	Selemion AMV	(AEM)	CO2	-1.1 V - iR vs. RHE	-3 mA/cm2	23	V. Okatenko et al., Alloying as a Strategy to Boost the Stability of Copper Nanocatalysts during the Electrochemical CO2 Reduction Reaction. Journal of the American Chemical Society 145, 5370-5383 (2023).
Alloy/mixed metal Ga/Cu (1:3 ratio) microparticles, on GDL - obtained via reduction of mixed nitrate salt with NaBH4 over 12h period	Alloyed/Doped	Cu, Ga	Nafion	NEOSEPTA, AHA	(AEM)	CO2	-0.6 V vs. RHE	-106 mA/cm2	19	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angewandte Chemie International Edition 61, e202213423 (2022).

Table S13. Fe-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Cu NP layer (0.8 mg/cm2) with Fe-N/C overlayer (only present near CO2 inlet, 5% of total area), on GDL	Overlayer, Tandem catalyst	Cu, Fe, C, N	Sustainion XA-9	"Sustainion"	(AEM)	CO2	-3.38 V vs. ANODE	-1200 mA/cm2	64	T. Zhang et al., Highly selective and productive reduction of carbon dioxide to multicarbon products via in situ CO management using segmented tandem electrodes. Nature Catalysis 5, 202-211 (2022).
Fe-TMC shell around Cu2O NCs, on carbon paper	Core/shell	Cu, Fe	-	Nafion 117	(CEM)	CO2	-3.0 V vs. RHE	-500 mA/cm2	51	M. Ma et al., Metalloporphyrin Frameworks to Encapsulate Copper Oxides for Boosting Ethylene Production in Neutral Electrolyte. Advanced Functional Materials n/a, 2315667.
Fe TMC (porphyrin) coated on Cu-sputtered PTFE GDL	Overlayer	Cu, Fe	-	FAA-3-PK-130	(AEM)	CO2	?	?	41	F. Li et al., Cooperative CO2-to-ethanol conversion via enriched intermediates at molecule–metal catalyst interfaces. Nature Catalysis 3, 75-82 (2020).
Fe TMC (porphyrin) coated on Cu NCs, on glassy carbon	A-supports-B, Mixed-Phase/Janus	Cu, Fe	-	"Selemion"	(AEM)	CO2	-1.05 V vs. RHE	-4 mA/cm2	36	M. Wang et al., Tandem electrocatalytic CO2 reduction with Fe-porphyrins and Cu nanocubes enhances ethylene production. Chemical Science 13, 12673-12680 (2022).
Coral-like catalyst obtained via thermal and electrochemical treatment of Fe-based metalloporphyrin intermixed in Cu-based MOF, on carbon paper	Mixed-phase/Janus	Cu, Fe, C	Nafion	Nafion 115	(CEM)	CO2	-1.17 V vs. RHE	-38 mA/cm2	33	T. Yan, J.-H. Guo, Z.-Q. Liu, W.-Y. Sun, Metalloporphyrin Encapsulation for Enhanced Conversion of CO2 to C2H4. ACS Applied Materials & Interfaces 13, 25937-25945 (2021).
Cu NWs decorated with Fe-TMC, on GDL	Core/shell, A-supports-B	Cu, Fe	Nafion	?	(AEM)	CO2	-1.0 V vs. RHE	?	31	Y. Luo et al., Cobalt phthalocyanine promoted copper catalysts toward enhanced electro reduction of CO2 to C2: Synergistic catalysis or tandem catalysis? Journal of Energy Chemistry 92, 499-507 (2024).
Single atom Fe sites on a Cu-sputtered PTFE GDL	Single atom	Cu, Fe	-	?	(AEM)	CO2	?	-100 mA/cm2	31	S.-F. Hung et al., A metal-supported single-atom catalytic site enables carbon dioxide hydrogenation. Nature Communications 13, 819 (2022).
Fe-doped (1.3 at.%) self-supporting Cu2O NWs arrays on Cu mesh substrate	Mixed-phase/Janus, A-supports-B	Cu, Fe, O	-	Nafion 117	(CEM)	CO2	-1.1 V -iR vs. RHE	-25 mA/cm2	22	S. Min et al., Transition metal (Fe, Co, Ni)-doped cuprous oxide nanowire arrays as self-supporting catalysts for electrocatalytic CO2 reduction reaction to ethylene. Applied Surface Science 663, 160150 (2024).

Table S14. Au-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Au NP layer on top of Cu NP layer, on a GDL	Tandem catalyst	Cu, Au	Nafion	FAA-3-PK-75	(AEM)	CO2	-0.70 V -iR vs. RHE	-596 mA/cm2	56	X. She et al., Tandem Electrodes for Carbon Dioxide Reduction into C2+ Products at Simultaneously High Production Efficiency and Rate. Cell Reports Physical Science 1, 100051 (2020).
Cu shell grown on top of Au nanoribbons with 4H phase supported on carbon black, on carbon paper	Core/Shell	Cu, Au, C	Nafion	Nafion 117	(CEM)	CO2	-1.11 V -iR vs. RHE	-14 mA/cm2	45	Y. Chen et al., Ethylene Selectivity in Electrocatalytic CO2 Reduction on Cu Nanomaterials: A Crystal Phase-Dependent Study. Journal of the American Chemical Society 142, 12760-12766 (2020).
Au/Cu janus nanocrystals derived from penta-twinned Au nanobipyramids, on glassy carbon	Mixed-phase/Janus	Cu, Au	-	Nafion 117	(CEM)	CO2	-0.98 V -iR vs. RHE	-5 mA/cm2	42	H. Jia et al., Symmetry-Broken Au–Cu Heterostructures and their Tandem Catalysis Process in Electrochemical CO2 Reduction. Advanced Functional Materials 31, 2101255 (2021).
Au/Cu alloy hollow NWs (Cu:Au of 5:1) prepared via galvanic displacement, on GDL	Alloyed/Doped	Cu, Au	-	?	?	CO	-0.6 V vs. RHE	-67 mA/cm2	40	A. Guan et al., Steric effect induces CO electroreduction to CH4 on Cu–Au alloys. Journal of Materials Chemistry A 9, 21779-21784 (2021).
Au/Cu bimetallic {100}-facet rich penta-twinned nanorods (1 at. % Au, single atom sites), on carbon paper	Alloyed/Doped	Cu, Au	Nafion	"Selemion"	(AEM)	CO2	-0.62 V -iR vs. RHE	-200 mA/cm2	40	S. Jeong et al., Facet-Defined Dilute Metal Alloy Nanorods for Efficient Electroreduction of CO2 to n-Propanol. Journal of the American Chemical Society 146, 4508-4520 (2024).
Au NPs (0.7 at.%) supported on Cu NWs, on glassy carbon	A-supports-B	Cu, Au	Nafion	Nafion 117	(CEM)	CO2	-1.4 V vs. RHE	-25 mA/cm2	39	Z. Wei, S. Yue, S. Gao, M. Cao, R. Cao, Synergetic effects of gold-doped copper nanowires with low Au content for enhanced electrocatalytic CO2 reduction to multicarbon products. Nano Research 16, 7777-7783 (2023).
Au NPs supported on Cu2O NWs grown on Cu-sputtered, etched FTO substrate	A-supports-B	Cu, Au	-	Fumasep FKS-50	(AEM)	CO2	-1.05 V vs. RHE	-43 mA/cm2	39	J. Gao, D. Ren, X. Guo, S. M. Zakeeruddin, M. Grätzel, Sequential catalysis enables enhanced C–C coupling towards multi-carbon alkenes and alcohols in carbon dioxide reduction: a study on bifunctional Cu/Au electrocatalysts. Faraday Discussions 215, 282-296 (2019).
Air-annealed (400 °C/4h) Au/CuC2O4/C yielding nanoporous hollow Au/CuO–CuO tandem catalsyt, on carbon paper	Mixed-phase/Janus	Cu, Au, O	Nafion	"Fumasep"	(AEM)	CO2	-1.3 V vs. RHE	?	37	J.-H. Zhou et al., The site pair matching of a tandem Au/CuO–CuO nanocatalyst for promoting the selective electrolysis of CO2 to C2 products. RSC Advances 11, 38486-38494 (2021).
Air-annealed (400 °C/4h) Au/CuC2O4/C yielding nanoporous hollow Au/CuO–CuO tandem catalsyt, on carbon paper	Mixed-phase/Janus	Cu, Au, O	Nafion	"Fumasep"	(AEM)	CO	-1.3 V vs. RHE	?	37	J.-H. Zhou et al., The site pair matching of a tandem Au/CuO–CuO nanocatalyst for promoting the selective electrolysis of CO2 to C2 products. RSC Advances 11, 38486-38494 (2021).
Au/Cu janus-type NPs consisting of concave Au NCs linked with hollow quasi-spherical Cu particles (ca. 118 nm) (Au:Cu ratio of 1:24), on a GDL	Mixed-phase/Janus	Cu, Au	Nafion	-	(n/a)	CO2	-0.75 V -iR vs. RHE	-480 mA/cm2	36	Y. Zheng et al., Seeded Growth of Gold–Copper Janus Nanostructures as a Tandem Catalyst for Efficient Electroreduction of CO2 to C2+ Products. Small 18, 2201695 (2022).
Au/Cu bimetallic {100}-facet rich nanocubes (2 at. % Au, single atom sites), on carbon paper	Alloyed/Doped	Cu, Au	Nafion	"Selemion"	(AEM)	CO2	?	-150 mA/cm2	28	S. Jeong et al., Facet-Defined Dilute Metal Alloy Nanorods for Efficient Electroreduction of CO2 to n-Propanol. Journal of the American Chemical Society 146, 4508-4520 (2024).
Au NPs supported on Cu2O NCs, on carbon paper	A-supports-B	Cu, Au	Nafion	"Nafion"	(CEM)	CO2	-1.3 V vs. RHE	-6 mA/cm2	24	X. Cao et al., Enhanced Ethylene Formation from Carbon Dioxide Reduction through Sequential Catalysis on Au Decorated Cubic Cu2O Electrocatalyst. European Journal of Inorganic Chemistry 2021, 2353-2364 (2021).
Au NPs (8 nm) linked via bipyridine to Cu NWs (50 nm) supported on CNPs, on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Au, C	PVDF, NMP	Nafion 117	(CEM)	CO2	-1.5 V vs. RHE	?	23	J. Fu et al., Bipyridine-Assisted Assembly of Au Nanoparticles on Cu Nanowires To Enhance the Electrochemical Reduction of CO2. Angewandte Chemie International Edition 58, 14100-14103 (2019).
Galvanic displacement driven surface-Au doped Cu microcones on Cu foil	Core/shell	Cu, Au	-	Nafion 115	(CEM)	CO2	-1.1 V vs. RHE	-28 mA/cm2	21	S. Shen et al., AuCu Alloy Nanoparticle Embedded Cu Submicrocone Arrays for Selective Conversion of CO2 to Ethanol. Small 15, 1902229 (2019).

Hollow Cu NPs with Au NPs inside of them, on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Au	Nafion	Nafion 117	(CEM)	CO2	-1.05 V -iR vs. RHE	-28 mA/cm2	21	R. Zhang et al., Highly stability Cu+ species in hollow Cu2O nanoreactors by modulating cavity size for CO2 electroreduction to C2+ products. Chemical Engineering Journal 461, 142052 (2023).
Cu shell/Au core NPs (50 nm) with elemental gradient, on GDL	Core/shell (gradient)	Cu, Au	Nafion	Nafion 117	(CEM)	CO2	-0.4 V vs. RHE	-0.1 mA/cm2	20	J. Huang et al., Bimetallic Au-Cu gradient alloy for electrochemical CO2 reduction into C2H4 at low overpotential. Journal of Catalysis 415, 134-141 (2022).
Au NPs (10 nm) on top of electropolished monocrystalline Cu substrate, restructuring in-situ to form core/shell structures	Core/shell	Cu, Au	-	FAA-3-PK130	(AEM)	CO2	-1.03 V -iR vs. RHE	-10 mA/cm2	8	C. Zhu et al., Dynamic restructuring of epitaxial Au-Cu biphasic interface for tandem CO2-to-C2+ alcohol conversion. Chem 8, 3288-3301 (2022).

Table S15. Ag-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Ag foil coated with Cu NP Nafion ink		Cu, Ag	Nafion		(n/a)	CO2	-1.9 V vs. RHE	-21 mA/cm2	76	Akter, T., et al. (2022). "Tandem Electrocatalytic CO2 Reduction inside a Membrane with Enhanced Selectivity for Ethylene." The Journal of Physical Chemistry C 126(24): 10045-10052.
Prepared by electrodepositing Cu on Ag surfaces		Cu, Ag	Nafion		(n/a)	CO2	-1.9 V vs. RHE	-21 mA/cm2	76	Akter, T. and C. J. Barile (2023). "Membrane-controlled CO2 electrocatalysts with switchable C2 product selectivity and high faradaic efficiency for ethanol."
The Cu/Ag bimetallic catalysts are obtained using magnetron sputtering technology combined with a unique catalyst deposition process to ensure high Cu/Ag interface ratio.		Cu, Ag, Al	Nafion	Sustainion X37-50 Grade 60	(AEM)	CO2	-	-451 mA/cm2	69	Zhang, Y., et al. (2024). "Enhanced interfacial effect-induced asymmetric coupling boost electroreduction of CO2 to ethylene." Applied Catalysis B: Environment and Energy 344: 123666.
Sythesyzed nanocubes dopped with AgNO3	Cubes	Cu, Ag	Nafion	Nafion 115	(CEM)	CO2	-1.2 V vs. RHE	-27 mA/cm2	67	Dong, G., et al. (2023). "Synergetic enhancement of selectivity for electroreduction of CO2 to C2H4 by crystal facet engineering and tandem catalysis over silver-incorporated-cuprous oxides." Materials Reports: Energy 3(2): 100195.
Cu-nanowire from ACS Materials doped with aqueous AgNO3 solution.	Nanowire	Cu, Ag		Piperlon 40 µm		CO2	-3.2 V cell potential	-80 mA/cm2	60	Jiang, R., et al. (2023). "Copper-Nanowires Incorporated with Silver-Nanoparticles for Catalytic CO2 Reduction in Alkaline Zero Gap Electrolyzer." ACS Applied Energy Materials 6(20): 10475-10486.
Ag-doped Cu MOF (Cu:Ag of 10:1) NPs, on carbon paper	Mixed-phase/Janus	Cu, Ag, O	Nafion	?	(AEM)	CO2	-1.3 V vs. RHE	-220 mA/cm2	57	J. Feng et al., Restructuring multi-phase interfaces from Cu-based metal–organic frameworks for selective electroreduction of CO2 to C2H4. Chemical Science, (2024).
CuAg samples were electrodeposited by plating solution containing CuSO4 and Ag2SO4.	Nanowire	Cu, Ag		Fumatech		CO2	-0.68 V vs. RHE	-313 mA/cm2	55	Hoang, T. T. H., et al. (2018). "Nanoporous Copper–Silver Alloys by Additive-Controlled Electrodeposition for the Selective Electroreduction of CO2 to Ethylene and Ethanol." J Am Chem Soc 140(17): 5791-5797.
Catalyst layer was prepared by electroplating Ag then Cu + dropcasting fuctional group		Cu, Ag	Thiadiazole (N2SN)	Fumapem FAA-3-50	(AEM)	CO2	-4.55 Vvs. ANODE	-320 mA/cm2	55	Wu, H., et al. (2021). "Improved electrochemical conversion of CO2 to multicarbon products by using molecular doping." Nature Communications 12(1): 7210.
Synthesis of Ag NCs followed by addition of CuCl2		Cu, Ag	Nafion	Nafion 212	(CEM)	CO2	-1.2 V vs. RHE	-4 mA/cm2	54	Ma, Y., et al. (2022). "Confined Growth of Silver–Copper Janus Nanostructures with {100} Facets for Highly Selective Tandem Electrocatalytic Carbon Dioxide Reduction." Advanced Materials 34(19): 2110607.
Ag-doped (4.3 at. % vs. Cu) CuO nanospheres consisting of aggregated platelets, on carbon paper	Mixed-phase/Janus	Cu, Ag, O	Nafion	Nafion 115	(CEM)	CO2	-1.2 V vs. RHE	-25 mA/cm2	51	Z. Yang et al., Modulating surface microenvironment based on Ag-adorned CuO flower-liked nanospheres for strengthening C-C coupling during CO2RR. Surfaces and Interfaces 48, 104267 (2024).
Cu2O microcubes (1 µm) decorated with small Ag NPs (50 nm), prepared via galvanic displacement, mixed with carbon black, on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Ag, C	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-29 mA/cm2	51	X. Xu et al., Pd-Decorated Cu2O–Ag Catalyst Promoting CO2 Electroreduction to C2H4 by Optimizing CO Intermediate Adsorption and Hydrogenation. ACS Applied Materials & Interfaces 16, 16243-16252 (2024).
Synthesis of CuO NCs followed by addition of AgCl2		Cu, Ag	n.a.	?		CO2	-0.6 V vs. RHE	-150 mA/cm2	50	Liu, J., et al. (2022). "Dynamic determination of Cu+ roles for CO2 reduction on electrochemically stable Cu2O-based nanocubes." Journal of Materials Chemistry A 10(15): 8459-8465.
grown Cu needles with Ag NP		Cu, Ag	Nafion	Fumasep FAS-50	(AEM)	CO2	-0.93 V vs. RHE	-350 mA/cm2	50	Wei, C., et al. (2023). "Nanoscale Management of CO Transport in CO2 Electroreduction: Boosting Faradaic Efficiency to Multicarbon Products via Nanostructured Tandem Electrocatalysts." Advanced Functional Materials 33(28): 2214992.
CuO particles prepared by synthesis followed by AgNO3 doping		Cu, Ag, I	Nafion	Nafion 117	(CEM)	CO2	-1 V vs. RHE	-24 mA/cm2	49	Yang, R., et al. (2022). "In Situ Halogen-Ion Leaching Regulates Multiple Sites on Tandem Catalysts for Efficient CO2 Electroreduction to C2+ Products." Angewandte Chemie International Edition 61(21): e202116706.

Ag NP layer on top of Cu NP layer, on a GDL	Tandem catalyst	Cu, Ag	Nafion	FAA-3-PK-75	(AEM)	CO2	-0.75 V -iR vs. RHE	-490 mA/cm2	48	X. She et al., Tandem Electrodes for Carbon Dioxide Reduction into C2+ Products at Simultaneously High Production Efficiency and Rate. Cell Reports Physical Science 1, 100051 (2020).
	Foam	Cu, Ag	Nafion	Fumasep FAB-PK-130	(AEM)	CO2	-0.65 V vs. RHE	-708 mA/cm2	48	Du, C., et al. (2023). "Cascade electrocatalysis via AgCu single-atom alloy and Ag nanoparticles in CO2 electroreduction toward multicarbon products." Nature Communications 14(1): 6142.
Cu NP layer (0.4 mg/cm2) with Ag overlayer (only present near CO2 inlet, 5% of total area), on GDL	Overlayer, Tandem catalyst	Cu, Ag	Sustainion XA-9	"Sustainion"	(AEM)	CO2	-3.05 V vs. ANODE	-688 mA/cm2	46	T. Zhang et al., Highly selective and productive reduction of carbon dioxide to multicarbon products via in situ CO management using segmented tandem electrodes. Nature Catalysis 5, 202-211 (2022).
Cu NPs mixed with Ag NPs and PTFE, on GDL	Mixed-phase/Janus	Cu, Ag	Nafion	Selemion DSVN	(AEM)	CO2	-1.42 V -iR vs. RHE	-600 mA/cm2	45	M. Liu et al., Potential Alignment in Tandem Catalysts Enhances CO2-to-C2H4 Conversion Efficiencies. Journal of the American Chemical Society 146, 468-475 (2024).
		Cu, Au	Nafion	Nafion 117	(CEM)	CO2	-1.11 V vs. RHE	-100 mA/cm2	45	Chen, Y., et al. (2020). "Ethylene Selectivity in Electrocatalytic CO(2) Reduction on Cu Nanomaterials: A Crystal Phase-Dependent Study." J Am Chem Soc 142(29): 12760-12766.
Commercial Sigma-Aldrich Cu NP dispersed in methanol with Nafion deposited on GDL, immersed in aqueous AgNO3 solution for various times.		Cu, Ag	Nafion	Fumasep FAB-PK-130	(AEM)	CO	-0.56 V vs. RHE	?	44	Wang, X., et al. (2019). "Efficient upgrading of CO to C3 fuel using asymmetric C-C coupling active sites." Nature Communications 10(1): 5186.
sythesysed Ag NP dopped with copper		Cu, Ag, C	Nafion	Nafion 115	(CEM)	CO2	-1.6 V vs. RHE	-299 mA/cm2	44	Zhong, Y., et al. (2022). "Adjusting Local CO Confinement in Porous-Shell Ag@Cu Catalysts for Enhancing C–C Coupling toward CO2 Eletroreduction." Nano Letters 22(6): 2554-2560.
Co-plated Cu and Ag from a 1 mM 3,5-diamino-1,2,4-triazole containing plating bath, on a 10nm Cu-sputtered GDL	Alloyed/Doped	Cu, Ag	-	-	(n/a)	CO2	-0.8 V vs. RHE	-148 mA/cm2	43	X. Chen et al., Controlling Speciation during CO2 Reduction on Cu-Alloy Electrodes. ACS Catal 10, 672-682 (2020).
		Cu, Ag	Nafion	Not Found	(AEM)	CO2	-0.64 V vs. RHE	-400 mA/cm2	43	Zhang, J., et al. (2022). "Tandem effect of Ag@C@Cu catalysts enhances ethanol selectivity for electrochemical CO2 reduction in flow reactors." Cell Reports Physical Science 3(7): 100949.
The CuO supports were prepared by a precipitation method followed by Ag impregnation		Cu, Ag	Nafion 115	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-10 mA/cm2	42	Xue, L., et al. (2023). "Ultralow Ag-assisted carbon–carbon coupling mechanism on Cu-based catalysts for electrocatalytic CO2 reduction." Journal of Energy Chemistry 82: 414-422.
Sythesyzed nanocubes using AgNO3 during synthesis process	Cubes	CuO, Ag	Nafion	Selemion AMV, AGC Inc.		CO2	-0.95 V vs. RHE	-10 mA/cm2	42	Herzog, A., et al. (2021). "Operando Investigation of Ag-Decorated Cu2O Nanocube Catalysts with Enhanced CO2 Electroreduction toward Liquid Products." Angewandte Chemie International Edition 60(13): 7426-7435.
		Cu, Ag		non		CO2	-1.05 V vs. RHE	-36 mA/cm2	42	Gao, J., et al. (2019). "Selective C–C Coupling in Carbon Dioxide Electroreduction via Efficient Spillover of Intermediates As Supported by Operando Raman Spectroscopy." J Am Chem Soc 141(47): 18704-18714.
Commercial Sigma-Aldrich Cu NP dispersed in methanol with Nafion deposited on GDL, immersed in aqueous AgNO3 solution for various times.	Core shell	Cu, Ag	Nafion	Fumasep FAB-PK-130	(AEM)	CO2	-1.31 V vs. RHE	?	41	Wang, X., et al. (2019). "Efficient upgrading of CO to C3 fuel using asymmetric C-C coupling active sites." Nature Communications 10(1): 5186.
The AgCu alloy catalyst was obtained via electroreduction		Cu, Ag	Nafion	Nafion	(CEM)	CO2	-1.1 V vs. RHE	-6 mA/cm2	41	Wang, J., et al. (2019). "Silver/Copper Interface for Relay Electroreduction of Carbon Dioxide to Ethylene." ACS Applied Materials & Interfaces 11(3): 2763-2767.
Electroplated Cu np with Ag layer created by spincoated AgNO3 solution	Foam	Cu, Ag		Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-20 mA/cm2	41	Hou, L., et al. (2020). "Ag nanoparticle embedded Cu nanoporous hybrid arrays for the selective electrocatalytic reduction of CO2 towards ethylene." Inorganic Chemistry Frontiers 7(10): 2097-2106.
AgNO3 doping of CuO particles		Cu, Ag	Nafion	?		CO2	?	-1200 mA/cm2	40	Su, W., et al. (2021). "Highly dispersive trace silver decorated Cu/Cu2O composites boosting electrochemical CO2 reduction to ethanol." Journal of CO2 Utilization 52: 101698.

Ag/Cu catalysts were deposited by cosputtering with Cu and Ag targets		Cu, Ag	n.a.	Fumasep FAA-3-PK-130	(AEM)	CO_2	?	-200 mA/cm2	40	Li, Y. C., et al. (2019). "Binding Site Diversity Promotes CO2 Electroreduction to Ethanol." J Am Chem Soc 141(21): 8584-8591.
Synthesis of Cu_2O NCs and then $AgNO_3$ solution added	Cubes	Cu, Ag	Nafion	Fumasep FAB–PK–130	(AEM)	CO_2	-2.1 V vs. RHE	800 mA/cm2	39	Wang, P., et al. (2022). "Boosting electrocatalytic CO2–to–ethanol production via asymmetric C–C coupling." Nature Communications 13(1): 3754.
Consecutive galvanic replacement-prepared Ag-doped (4 wt%, XPS) CuOx NPs, on Cu-sputtered PTFE GDL	Alloyed/Doped	Cu, Ag	Nafion	"Sustainion"	(AEM)	CO	?	-600 mA/cm2	37	X. Wang et al., Efficient electrosynthesis of n-propanol from carbon monoxide using a Ag–Ru–Cu catalyst. Nature Energy 7, 170-176 (2022).
Ag–Cu NDs were synthesized using a seed-mediated method		Cu, Ag	Nafion	Selemion	(AEM)	CO_2	-1.1 V vs. RHE	-1 mA/cm2	37	Huang, J., et al. (2019). "Structural Sensitivities in Bimetallic Catalysts for Electrochemical CO2 Reduction Revealed by Ag–Cu Nanodimers." J Am Chem Soc 141(6): 2490-2499.
Ag dopped Cu/GDY		Cu, Ag, C	Nafion	Nafion N-115	(CEM)	CO_2	-1.8 V vs. RHE	-50 mA/cm2	36	Zhu, Q., et al. (2023). "Graphdiyne supported Ag–Cu tandem catalytic scheme for electrocatalytic reduction of CO2 to C2+ products." Nanoscale 15(5): 2106-2113.
	Core shell	Cu, Ag	Nafion	Nafion 115	(CEM)	CO_2	-1.1 V vs. RHE	-375 mA/cm2	36	Cai, Z., et al. (2023). "Hierarchical Ag-Cu interfaces promote C-C coupling in tandem CO2 electroreduction." Applied Catalysis B: Environmental 325: 122310.
The Cu-Ag bimetallic catalysts were synthesized by simultaneous galvanic replacement reactions		Cu, Ag, C	Nafion	Nafion 117	(CEM)	CO_2	-1.1 V vs. RHE	?	35	Li, M., et al. (2023). "Engineering Surface Oxophilicity of Copper for Electrochemical CO2 Reduction to Ethanol." Advanced Science 10(2): 2204579.
		Cu, Ag, C	Teflon	Nafion 117	(CEM)	CO	-2.3 V vs. SCE	-200 mA/cm2	34	Schwartz, M., et al. (1994). "Fischer-Tropsch Electrochemical CO2 Reduction to Fuels and Chemicals." Journal of The Electrochemical Society 141(11): 3119.
Synthesis of CuO NPs followed by addition of $AgOCOCF_3$ making core shell		Cu, Ag, C	Nafion	Fumatech PK-75	(AEM)	CO_2	-0.75 V vs. RHE	-110 mA/cm2	34	Kuhn, A. N., et al. (2021). "Engineering Silver-Enriched Copper Core-Shell Electrocatalysts to Enhance the Production of Ethylene and C2+ Chemicals from Carbon Dioxide at Low Cell Potentials." Advanced Functional Materials 31(26): 2101668.
		Cu, Ag	Nafion	?	(AEM)	CO_2	-1.2 V vs. RHE	-10 mA/cm2	34	Li, J., et al. (2021). "Copper sulfide as the cation exchange template for synthesis of bimetallic catalysts for CO2 electroreduction." RSC Advances 11(39): 23948-23959.
		Cu, Ag	n.a.	Fumasep FAB-PK-130	(AEM)	CO_2	-1.2 V vs. RHE	-102 mA/cm2	33	Yu, F., et al. (2023). "Multilayer-Cavity Tandem Catalyst for Profiling Sequentially Coupling of Intermediate CO in Electrocatalytic Reduction Reaction of CO2 to Multi-Carbon Products." Small 19(38): 2301558.
Deposited on carbon support		Cu, Ag	?	Nafion 117	(CEM)	CO_2	-1.23 V vs. RHE	-11 mA/cm2	33	Liu, H., et al. (2024). "High-performance carbon dioxide reduction to multi-carbon products on EDTA-modified Cu–Ag tandem catalyst." Journal of Catalysis 429: 115227.
Synthesized Ag nanowires were mixed with $Cu(OAc)_2$ generating Ag@CuOx-X	Nanowire	Cu, Ag	Nafion	Fumasep FAA-3-PK-130	(AEM)	CO_2	-1.05 V vs. RHE	-16 mA/cm2	32	Chang, C.-J., et al. (2019). "Quantitatively Unraveling the Redox Shuttle of Spontaneous Oxidation/Electroreduction of CuOx on Silver Nanowires Using in Situ X-ray Absorption Spectroscopy." ACS Central Science 5(12): 1998-2009.
Self prepared Cu np were doped with aqueous $AgNO_3$ solution creating Ag shell		Cu, Ag	Nafion	Nafion 115	(CEM)	CO_2	-1.1 V vs. RHE	-23 mA/cm2	32	Zhang, S., et al. (2021). "Electrochemical Reduction of CO2 Toward C2 Valuables on Cu@Ag Core-Shell Tandem Catalyst with Tunable Shell Thickness." Small 17(37): 2102293.
Cu-BTC doped with aqueous $AgNO_3$ solution		Cu, Ag	Nafion	Nafion 117	(CEM)	CO_2	-1.2 V vs. RHE	-6 mA/cm2	31	Zou, X., et al. (2023). "Nitrogen-doped carbon confined Cu-Ag bimetals for efficient electroreduction of CO2 to high-order products." Chemical Engineering Journal 468: 143606.
$Ag_2Cu_2O_3$ synthesised from $Cu(NO_3)_2$ and $AgNO_3$		Cu, Ag	Sustainion XA-9	Fumasep FAB–PK–130	(AEM)	CO	?	-200 mA/cm2	31	Martić, N., et al. (2020). "Ag2Cu2O3 – a catalyst template material for selective electroreduction of CO to C2+ products." Energy & Environmental Science 13(9): 2993-

										3006.
Cu/Ag alloy NPs synthesized by polyol method, dropped on glassy carbon. Tested in H-cell	Core shell	Cu, Ag	Nafion	Nafion 117	(CEM)	CO_2	-1.06 V vs. RHE	-2 mA/cm^2	30	Chang, Z., et al. (2017). "The Tunable and Highly Selective Reduction Products on Ag@Cu Bimetallic Catalysts Toward CO_2 Electrochemical Reduction Reaction." Journal of Physical Chemistry C 121(21): 11368-11379.
Prepared by high-energy ball milling CuO particles with Ag powders		Cu, Ag	Nafion	Selemion AMVAGC Inc.	(AEM)	CO	-0.57 V vs. RHE	-133 mA/cm^2	30	Li, J., et al. (2023). "Weak CO binding sites induced by Cu–Ag interfaces promote CO electroreduction to multi-carbon liquid products." Nature Communications 14(1): 698.
the alloy has been synthesized using controlled route of melting and cryogrinding		Cu, Ag, Au, Pt, Pd	Nafion	?		CO_2	-0.3 V vs. RHE	-13 mA/cm^2	30	Nellaiappan, S., et al. (2020). "High-Entropy Alloys as Catalysts for the CO_2 and CO Reduction Reactions: Experimental Realization." ACS Catalysis 10(6): 3658-3663.
Cu cubes were sythesised and then dopped with $AgNO_3$ solution	Cubes	Cu, Ag	Nafion		(AEM)	CO_2	-1.1 V vs. RHE	-233 mA/cm^2	30	Niu, D., et al. (2021). "Cu_2O-Ag Tandem Catalysts for Selective Electrochemical Reduction of CO_2 to C2 Products." Molecules 26(8): 2175.
Silicon wafers covered by Cu and Ag by reactive sputtering		Cu, Ag	?	Selemion AMV	(AEM)	CO_2	-1.0 V vs. RHE	-10 mA/cm^2	30	Lum, Y. and J. W. Ager (2018). "Sequential catalysis controls selectivity in electrochemical CO_2 reduction on Cu." Energy & Environmental Science 11(10): 2935-2944.
$AgNO_3$ doping of CuO NP		Cu, Ag	Nafion	Fumasep FAB–PK–130	(AEM)	CO_2	-0.99 V vs. RHE	-52 mA/cm^2	29	Kim, Y. E., et al. (2023). "Ag decorated-Cu_2O catalysts with enhanced selectivity for CO_2 electroreduction toward C2+ products." Journal of Environmental Chemical Engineering 11(5): 111028.
400 nm thick evaporated Cu/Ag alloy (95:5), on GDL	Alloyed/Doped	Cu, Ag	-	AF1-HNN8-50-X	(AEM)	CO_2	?	-100 mA/cm^2	28	S. E. Weitzner et al., Evaluating the stability and activity of dilute Cu-based alloys for electrochemical CO_2 reduction. The Journal of Chemical Physics 155, (2021).
Cu NCs with a non-equilibrium Cu/Ag alloy shell, on a GDL	Alloyed/Doped, core/shell	Cu, Ag	Nafion	"Nafion"	(CEM)	CO_2	-1.1 V -iR vs. RHE	?	28	C. D. Koolen et al., Low-temperature non-equilibrium synthesis of anisotropic multimetallic nanosurface alloys for electrochemical CO_2 reduction. Nature Synthesis 3, 47-57 (2024).
		Cu, Ag	Nafion	?		CO_2	-0.77 V vs. RHE	-6 mA/cm^2	27	Zha, J., et al. (2023). "Surface Site-Specific Replacement for Catalysis Selectivity Switching." ACS Applied Materials & Interfaces 15(3): 3985-3992.
Cu–Ag NCs were synthesized by galvanic exchange of Cu(0) with Ag-trifluoroacetate (Ag-TFA)		Cu, Ag, C	n.a.	Selemion DSVN	(AEM)	CO_2	-1.13 V vs. RHE	-288 mA/cm^2	26	Choukroun, D., et al. (2021). "Mapping Composition–Selectivity Relationships of Supported Sub-10 nm Cu–Ag Nanocrystals for High-Rate CO_2 Electroreduction." ACS Nano 15(9): 14858-14872.
Thermodynamically unstable Cu_9Ag_1 NPs prepared via thermal shock, on carbon nanotubes	Alloyed/Doped, A-supports-B	Cu, Ag	-	FAA-3	(AEM)	CO	-0.65 V -iR vs. RHE	-25 mA/cm^2	25	C. Yang et al., Overcoming immiscibility toward bimetallic catalyst library. Science Advances 6, eaaz6844 (2020).
Cu coated Ag core shell		Cu, Ag	PTFE powder	FAA-3-PK-75	(AEM)	CO_2	-0.8 V vs. RHE	-137 mA/cm^2	23	Junqueira, J. R. C., et al. (2021). "Combining Nanoconfinement in Ag Core/Porous Cu Shell Nanoparticles with Gas Diffusion Electrodes for Improved Electrocatalytic Carbon Dioxide Reduction." ChemElectroChem 8(24): 4848-4853.
galvanic replacement from Cu to Ag to achieve in situ formation of CuAg ensembles		Cu, Ag	Nafion	?	(CEM)	CO_2	-1.12 V vs. RHE	-2 mA/cm^2	22	Choi, C., et al. (2021). "Intimate atomic Cu-Ag interfaces for high CO2RR selectivity towards CH_4 at low over potential." Nano Research 14(10): 3497-3501.
Cu/Ag alloy NPs synthesized by polyol method, dropped on glassy carbon. Tested in H-cell		Cu, Ag	Nafion	Fumasep FAA-3-PK-130	(AEM)	CO_2	-1.1 V vs. RHE	-15 mA/cm^2	13	Wei, D., et al. (2023). "Decrypting the Controlled Product Selectivity over Ag–Cu Bimetallic Surface Alloys for Electrochemical CO_2 Reduction." Angewandte Chemie International Edition 62(19): e202217369.

Table S16. Zr-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
ZrO2 supported on Cu-Cu2O NPs prepared via co-precipitation, on carbon paper	Bi-phasic/Janus, A-supports-B	Cu, Zr, O	Nafion	Nafion 117	(CEM)	CO2	-0.70 V vs. RHE	-24 mA/cm2	63	P.-P. Guo et al., Electrocatalytic CO2 reduction to ethylene over ZrO2/Cu-Cu2O catalysts in aqueous electrolytes. Green Chemistry 24, 1527-1533 (2022).
Single atom Cu sites enclosed in a Zr-based MOF framework with rod-like morphology, on GDL	Single atom, Atomically mixed/Crystalline	Cu, Zr	Nafion	Nafion 212	(CEM)	CO2	?: -1.0 V vs. RHE	-125 mA/cm2	62	Q. Mo et al., Engineering Dual Sites into the Confined Nanospace of the Porphyrinic Metal–Organic Framework for Tandem Transformation of CO2 to Ethylene. ACS Sustainable Chemistry & Engineering, (2024).
NPs composed of a mix of ZrO2 and CuO, prepared via co-precipitation, on carbon paper	Bi-phasic/Janus	Cu, Zr, O	Nafion	Nafion 117	(CEM)	CO2	?	-250 mA/cm2	55	X. Li et al., Selective Electroreduction of CO2 and CO to C2H4 by Synergistically Tuning Nanocavities and the Surface Charge of Copper Oxide. ACS Sustainable Chemistry & Engineering 10, 6466-6475 (2022).
NPs composed of a mix of ZrO2 and CuO, prepared via co-precipitation, on carbon paper	Bi-phasic/Janus	Cu, Zr, O	Nafion	Nafion 117	(CEM)	CO2	-1.10 V vs. RHE	-11 mA/cm2	48	X. Li et al., Selective Electroreduction of CO2 and CO to C2H4 by Synergistically Tuning Nanocavities and the Surface Charge of Copper Oxide. ACS Sustainable Chemistry & Engineering 10, 6466-6475 (2022).
NPs composed of a mix of ZrO2 and CuO, prepared via co-precipitation, on carbon paper	Bi-phasic/Janus	Cu, Zr, O	Nafion	Nafion 117	(CEM)	CO	-0.6 V vs. RHE	?	44	X. Li et al., Selective Electroreduction of CO2 and CO to C2H4 by Synergistically Tuning Nanocavities and the Surface Charge of Copper Oxide. ACS Sustainable Chemistry & Engineering 10, 6466-6475 (2022).
Porous ZrO2 layer on top of Cu plate - dropcast with Nafion binder, dried on hotplate at 110 C in air	Cu with overlayer	Cu, Zr, O	Nafion	"Nafion"	(CEM)	CO2	-1.05 V - iR vs. RHE	-24 mA/cm2	44	X. Li et al., Enhanced electroreduction of CO2 to C2+ products on heterostructured Cu/oxide electrodes. Chem 8, 2148-2162 (2022).
Porous ZrO2 layer prepared via decomposition of UiO-66 (Zr-based MOF, 0.25 mg/cm2), on top of Cu plate - dropcast with Nafion binder, dried on hotplate at 110 C in air	Cu with overlayer	Cu, Zr, O	Nafion	"Nafion"	(CEM)	CO2	-1.05 V - iR vs. RHE	-26 mA/cm2	43	X. Li et al., Hetero-Interfaces on Cu Electrode for Enhanced Electrochemical Conversion of CO2 to Multi-Carbon Products. Nano-Micro Letters 14, 134 (2022).
Zr(OH)x overlayer on Cu-sputtered PTFE GDL	Overlayer, Mixed-phase/Janus	Cu, Zr, O	-	FAA-3-PK-130	(AEM)	CO2	?	?	17	M. Luo et al., Hydroxide promotes carbon dioxide electroreduction to ethanol on copper via tuning of adsorbed hydrogen. Nature Communications 10, 5814 (2019).
Alloy/mixed metal Zr/Cu (1:1 ratio) microparticles, on GDL - obtained via reduction of mixed nitrate salt with NaBH4 over 12h period	Alloyed/Doped	Cu, Zr	Nafion	NEOSEPTA, AHA	(AEM)	CO2	-0.6 V vs. RHE	-102 mA/cm2	15	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angewandte Chemie International Edition 61, e202213423 (2022).
Alloy/mixed metal Zr/Cu (1:1 ratio) microparticles, on GDL - obtained via reduction of mixed nitrate salt with NaBH4 over 12h period	Alloyed/Doped	Cu, Zr	Nafion	NEOSEPTA, AHA	(AEM)	CO2	-0.8 V vs. RHE	-170 mA/cm2	15	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angewandte Chemie International Edition 61, e202213423 (2022).

Table S17. Hf-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Co-precipitated HfOx and CuOx (2:3 ratio) mixed NPs, on carbon paper	Mixed-phase/Janus	Cu, Hf, O	Nafion	?	(AEM)	CO2	?	-300 mA/cm2	63	X. Li et al., Engineering the CuO–HfO2 interface toward enhanced CO2 electroreduction to C2H4. Chemical Communications 58, 7412-7415 (2022).
Co-precipitated HfOx and CuOx (2:3 ratio) mixed NPs, on glassy carbon (?)	Mixed-phase/Janus	Cu, Hf, O	Nafion	Nafion 117	(CEM)	CO2	-0.4 V vs. RHE	?	51	X. Li et al., Engineering the CuO–HfO2 interface toward enhanced CO2 electroreduction to C2H4. Chemical Communications 58, 7412-7415 (2022).
Co-precipitated HfOx and CuOx (2:3 ratio) mixed NPs, on glassy carbon (?)	Mixed-phase/Janus	Cu, Hf, O	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-1 mA/cm2	49	X. Li et al., Engineering the CuO–HfO2 interface toward enhanced CO2 electroreduction to C2H4. Chemical Communications 58, 7412-7415 (2022).
Alloy/mixed metal Hf/Cu (1:3 ratio) microparticles, on GDL - obtained via reduction of mixed nitrate salt with NaBH4 over 12h period	Alloyed/Doped	Cu, Hf	Nafion	NEOSEPTA, AHA	(AEM)	CO2	-0.8 V vs. RHE	-136 mA/cm2	13	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angewandte Chemie International Edition 61, e202213423 (2022).

Table S18. Ti-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Single atom Cu supported on ultrathin Ti3C2Tx nanosheets, on carbon paper	Single atom	Cu, C, Ti	Nafion	Nafion 117	(CEM)	CO	-0.70 V vs. RHE	-23 mA/cm2	71	H. Bao et al., Isolated copper single sites for high-performance electroreduction of carbon monoxide to multicarbon products. Nature Communications 12, 238 (2021).
Electroplated Cu on metallic Ti nanotube-functionalized Ti foil	A-supports-B	Cu, Ti	-	"Nafion"	(CEM)	CO2	-1.6 V vs. Ag/AgCl	-12 mA/cm2	55	A. Stalinraja et al., Electrochemical reduction of CO2 on Cu doped titanium nanotubes—An insight on ethylene selectivity. Electrochimica Acta 431, 141078 (2022).
TiO2/sustainion toplayer on a Cu-sputtered PTFE GDL	Overlayer, Mixed-phase/Janus	Cu, Ti, O	Sustainion	-	(n/a)	CO2	-3.00 V vs. ANODE	-261 mA/cm2	48	Y. Xu et al., Oxygen-tolerant electroproduction of C2 products from simulated flue gas. Energy & Environmental Science 13, 554-561 (2020).
TiO2 NP overlayer on top of Cu-sputtered PTFE GDL	Overlayer, Mixed-phase/Janus	Cu, Ti, O	Nafion	Nafion 117	(CEM)	CO2	-0.91 V -iR vs. RHE	?	46	Z. Wang et al., Localized Alkaline Environment via In Situ Electrostatic Confinement for Enhanced CO2-to-Ethylene Conversion in Neutral Medium. Journal of the American Chemical Society 145, 6339-6348 (2023).
TiO2 overlayer on Cu-sputtered PTFE GDL	Overlayer, Mixed-phase/Janus	Cu, Ti, O	-	FAA-3-PK-130	(AEM)	CO2	?	?	15	M. Luo et al., Hydroxide promotes carbon dioxide electroreduction to ethanol on copper via tuning of adsorbed hydrogen. Nature Communications 10, 5814 (2019).

Table S19. Si-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
CuSiO3 coated on ordered porous CuO prepared from mesoporous SiO2 molecular sieve starting material, supported on carbon, on "GDE"	Core/shell, atomically mixed/crystalline	Cu, Si, O, C	Nafion	FAA-PK-130	(AEM)	CO2	-1.18 V vs. RHE	-400 mA/cm2	82	Q. Li et al., Efficient CO2 Electroreduction to Multicarbon Products at CuSiO3/CuO Derived Interfaces in Ordered Pores. Advanced Materials n/a, 2305508.
Homogeneously dispersed Si(II)Ox clusters with Cu NPs, on Cu-sputtered PTFE GDL	Mixed-phase/Janus	Cu, Si, O	Aquivion	Sustainion X37-50 Grade RT	(AEM)	CO2	-4.1 V vs. ANODE	-331 mA/cm2	65	J. Li et al., Silica-copper catalyst interfaces enable carbon-carbon coupling towards ethylene electrosynthesis. Nature Communications 12, 2808 (2021).
Cu2O octahedral NPs (800 nm) with a mesoporous SiO2 shell (25 nm), on carbon paper	Core/shell	Cu, Si, O	Nafion	?	(AEM)	CO2	-1.5 V vs. RHE	-380 mA/cm2	56	W.-F. Xiong et al., Steering CO2 Electroreduction Selectivity U-Turn to Ethylene by Cu–Si Bonded Interface. Journal of the American Chemical Society 146, 289-297 (2024).
Cu NPs supported in/on fibrous SiO2 nanospheres (500 nm), on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Si, O	Nafion	-	(n/a)	CO2	-1.2 V vs. RHE	-19 mA/cm2	53	Z. Yang et al., High dispersion dendritic fibrous morphology nanospheres for electrochemical CO2 reduction to C2H4. Journal of Colloid and Interface Science 650, 1446-1456 (2023).
CuSiO3 coated on ordered porous CuO prepared from mesoporous SiO2 molecular sieve starting material, supported on carbon, on carbon paper	Core/shell, atomically mixed/crystalline	Cu, Si, O, C	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-40 mA/cm2	53	Q. Li et al., Efficient CO2 Electroreduction to Multicarbon Products at CuSiO3/CuO Derived Interfaces in Ordered Pores. Advanced Materials n/a, 2305508.
Small CuO NPs (<5 nm) dispersed on (amorphous) CuSiO3 lamella, mixed with Vulcan XC-72R, on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Si, C, O	Nafion	Nafion 115	(CEM)	CO2	-1.1 V vs. RHE	-20 mA/cm2	52	X. Yuan et al., Controllable Cu0-Cu+ sites for electrocatalytic reduction of carbon dioxide. Angewandte Chemie 133, 15472-15475 (2021).
SiO2 NPs supported on Cu2O NCs through physical mixing (10:2 mL basis), on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Si, O	Nafion	Nafion 117	(CEM)	CO2	-1.4 V - iR vs. RHE	-25 mA/cm2	47	T. Zhao et al., Tailoring the Catalytic Microenvironment of Cu2O with SiO2 to Enhance C2+ Product Selectivity in CO2 Electroreduction. ACS Catal 13, 4444-4453 (2023).
Branched/'spikey', amorphous sub-micron SiOx particles decorated with amorphous CuO NPs (18.52 wt%), on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Si, O	Nafion	Nafion 117	(CEM)	CO2	-1.4 V vs. RHE	-23 mA/cm2	46	R. Yang et al., Amorphous urchin-like copper@nanosilica hybrid for efficient CO2 electroreduction to C2+ products. Journal of Energy Chemistry 61, 290-296 (2021).
Commercial Cu NPs with a hydrophobic polymer coating consisting of 3-methacryloxypropyltrimethoxysilane (MAPTMS), 2,2,2-trifluoroethyl methacrylate (TFEMA) and 2,2-azobis (2-methylpropionitrile) (AIBN), on GDL	Core/shell	Cu, Si	Nafion, 3-methacryloxypropyltrimethoxysilane (MAPTMS), 2,2,2-trifluoroethyl methacrylate (TFEMA) and 2,2-azobis (2-methylpropionitrile) (AIBN)	X37-Grade 50 RT	(AEM)	CO2	-3.81 V vs. ANODE	-450 mA/cm2	42	T. Zhao et al., Functionalizing Cu nanoparticles with fluoric polymer to enhance C2+ product selectivity in membraned CO2 reduction. Applied Catalysis B: Environmental 340, 123281 (2024).
CuSiO3 nanotube-assembled hollow spheres, on carbon fiber paper	Mixed-phase/Janus	Cu, Si, O	Nafion	Nafion 117	(CEM)	CO2	-1.8 V vs. Ag/AgCl	?	41	Z. Xu et al., Confinement and interface engineering of CuSiO3 nanotubes for enhancing CO2 electroreduction to C2+ products. Electrochimica Acta 470, 143291 (2023).
Carbon/graphite toplayer on Cu2O dodecahedron NPs with a NH2-functionalized SiO2 shell supported on carbon midlayer, on Cu-sputtered PTFE GDL	Core/shell	Cu, Si, O, N, C	Nafion	Nafion 211	(CEM)	CO2	-1.7 V vs. RHE	-292 mA/cm2	40	Z.-Y. Zhang et al., SiO2 assisted Cu0–Cu+–NH2 composite interfaces for efficient CO2 electroreduction to C2+ products. Journal of Materials Chemistry A 12, 1218-1232 (2024).
SiO2 NPs with thin Cu/Si shell prepared via H2 atmosphere annealing of CuSiO3@SiO2, on Toray carbon paper	Core/shell	Cu, Si, O	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-13 mA/cm2	38	D. Wang et al., Boosting CO2 Electroreduction to Multicarbon Products via Tuning of the Copper Surface Charge. ACS Sustainable Chemistry & Engineering 10, 11451-11458 (2022).
Cu2O octahedral NPs (800 nm) with a mesoporous SiO2 shell (25 nm), on carbon paper	Core/shell	Cu, Si, O	Nafion	?	(AEM)	CO	-1.5 V vs. RHE	?	38	W.-F. Xiong et al., Steering CO2 Electroreduction Selectivity U-Turn to Ethylene by Cu–Si Bonded Interface. Journal of the American Chemical Society 146, 289-297 (2024).

H2-annealed Cu-doped SiOx NPs (thermal treatment results in Cu aggregation), on glassy carbon	Mixed-phase/Janus	Cu, Si, O	Nafion	Nafion 117	(CEM)	CO_2	-1.4 V vs. RHE	?	37	X. Tan et al., Stabilizing Copper by a Reconstruction-Resistant Atomic Cu–O–Si Interface for Electrochemical CO_2 Reduction. Journal of the American Chemical Society 145, 8656-8664 (2023).
SiO_2 NPs with thin Cu/Si shell prepared via H_2 atmosphere annealing of $CuSiO_3$@SiO_2, on Toray carbon paper	Core/shell	Cu, Si, O	Nafion	Nafion 117	(CEM)	CO	-0.6 V vs. RHE	?	35	D. Wang et al., Boosting CO_2 Electroreduction to Multicarbon Products via Tuning of the Copper Surface Charge. ACS Sustainable Chemistry & Engineering 10, 11451-11458 (2022).
Ultrathin hydrophobic SiO_2 shell (3.4 nm) around Cu NP core (<90 nm) (1% Si), on GDL	Core/Shell	Cu, Si	Nafion	"Nafion"	(CEM)	CO_2	-2.2 V vs. RHE	-900 mA/cm^2	35	M. Wang et al., Hydrophobic SiO_2 Armor: Stabilizing $Cu^{\delta+}$ to Enhance CO_2 Electroreduction toward C_{2+} Products in Strong Acidic Environments. ACS Nano, (2024).
$CuSiO_3$ long nanotubes, on carbon fiber paper	Mixed-phase/Janus	Cu, Si, O	Nafion	Nafion 117	(CEM)	CO_2	-1.8 V vs. Ag/AgCl	-19 mA/cm^2	30	Z. Xu et al., Confinement and interface engineering of $CuSiO_3$ nanotubes for enhancing CO_2 electroreduction to C_{2+} products. Electrochimica Acta 470, 143291 (2023).

Table S20. Ce-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Hollow Cu/CeO2 nanotubes composed of aggregated nanoparticles, on carbon paper - prepared by decorating electrospun polyacrylonitrile (PAN) fibres with metal and burning away the PAN	Mixed-phase/Janus	Cu, Ce, O	Nafion	FAA-3-PK-130	(AEM)	CO2	-0.7 V vs. RHE	-110 mA/cm2	78	D. Tan, B. Wulan, X. Cao, J. Zhang, Strong interactions of metal-support for efficient reduction of carbon dioxide into ethylene. Nano Energy 89, 106460 (2021).
Hollow Cu/CeO2 nanotubes composed of aggregated nanoparticles, on carbon paper - prepared by decorating electrospun polyacrylonitrile (PAN) fibres with metal and burning away the PAN	Mixed-phase/Janus	Cu, Ce, O	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-25 mA/cm2	70	D. Tan, B. Wulan, X. Cao, J. Zhang, Strong interactions of metal-support for efficient reduction of carbon dioxide into ethylene. Nano Energy 89, 106460 (2021).
CuO NPs supported on Cu-doped CeO2 NRs, on GDL	Alloyed/Doped, Mixed-phase/Janus, A-supports-B	Cu, Ce, O	Nafion	"Sustainion membrane"	(AEM)	CO2	-0.85 V -iR vs. RHE	-200 mA/cm2	55	S. Hong et al., Tuning the C1/C2 Selectivity of Electrochemical CO2 Reduction on Cu–CeO2 Nanorods by Oxidation State Control. Advanced Materials 35, 2208996 (2023).
Mixed-phase CuOx/CeO2 NPs, on carbon paper	Mixed-phase/Janus	Cu, Ce, O	Nafion	FAA-3-PK-130	(AEM)	CO2	-0.68 V vs. RHE	-150 mA/cm2	53	J. Shan et al., Effective CO2 electroreduction toward C2H4 boosted by Ce-doped Cu nanoparticles. Chemical Engineering Journal 433, 133769 (2022).
Cu NPs supported on CeO2 nanorods, on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Ce, O	-	Nafion 117	(CEM)	CO2	-1.6 V vs. RHE	-17 mA/cm2	52	Y. Zhang et al., Highly dispersed Cu nanoparticles on ceria for enhanced ethylene selectivity during electrochemical reduction of CO2. New Journal of Chemistry 46, 17244-17250 (2022).
CuOx overlayer on CeO2 nanorods, on carbon paper	Core/shell	Cu, Ce, O	Nafion	Nafion 117	(CEM)	CO2	-1.16 V vs. RHE	-18 mA/cm2	51	M. Chu et al., Enhanced CO2 electroreduction to ethylene via strong metal-support interaction. Green Energy & Environment 7, 792-798 (2022).
CuOx/CeOx mixed-phase supported on carbon black, on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Ce, O, C	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-8 mA/cm2	50	S. Chu et al., Stabilization of Cu+ by tuning a CuO–CeO2 interface for selective electrochemical CO2 reduction to ethylene. Green Chemistry 22, 6540-6546 (2020).
CeO2 quantum dots (3 nm) supported on irregularly shaped CuO NPs (200 nm), on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Ce, O	Nafion	-	(n/a)	CO2	?	-400 mA/cm2	50	S. Wang et al., Efficiently Electroreducing CO2 to Ethylene on Heterostructured CeO2/CuO. Industrial & Engineering Chemistry Research 61, 16445-16452 (2022).
Mixed CuO/CeO2 NPs, on glassy carbon	Mixed-phase/Janus	Cu, Ce, O	Nafion	Selemion AMV	(AEM)	CO2	-1.08 V -iR vs. RHE	-4 mA/cm2	50	C. W. Lee et al., Metal–Oxide Interfaces for Selective Electrochemical C–C Coupling Reactions. ACS Energy Letters 4, 2241-2248 (2019).
Cu-doped CeOx nanorods, on glassy carbon - prepared via deposition-precipitation method and subsequent annealing step	Alloyed/Doped	Ce, O, Cu	Nafion	Nafion 115	(CEM)	CO2	-1.1 V vs. RHE	-5 mA/cm2	48	D. Wu et al., Cuprous ions embedded in ceria lattice for selective and stable electrochemical reduction of carbon dioxide to ethylene. Journal of Materials Chemistry A 6, 9373-9377 (2018).
CeO2 NPs (5 nm) supported on CuO NPs, on PTFE GDL	Mixed-phase/Janus, A-supports-B	Cu, Ce, O	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.12 V -iR vs. RHE	-1214 mA/cm2	48	X. Yan et al., Efficient electroreduction of CO2 to C2+ products on CeO2 modified CuO. Chemical Science 12, 6638-6645 (2021).
Cu NSs supported on CeO2 nanorods, on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Ce, O	Nafion	Nafion 117	(CEM)	CO2	-1.27 V vs. RHE	-27 mA/cm2	45	H.-D. Cai et al., Tuning the Interactions in CuO Nanosheet-Decorated CeO2 Nanorods for Controlling the Electrochemical Reduction of CO2 to Methane or Ethylene. ACS Applied Nano Materials 5, 7259-7267 (2022).
Cu2O nanocubes with a tensile-strained CeO2/Cu shell, on GDL	Core/shell, mixed-phase/Janus	Cu, Ce, O	Nafion	?	(AEM)	CO2	-0.43 V -iR vs. RHE	?	45	H. Wang et al., Strain in Copper/Ceria Heterostructure Promotes Electrosynthesis of Multicarbon Products. ACS Nano 17, 346-354 (2023).
Mixed-phase CeO2/CuOx NPs, on carbon paper	Mixed-phase/Janus	Cu, Ce, O	Nafion	Nafion 117	(CEM)	CO2	-1.0 V vs. RHE	-17 mA/cm2	43	M. Fang et al., Boosting CO2 Electroreduction to Multi-carbon Products via Oxygen-rich Vacancies and Ce4+–O2−–Cu+ Structure in Cu/CeO2 for Stabilizing Cu+. ChemCatChem n/a, e202301266 (2023).

Ce(OH)x overlayer on Cu-sputtered PTFE GDL	Overlayer, Mixed-phase/Janus	Cu, Ce, O	-	FAA-3-PK-130	(AEM)	CO2	-0.64 V -iR vs. RHE	-200 mA/cm2	39	M. Luo et al., Hydroxide promotes carbon dioxide electroreduction to ethanol on copper via tuning of adsorbed hydrogen. Nature Communications 10, 5814 (2019).
Cu NPs (5 nm) supported on rod-shaped CeO2 particles, on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, Ce, O	Nafion	Nafion 117	(CEM)	CO2	-1.05 V vs. RHE	-7 mA/cm2	39	X. L. Senlin Chu, Alex W. Robertson, Zhenyu Sun, Electrocatalytic CO2 Reduction to Ethylene over CeO2-Supported Cu Nanoparticles: Effect of Exposed Facets of CeO2. Acta Phys. -Chim. Sin. 37, 2009023- (2021).
CeO2 NPs overlayer interfaced with CuOx layer, on Cu foil - prepared via drop-casting and drying at 110 C	Overlayer	Cu, Ce, O	Nafion	Nafion 117	(CEM)	CO2	-1.05 V vs. RHE	-14 mA/cm2	38	Z. Zhao, X. Li, J. Wang, X. Lv, H. B. Wu, CeO2-modified Cu electrode for efficient CO2 electroreduction to multi-carbon products. Journal of CO2 Utilization 54, 101741 (2021).
Cu NPs supported on CeO2 nanorods on glassy carbon - prepared via galvanic displacement of lithiated CeO2 rods	Mixed-phase/Janus, A-supports-B	Cu, Ce, O	Nafion	QAPPT	(AEM)	CO2	-1.3 V vs. RHE	-13 mA/cm2	38	J. Yin et al., Customizable CO2 Electroreduction to C1 or C2+ Products through Cuy/CeO2 Interface Engineering. ACS Catal 12, 1004-1011 (2022).
r-GO overlayer on top of CNP overlayer on top of ultrafine highly dispersed Cu2S-CeOx nanocomposites supported on reduced graphene oxide, on Cu-sputtered PTFE	Overlayer, Mixed-phase/Janus, A-supports-B	Cu, Ce, S, O, C	Nafion	FAA-3-PK-130	(AEM)	CO2	-0.9 V vs. RHE	-230[a] mA/cm2	32	Z. Zhang et al., Highly dispersed Cu-Cu2O-CeOx interfaces on reduced graphene oxide for CO2 electroreduction to C2+ products. Journal of Colloid and Interface Science 661, 966-976 (2024).
Cu/CeOx bi-phasic heterodimers (24 nm), on glassy carbon	Mixed-phase/Janus	Cu, Ce, O	-	Selemion AMV	(AEM)	CO2	-1.1 V vs. RHE	-1 mA/cm2	31	S. B. Varandili et al., Synthesis of Cu/CeO2-x Nanocrystalline Heterodimers with Interfacial Active Sites To Promote CO2 Electroreduction. ACS Catal 9, 5035-5046 (2019).
Few-atom thick Cu shell on CeO2 NRs, on GDL	Core/shell	Cu, Ce, O	?	?	(AEM)	CO	?	-100 mA/cm2	31	T. Yang et al., Interfacial Synergy between the Cu Atomic Layer and CeO2 Promotes CO Electrocoupling to Acetate. ACS Nano 17, 8521-8529 (2023).
r-GO overlayer on top of CNP overlayer on top of ultrafine highly dispersed Cu-CeOx nanocomposites supported on reduced graphene oxide, on Cu-sputtered PTFE	Overlayer, Mixed-phase/Janus, A-supports-B	Cu, Ce, O, C	Nafion	FAA-3-PK-130	(AEM)	CO2	-0.9 V vs. RHE	-161[a] mA/cm2	30	Z. Zhang et al., Highly dispersed Cu-Cu2O-CeOx interfaces on reduced graphene oxide for CO2 electroreduction to C2+ products. Journal of Colloid and Interface Science 661, 966-976 (2024).
Ce4+- (ion, not oxide) doped CuO NPs (100 nm), on carbon paper	Alloyed/Doped	Cu, Ce, O	Nafion	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-32 mA/cm2	25[※]	Y. Sun et al., Boosting CO2 Electroreduction to C2H4 via Unconventional Hybridization: High-Order Ce4+ 4f and O 2p Interaction in Ce-Cu2O for Stabilizing Cu+. ACS Nano 17, 13974-13984 (2023).
[※]Conflicting information (main text vs. figure) in document, report here number given in main text										
[a]Text and figure information does not match, report here the numbers provided in the text										

Table S21. Eu/Gd/La/Nd/Pr/Sm-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
La2CuO4 perovskite nanobamboo fibers with abundant grain boundaries, on glassy carbon	Atomically mixed	Cu, La, O	Nafion	Nafion 117	(CEM)	CO2	-1.0 V vs. Ag/AgCl	-3 mA/cm2	60	J. Wang et al., Grain-Boundary-Engineered La2CuO4 Perovskite Nanobamboos for Efficient CO2 Reduction Reaction. Nano Letters 21, 980-987 (2021).
Mixed-phase Cu2NdOx NPs , on carbon paper	Mixed-phase/Janus	Cu, Nd	Nafion	Nafion 115	(CEM)	CO2	-1.2 V vs. RHE	-28 mA/cm2	54	Z.-H. He et al., Electrocatalytic CO2 reduction to ethylene over CuOx boosting CO2 adsorption by lanthanide neodymium. Catalysis Science & Technology, (2023).
"Cu10La1" (wt%/at.% not reported) co-catalyst electroplated on carbon paper	Alloyed/Doped	Cu, La	-	Nafion 117	(CEM)	CO2	-1.4 V vs. RHE	-46 mA/cm2	51	S. Jia et al., Preparation of trimetallic electrocatalysts by one-step co-electrodeposition and efficient CO2 reduction to ethylene. Chemical Science 13, 7509-7515 (2022).
CuO/Sm2O3 mixed phase NPs (8.2:1 at. Ratio Cu:Sm), on GDL	Mixed-phase/Janus	Cu, Sm, O	Nafion	"ion exchange membrane"	?	CO2	-1.1 V - iR vs. RHE	-700 mA/cm2	48	J. Liu et al., Switching between C2+ Products and CH4 in CO2 Electrolysis by Tuning the Composition and Structure of Rare-Earth/Copper Catalysts. Journal of the American Chemical Society 145, 23037-23047 (2023).
CuO/Pr2O3 mixed phase NPs (ca. 9:1 at. Ratio Cu:Pr), on GDL	Mixed-phase/Janus	Cu, Pr, O	Nafion	"ion exchange membrane"	?	CO2	?	-700 mA/cm2	46	J. Liu et al., Switching between C2+ Products and CH4 in CO2 Electrolysis by Tuning the Composition and Structure of Rare-Earth/Copper Catalysts. Journal of the American Chemical Society 145, 23037-23047 (2023).
Gd-doped (6.5 %, ICP) CuO NCs (60 nm), on carbon paper	Alloyed/Doped, single atom	Cu, Gd, O	Nafion	FAA-3-PK-130	(AEM)	CO2	-0.8 V -iR vs. RHE	-546 mA/cm2	42	J. Feng et al., Improving CO2-to-C2+ Product Electroreduction Efficiency via Atomic Lanthanide Dopant-Induced Tensile-Strained CuOx Catalysts. Journal of the American Chemical Society 145, 9857-9866 (2023).
La(OH)3 nanosheets supported on CuO nanosheets mixed with Ketjen Black, on carbon paper	Mixed-phase/Janus, A-supports-B	Cu, La, C, O	Nafion	Sustainion X37-50RT	(AEM)	CO2	-1.25 V - iR vs. RHE	-1000 mA/cm2	41	S. Hu et al., Ampere-Level Current Density CO2 Reduction with High C2+ Selectivity on La(OH)3-Modified Cu Catalysts. Small n/a, 2308226.
La2CuO4 calcined at 1000 °C, on glassy carbon	Mixed-phase/Janus	Cu, La, O	Nafion	-	(n/a)	CO2	-1.0 V vs. Ag/AgCl	-1 mA/cm2	40	R. P. Singh et al., Electrochemical insights into layered La2CuO4 perovskite: Active ionic copper for selective CO2 electroreduction at low overpotential. Electrochimica Acta 326, 134952 (2019).
CuO/Eu2O3 mixed phase NPs (ca. 9:1 at. Ratio Cu:Eu), on GDL	Mixed-phase/Janus	Cu, Eu, O	Nafion	"ion exchange membrane"	?	CO2	?	-700 mA/cm2	38	J. Liu et al., Switching between C2+ Products and CH4 in CO2 Electrolysis by Tuning the Composition and Structure of Rare-Earth/Copper Catalysts. Journal of the American Chemical Society 145, 23037-23047 (2023).
Fragmented Cu NPs derived from CO2-induced electrochemically La-leached La2CuO4 NPs (La content ultra-low, near detection limit of equipment), on GDL	Alloyed/Doped, atomically mixed/crystalline	Cu, La, O	!!	!!		CO2	-2.41 V vs. NHE	-600 mA/cm2	36	Z.-Z. Niu et al., CO2-assisted formation of grain boundaries for efficient CO–CO coupling on a derived Cu catalyst. National Science Open 2, 20220044 (2023).
CuO/La2O3 mixed phase NPs (ca. 9:1 at. Ratio Cu:La), on GDL	Mixed-phase/Janus	Cu, La, O	Nafion	"ion exchange membrane"	?	CO2	?	-700 mA/cm2	33	J. Liu et al., Switching between C2+ Products and CH4 in CO2 Electrolysis by Tuning the Composition and Structure of Rare-Earth/Copper Catalysts. Journal of the American Chemical Society 145, 23037-23047 (2023).
La2-xCuO4-δ NPs with moderate oxygen vacancy content (x=0.01), on GDL	Atomically mixed	Cu, La, O	Nafion	"X37-50 anion"	(AEM)	CO2	-1.53 V vs. RHE	-160 mA/cm2	28	J. Zhu et al., Cation-Deficiency-Dependent CO2 Electroreduction over Copper-Based Ruddlesden–Popper Perovskite Oxides. Angewandte Chemie International Edition 61, e202111670 (2022).
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Table S22. C-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Cu NPs supported on Cu/SAC-graphitic carbon nitride (g-C3N4), on carbon paper	Supported, SAC	Cu, C	-	Fumasep FAA-3-PK-130	(AEM)	CO2	-1.28 V vs. RHE	-45↓ mA/cm2	81	H. Zhang et al., Insight into the island-sea effect of Cu−N−C for enhanced CO2 eletroreduction selectively towards C2H4. Applied Catalysis B: Environmental 343, 123566 (2024).
Thin quasi-graphitic carbon-shell functionalized, N-doped Cu NPs supported on carbon fibers, on GDL	Core/shell	Cu, C, N	Nafion, quasi-graphitic carbon shell	Sustanion X37-50	(AEM)	CO2	-0.69 V -iR vs. RHE	-400 mA/cm2	71	J.-Y. Kim et al., Quasi-graphitic carbon shell-induced Cu confinement promotes electrocatalytic CO2 reduction toward C2+ products. Nature Communications 12, 3765 (2021).
Cu3(2,3,6,7,10,11-hexaiminotriphenylene)2 MOF supported on Ketjen Black, on glassy carbon	MOF	Cu, O, C	Nafion	Nafion	(CEM)	CO2	-1.37 V - iR vs. RHE	-38 mA/cm2	70	H. Sun et al., Promoting ethylene production over a wide potential window on Cu crystallites induced and stabilized via current shock and charge delocalization. Nature Communications 12, 6823 (2021).
In-situ formed Cu2O ultra-small NPs derived from CO2RR/KCl electro-activated Cu(Pyrazole)2 MOF, on carbon paper	MOF	Cu, O, C, N	Nafion	Nafion	(CEM)	CO2	-1.03 V - iR vs. RHE	-18 mA/cm2	70	C. Liu et al., In Situ Reconstruction of Cu–N Coordinated MOFs to Generate Dispersive Cu/Cu2O Nanoclusters for Selective Electroreduction of CO2 to C2H4. ACS Catal 12, 15230-15240 (2022).
Cu NPs supported on XC-72R, on home-made GDL	Supported	Cu, C	-	-	(n/a)	CO2	-3 V vs. Ag/AgCl	-400 mA/cm2	69	R. L. Cook, R. C. MacDuff, A. F. Sammells, High rate gas phase CO2 reduction to ethylene and methane using gas diffusion electrodes. Journal of The Electrochemical Society 137, 607-608 (1990).
Solution-phase Cu phenanthroline complex with carbon paper cathode	TMC	Cu	-	"Hangzhou Huamo Technology Co., Ltd"	(AEM)	CO2	-1.3 V vs. RHE	-7 mA/cm2	69	J. Du, B. Cheng, L. Jiang, Z. Han, Copper phenanthroline for selective electrochemical CO2 reduction on carbon paper. Chemical Communications 59, 4778-4781 (2023).
Water-etched Cu MOF ([Cu2(benzene-1,3,5-tricarboxylic acid,)(OH)(H2O)]n·2nH2O), on glassy carbon	MOF	Cu	-	Nafion 117	(CEM)	CO2	-1.40 V vs. RHE	-23 mA/cm2	67	C. F. Wen et al., A copper coordination polymer precatalyst with asymmetric building units for selective CO2-to-C2H4 electrolysis. Journal of Materials Chemistry A 11, 12121-12129 (2023).
Water-etched Cu MOF ([Cu2(benzene-1,3,5-tricarboxylic acid,)(OH)(H2O)]n·2nH2O), on a GDL	MOF	Cu	-	FAB-PK-130	(AEM)	CO2	-0.73 V - iR vs. RHE	-350 mA/cm2	65	C. F. Wen et al., A copper coordination polymer precatalyst with asymmetric building units for selective CO2-to-C2H4 electrolysis. Journal of Materials Chemistry A 11, 12121-12129 (2023).
Impregnation-derived Cu NPs supported on N-functionalized carbon, on carbon paper (ill-defined carbon support derived from biological source)	Supported	Cu, C, N	Nafion	Nafion 115	(CEM)	CO2	-1.0 V vs. RHE	-50 mA/cm2	64	Y. Huo, X. Peng, X. Liu, H. Li, J. Luo, High Selectivity Toward C2H4 Production over Cu Particles Supported by Butterfly-Wing-Derived Carbon Frameworks. ACS Applied Materials & Interfaces 10, 12618-12625 (2018).
Pre-reduced CuOx NPs supported on sheet-like tannic acid substrate, on GDL	Supported	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-0.7 V - iR vs. RHE	-500 mA/cm2	64	S. Chen et al., Selective CO2 Reduction to Ethylene Mediated by Adaptive Small-molecule Engineering of Copper-based Electrocatalysts. Angewandte Chemie International Edition n/a, e202315621 (2023).
Cu-MOF calcination derived grainboundary-rich CuOx NPs supported on Ketjen Black, on glassy carbon	MOF	Cu, O, C	Nafion (top-coat)	Nafion 117	(CEM)	CO2	-1.01 V - iR vs. RHE	-11 mA/cm2	63	S. Kim, D. Shin, J. Park, J.-Y. Jung, H. Song, Grain Boundary-Rich Copper Nanocatalysts Generated from Metal-Organic Framework Nanoparticles for CO2-to-C2+ Electroconversion. Advanced Science 10, 2207187 (2023).
Cu NPs supported on N-doped CNTs, on GDL	Supported	Cu, C, N	Nafion	"Sustainion"	(AEM)	CO2	-0.57 V - iR vs. RHE	-500 mA/cm2	62	J.-C. Lee et al., Thermodynamically driven self-formation of copper-embedded nitrogen-doped carbon nanofiber catalysts for a cascade electroreduction of carbon dioxide to ethylene. Journal of Materials Chemistry A 8, 11632-11641 (2020).
Cu2O NPs electroplated on Cu-CuTCPP MOF nanosheets, on GDL	MOF	Cu, O	Nafion	Nafion 211	(CEM)	CO2	-1.3 V vs. RHE	-15 mA/cm2	62	M. Sun et al., Controllable preparation of Cu2O/Cu-CuTCPP MOF heterojunction for enhanced electrocatalytic CO2 reduction to C2H4. Applied Surface Science 659, 159937 (2024).
{100}-rich Cu NPs derived from reconstruction of Cu-tannic acid NSs, on GDL	TMC	Cu	Nafion	FAB-PK-130	(AEM)	CO2	-2.16 V vs. RHE	-700 mA/cm2	61	M. Wu et al., Sequential *CO management via controlling in situ reconstruction for efficient industrial-current-density CO2-to-C2+ electroreduction. Proceedings of the National Academy of Sciences 120, e2302851120 (2023).
Cu NPs supported on vacuum-calcined (1800 C) UD-90	Supported	Cu, C	Nafion	-	(n/a)	CO2	-1.8 V	-6	60	O. Baturina et al., Effect of nanostructured carbon support on copper electrocatalytic

nanodiamonds from NanoBlox,Inc., on glassy carbon							vs. RHE	mA/cm2		activity toward CO2 electroreduction to hydrocarbon fuels. Catal Today 288, 2-10 (2017).
Honeycomb-like CuO supported on amorphous carbon annealed at 600 °C, on carbon paper	Supported	Cu, O, C	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-18 mA/cm2	60	L. Zhang, X. Li, L. Chen, C. Zhai, H. Tao, Honeycomb-like CuO@C for electroreduction of carbon dioxide to ethylene. Journal of Colloid and Interface Science 640, 783-790 (2023).
Cu-SAC (<1 wt%) on hetero-atom (S) doped C3N4 lamellae, on carbon paper	SAC	Cu, C, N, S	Nafion	"ion exchange membrane"	?	CO2	-0.9 V vs. RHE	-20 mA/cm2	60	Y. Shen et al., Enhanced electrochemical CO2-to-ethylene conversion through second-shell coordination on a Cu single-atom catalyst. Journal of Materials Chemistry A 12, 9075-9087 (2024).
Sulfur-doped Cu-MOF Cu3(benzene-1,3,5-tricarboxylate)2·xH2O, on glassy carbon	MOF	Cu, O, S	Nafion	Nafion 117	(CEM)	CO2	-1.32 V - iR vs. RHE	-19 mA/cm2	60	C. F. Wen et al., Highly Ethylene-Selective Electrocatalytic CO2 Reduction Enabled by Isolated Cu−S Motifs in Metal–Organic Framework Based Precatalysts. Angewandte Chemie International Edition 61, e202111700 (2022).
CuO NPs supported on NH2 modified carbon dots, on glassy carbon (possibly carbon paper - unclear)	Supported	Cu, O, C, N	Nafion	Nafion 212	(CEM)	CO2	-1.4 V vs. RHE	-41 mA/cm2	57	Y. Zhou et al., Amino Modified Carbon Dots with Electron Sink Effect Increase Interface Charge Transfer Rate of Cu-Based Electrocatalyst to Enhance the CO2 Conversion Selectivity to C2H4. Advanced Functional Materials 32, 2113335 (2022).
Sulfur-doped Cu-MOF Cu3(benzene-1,3,5-tricarboxylate)2·xH2O, on Cu-sputtered PTFE GDL	MOF	Cu, O, S	Nafion	?	(AEM)	CO2	-1.09 V - iR vs. RHE	-400 mA/cm2	57	C. F. Wen et al., Highly Ethylene-Selective Electrocatalytic CO2 Reduction Enabled by Isolated Cu−S Motifs in Metal–Organic Framework Based Precatalysts. Angewandte Chemie International Edition 61, e202111700 (2022).
1D chains of Cu transition metal complex [Cu(4-"H-pyrazole")2]n·solvent, on carbon paper	TMC	Cu, O	Nafion	?	(AEM)	CO2	-1.0 V - iR vs. RHE	-346 mA/cm2	56†	R. Wang et al., Partial Coordination-Perturbed Bi-Copper Sites for Selective Electroreduction of CO2 to Hydrocarbons. Angewandte Chemie International Edition 60, 19829-19835 (2021).
Cu NPs supported on N-doped CNTs, on Cu-sputtered PTFE GDL	Supported	Cu, C, N	Nafion	"Sustainion"	(AEM)	CO2	-2.6 vs. Hg/HgO	-200 mA/cm2	56	J.-C. Lee et al., Thermodynamically driven self-formation of copper-embedded nitrogen-doped carbon nanofiber catalysts for a cascade electroreduction of carbon dioxide to ethylene. Journal of Materials Chemistry A 8, 11632-11641 (2020).
CuO NSs supported on Ketjen EC-300 J, on a GDL	Supported	Cu, O, C	-	FABPK-130	(AEM)	CO2	-0.87 V - iR vs. RHE	-304 mA/cm2	56	H. Xie et al., Achieving highly selective electrochemical CO2 reduction to C2H4 on Cu nanosheets. Journal of Energy Chemistry 79, 312-320 (2023).
Cu2O NPs supported on pyridinic-N-rich graphitic carbon nitride (C3N4), on carbon paper	Supported	Cu, O, C, N	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-23 mA/cm2	56	W. Xu et al., Facilitating electroreduction CO2-to-C2H4 over doped CuO nanospheres assisted by nitrogen species and oxygen vacancies. Fuel Processing Technology 250, 107890 (2023).
Copper-tetracyanoquinodimethane (TCNQ)-derived Cu NPs, on glassy carbon	TMC	Cu	Nafion	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-12 mA/cm2	56	X. Huang et al., Copper-tetracyanoquinodimethane-derived copper electrocatalysts for highly selective carbon dioxide reduction to ethylene. Nano Research 15, 7910-7916 (2022).
Cu transition metal complex with oxygen coordination center; ({Cu3(m3-OH)(mpz)3(Im)3}2+)2+ with Br- anion, on carbon paper	TMC	Cu, O, Br	Nafion	Fumasep, FAA-3-PK-130	(AEM)	CO2	-0.70 V - iR vs. RHE	-130 mA/cm2	55	Y.-F. Lu et al., Predesign of Catalytically Active Sites via Stable Coordination Cluster Model System for Electroreduction of CO2 to Ethylene. Angewandte Chemie International Edition 60, 26210-26217 (2021).
Conductive dinuclear Cu-based TMC ([Cu2(ophen)2] (Cuophen) with ophen = 1H-[1,10]phenanthrolin-2-one), on GDL	TMC	Cu	Nafion	?	(AEM)	CO2	-1.4 V vs. RHE	-52 mA/cm2	55	J.-M. Heng et al., A Conductive Dinuclear Cuprous Complex Mimicking the Active Edge Site of the Copper(100)/(111) Plane for Selective Electroreduction of CO2 to C2H4 at Industrial Current Density. Research 2022, 0008 (2022).
Cu layered double hydroxide (Cu5Al-CO3)-derived CuOx NPs supported on reduced graphene oxide, on carbon cloth (also referred to as "carbon paper" [sic] in text)[¶]	Supported	Cu, O, C	Nafion	-	(n/a)	CO2	-1.2 V vs. RHE	-12 mA/cm2	54[#]	N. Altaf et al., Cu-CuOx/rGO catalyst derived from hybrid LDH/GO with enhanced C2H4 selectivity by CO2 electrochemical reduction. Journal of CO2 Utilization 40, 101205 (2020).
Quasi-1D Cu MOF (Cu(OH)[1,2,3-benzotriazolate]) nanowires, on GDL	MOF	Cu	Nafion	Sustainion x37-50-grade-60	(AEM)	CO2	-3.8 V vs. ANODE	-240 mA/cm2	54	Y. Liang et al., Stabilizing copper sites in coordination polymers toward efficient electrochemical C-C coupling. Nature Communications 14, 474 (2023).
Reductively calcined (350 C) dopamine-derived N-functionalized carbon-shell functionalized Cu NPs, on glassy carbon	Core/shell	Cu, C, N	Nafion, carbon shell	Nafion	(CEM)	CO2	-1.4 V vs. RHE	-15 mA/cm2	54	Y. Cui et al., NxC-Induced Switching of Methane and Ethylene Products' Selectivity from CO2 Electroreduction over Cu Catalyst. ACS Catal 13, 11625-11633 (2023).

Cu2O-derived bimodal Cu catalyst supported on Ketjen black, on glassy carbon	Supported	Cu, O, C	Nafion	Nafion 117	(CEM)	CO2	-1.15 V - iR vs. RHE	-40 mA/cm2	53	Y. Jiang et al., Structural Reconstruction of Cu2O Superparticles toward Electrocatalytic CO2 Reduction with High C2+ Products Selectivity. Advanced Science 9, 2105292 (2022).
Cu3(2,3,6,7,10,11-hexaiminotriphenylene)2 MOF supported on Ketjen Black, on GDL	MOF	Cu, O, C	-	Fumasep FAB-PK-130	(AEM)	CO2	-0.82 V - iR vs. RHE	-500 mA/cm2	53	H. Sun et al., Promoting ethylene production over a wide potential window on Cu crystallites induced and stabilized via current shock and charge delocalization. Nature Communications 12, 6823 (2021).
Tetraminobenzo-quinone/Cu2+ based hydrogen-bonded network, on GDL (carbon paper modified with PTFE-coated carbon spheres)	COF	Cu	Nafion	Fumasep FAA-3-PK-130	(AEM)	CO2	-1.17 V - iR vs. RHE	-423 mA/cm2	53	F. Zhang et al., Tuning d-Band Structure of CuII in Coordinated Polymer via d–π Conjugation for Improving CO2 Electroreduction Selectivity toward C2 Products. ChemSusChem 15, e202201267 (2022).
High loading electrosprayed CuO particles on carbon paper/fibers (Toray, TGP-H-120)	Supported	Cu, O, C	-	Selemion AMV	(AEM)	CO2	-1.09 V - iR vs. RHE	-40 mA/cm2	52	S. Y. Lee et al., Controlling the C2+ product selectivity of electrochemical CO2 reduction on an electrosprayed Cu catalyst. Journal of Materials Chemistry A 8, 6210-6218 (2020).
CuOx NPs prepared through thermal reduction of Cu(acac)2-oleylamine complex, on GDL	TMC	Cu	Nafion	"Nafion"	(CEM)	CO2	-1.0 V - iR vs. RHE	-360 mA/cm2	52	X. Liu et al., Electrochemical CO2 reduction to C2+ products with Cu-oleylamine based nanoparticles synthesized by simple thermal treatment. Fuel 348, 128498 (2023).
Cu-MOF [azolate] / Cu(I) 3,5-dialkyl-1,2,4-triazolate, on glassy carbon	MOF	Cu, O	Nafion	Nafion	(CEM)	CO2	-1.3 V vs. RHE	-11 mA/cm2	52	L.-L. Zhuo et al., Flexible Cuprous Triazolate Frameworks as Highly Stable and Efficient Electrocatalysts for CO2 Reduction with Tunable C2H4/CH4 Selectivity. Angewandte Chemie International Edition 61, e202204967 (2022).
CuOx NPs with hydrophobic porous carbon shell, on Cu-sputtered PTFE GDL	Core/shell	Cu, C	Nafion	"Sustainion"	(AEM)	CO2	?	-300 mA/cm2	52	X. Y. Zhang et al., Selective methane electrosynthesis enabled by a hydrophobic carbon coated copper core–shell architecture. Energy & Environmental Science 15, 234-243 (2022).
Polystyrene template-assisted interconnected mesoporous Cu2O NPs supported on Vulcan XC-72, on glassy carbon	Supported	Cu, O, C	Nafion	Nafion 117	(CEM)	CO2	-1.4 V vs. RHE	-18 mA/cm2	51	L. Fan et al., Evoking C2+ production from electrochemical CO2 reduction by the steric confinement effect of ordered porous Cu2O. Chemical Science 14, 13851-13859 (2023).
Cu NPs encapsulated in cub mesoporous carbon (CMK-8), on GDL	Supported	Cu, C, N	-	"Fuel Cell Store"	(AEM)	CO2	-1.1 V -iR vs. RHE	-250 mA/cm2	51	B. Chen et al., Tandem Catalysis for Enhanced CO2 to Ethylene Conversion in Neutral Media. Advanced Functional Materials n/a, 2310029.
Calcined (265 C) Cu-MOF [HKUST-1] (C18H6Cu3O12, Cu3(benzene-1,3,5-tricarboxylate)2·xH2O)-derived CuOx/C, on glassy carbon (?)	MOF	Cu, O, C	-	Nafion 117	(CEM)	CO2	-1.57 V vs. RHE	?	51	K. Yao et al., Metal–organic framework derived copper catalysts for CO2 to ethylene conversion. Journal of Materials Chemistry A 8, 11117-11123 (2020).
Metallic Cu overlayer sputtered on commercial Cu NPs (25 nm, Sigma Aldrich) supported on Ketjen Black mixed with poly(methyl methacrylate) electrosprayed on a GDL	Supported	Cu	Poly(methyl methacrylate)	Fumasep FABPK-130	(AEM)	CO	-0.56 V - iR vs. RHE	-60 mA/cm2	50	Y. Yan et al., Interface regulation promoting carbon monoxide gas diffusion electrolysis towards C2+ products. Chemical Communications 58, 3645-3648 (2022).
Cu-based TMC (terephthalate), on glassy carbon (?)	TMC	Cu	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-12 mA/cm2	50	Y. Zhang, Y. Li, Q. Tan, S. Hong, Z. Sun, Facile synthesis of two-dimensional copper terephthalate for efficient electrocatalytic CO2 reduction to ethylene. Journal of Experimental Nanoscience 16, 246-254 (2021).
Calcined (265 C) Cu-MOF [HKUST-1] (C18H6Cu3O12, Cu3(benzene-1,3,5-tricarboxylate)2·xH2O)-derived CuOx/C, on GDL	MOF	Cu, O, C	Nafion	Fumasep FAA-3-PK-130	(AEM)	CO2	?	-320 mA/cm2	50	K. Yao et al., Metal–organic framework derived copper catalysts for CO2 to ethylene conversion. Journal of Materials Chemistry A 8, 11117-11123 (2020).
Exfoiliated 2D MOF obtained from combining copper(II) acetylacetonate with (2,3,9,10,16,17,23,24-octahydroxyphthalo-cyaninato)copper(II), on glassy carbon	MOF	Cu, O, C	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-7 mA/cm2	50	X.-F. Qiu, H.-L. Zhu, J.-R. Huang, P.-Q. Liao, X.-M. Chen, Highly Selective CO2 Electroreduction to C2H4 Using a Metal–Organic Framework with Dual Active Sites. Journal of the American Chemical Society 143, 7242-7246 (2021).
Cu MOF ([Cu3(μ3-OH)(μ3-trz)3(OH)2(H2O)4]·xH2O)-derived CuOx NPs, on GDL	MOF	Cu	Nafion	Nafion 117	(CEM)	CO2	-0.8 V vs. RHE	-250 mA/cm2	50	D.-S. Huang et al., A Stable and Low-Cost Metal-Azolate Framework with Cyclic Tricopper Active Sites for Highly Selective CO2 Electroreduction to C2+ Products. ACS Catal 12, 8444-8450 (2022).
Ultrafine CuO NPs supported on 2D copper	MOF	Cu	Nafion	Nafion 117	(CEM)	CO2	-1.1 V	-14	50	L. Wang et al., Integration of ultrafine CuO nanoparticles with two-dimensional MOFs for enhanced electrochemical CO2 reduction to ethylene. Chinese Journal of Catalysis 43,

1,4-dicarboxybenzene (1,4-BDC) MOF, on carbon paper							vs. RHE	mA/cm2		1049-1057 (2022).
Ultrafine Cu NPs on fibrous pyrenyl-graphdiyne, supported on Cu foil	Supported	Cu, C	-	Nafion 117	(CEM)	CO2	-1.5 V vs. RHE	-12 mA/cm2	49	Y.-B. Chang, C. Zhang, X.-L. Lu, W. Zhang, T.-B. Lu, Graphdiyene enables ultrafine Cu nanoparticles to selectively reduce CO2 to C2+ products. Nano Research 15, 195-201 (2022).
Cu NPs embedded in carbon matrix derived from pyrolysis of benzoxazine, mixed with PTFE (25 wt%), on GDL	Supported	Cu, C	-	FAB-PK-75	(AEM)	CO2	-0.58 V -iR vs. RHE	-200 mA/cm2	49	V. Chanda et al., A CuOx/Cu/C electrocatalyst-based gas diffusion electrode for the electroreduction of CO2 with high selectivity to C2H4. Electrochemical Science Advances 3, e2100200 (2023).
Cu MOF ([Cu2(L1)2(L2)(H2O)2]·SO4·2H2O)-functionalized Cu plate	MOF	Cu	-	Nafion 117	(CEM)	CO2	-1.11 V - iR vs. RHE	-17 mA/cm2	49	T. Yan, P. Wang, W.-Y. Sun, Single-Site Metal–Organic Framework and Copper Foil Tandem Catalyst for Highly Selective CO2 Electroreduction to C2H4. Small 19, 2206070 (2023).
Commercial Cu NPs (10-30 nm, Macklin) supported on Ketjen Black, on GDL	Supported	Cu, C	Nafion	Nafion	(CEM)	CO2	-1.56 V - iR vs. RHE	-60 mA/cm2	48	H. Sun et al., Promoting ethylene production over a wide potential window on Cu crystallites induced and stabilized via current shock and charge delocalization. Nature Communications 12, 6823 (2021).
CuO NSs supported on phenol formaldehyde resin carbon (PFRC), on GDL	Supported	Cu, C	Nafion	Nafion 117	(CEM)	CO2	-0.64 V vs. RHE	-1268 mA/cm2	47	H. Tang et al., Rationally designed hierarchical carbon supported CuO nano-sheets for highly efficient electroreduction of CO2 to multi-carbon products. Journal of CO2 Utilization 67, 102320 (2023).
Individual Cu NPs supported on/embedded in an amorphous CuOx phase obtained through tannic acid-assisted synthesis, on a GDL	Supported [on Cu]	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-0.9 V - iR vs. RHE	-400 mA/cm2	46	P.-P. Yang et al., Highly Enhanced Chloride Adsorption Mediates Efficient Neutral CO2 Electroreduction over a Dual-Phase Copper Catalyst. Journal of the American Chemical Society 145, 8714-8725 (2023).
CuOx NPs supported on Vulcan XC-72, on GDL	Supported	Cu, C	Nafion	FAB-PK-130	(AEM)	CO2	-1.65 V vs. RHE	-200 mA/cm2	46	V. S. R. K. Tandava, M. C. Spadaro, J. Arbiol, S. Murcia-López, J. R. Morante, Hydrothermal Fabrication of Carbon-Supported Oxide-Derived Copper Heterostructures: A Robust Catalyst System for Enhanced Electro-Reduction of CO2 to C2H4. ChemSusChem 16, e202300344 (2023).
Cu-MOF calcination derived grainboundary-rich CuOx NPs supported on Ketjen Black, on carbon paper	MOF	Cu, O, C	Nafion (top-coat)	Nafion 117	(CEM)	CO2	-0.56 V - iR vs. RHE	-200 mA/cm2	46	S. Kim, D. Shin, J. Park, J.-Y. Jung, H. Song, Grain Boundary-Rich Copper Nanocatalysts Generated from Metal-Organic Framework Nanoparticles for CO2-to-C2+ Electroconversion. Advanced Science 10, 2207187 (2023).
Self-assembling Cu-TMC (Bis(triphenylphosphine) Cu(I) nitrate) nanorods supported on XC-72R, on glassy carbon	TMC	Cu, C	Nafion	?	(n/a)	CO2	-0.96 V vs. RHE	-2 mA/cm2	45	P. Wang et al., Molecular Assembled Electrocatalyst for Highly Selective CO2 Fixation to C2+ Products. ACS Nano 16, 17021-17032 (2022).
Calcination-distorted Cu-MOF [HKUST-1] (C18H6Cu3O12, Cu3(benzene-1,3,5-tricarboxylate)2·xH2O), on GDL	MOF	Cu, O, C	Nafion	?	(AEM)	CO2	-1.07 V - iR vs. RHE	-262 mA/cm2	45	D.-H. Nam et al., Metal–Organic Frameworks Mediate Cu Coordination for Selective CO2 Electroreduction. Journal of the American Chemical Society 140, 11378-11386 (2018).
CuO nanosheets derived from calcining CuII/adeninato/carboxylato-MOFs, on glassy carbon	MOF	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-1.4 V vs. RHE	-9 mA/cm2	45	F. Yang et al., Highly efficient electroconversion of carbon dioxide into hydrocarbons by cathodized copper–organic frameworks. Chemical Science 10, 7975-7981 (2019).
In-situ reduced air-annealed commercial µm sized Cu particles supported on multi-walled carbon nanotubes, on GDL	Supported	Cu, O, C	Nafion	Fumatech FAA-3	(AEM)	CO	-0.72 V - iR vs. RHE	-1050 mA/cm2	44	M. Jouny, W. Luc, F. Jiao, High-rate electroreduction of carbon monoxide to multi-carbon products. Nature Catalysis 1, 748-755 (2018).
CuO NSs supported on VXC-72r, on GDL	Supported	Cu, C	Nafion	Nafion 117	(CEM)	CO2	-0.66 V vs. RHE	?	44	H. Tang et al., Rationally designed hierarchical carbon supported CuO nano-sheets for highly efficient electroreduction of CO2 to multi-carbon products. Journal of CO2 Utilization 67, 102320 (2023).
Cubic Cu2O microparticles (1 µm) supported on carbon black, on glassy carbon	Supported	Cu, C, O	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-18 mA/cm2	44	D. Xiao et al., Stabilizing Cu2O for enhancing selectivity of CO2 electroreduction to C2H4 with the modification of Pd nanoparticles. Chemical Engineering Journal 452, 139358 (2023).
[Cu3(HBtz = benzotriazole)3(Btz)Cl2] based, π-π stacking-driven network, on glassy carbon	COF	Cu	Nafion	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-8 mA/cm2	44	H.-L. Zhu et al., A Porous π–π Stacking Framework with Dicopper(I) Sites and Adjacent Proton Relays for Electroreduction of CO2 to C2+ Products. Journal of the American Chemical Society 144, 13319-13326 (2022).

Thermally decomposed Cu TMC (copper phthalocyanine) supported on Ketjen Black EC600 JD, on copper foil (unclear if it remains as a supported catalyst after final heat treatment)	TMC	Cu, C	Nafion	Nafion 115	(CEM)	80/20 CO2/O2	-0.4 V vs. RHE	-8 mA/cm2	43	M. Li et al., Heat-treated copper phthalocyanine on carbon toward electrochemical CO2 conversion into ethylene boosted by oxygen reduction. Chemical Communications 58, 12192-12195 (2022).
CuBaCO3 NPs supported on MWCNTs, on Cu-sputtered PTFE GDL	Supported	Cu, Ba, C	Nafion	?	(AEM)	CO2	-0.7 V vs. RHE	-500 mA/cm2	43	F.-Y. Wu et al., Copper–barium-decorated carbon-nanotube composite for electrocatalytic CO2 reduction to C2 products. Journal of Materials Chemistry A 11, 13217-13222 (2023).
Cu NPs with nitrogen-doped carbon shell prepared with a mass ratio of Cu to 7, 7, 8, 8-tetracyanoquinodimethane of 20:4 and calcined at 350 °C, on glassy carbon	Core/shell	Cu, C, N	Nafion	QAPPT	(AEM)	CO2	-1.1 V vs. RHE	-19 mA/cm2	43	Z. Li et al., Interface-Enhanced Catalytic Selectivity on the C2 Products of CO2 Electroreduction. ACS Catal 11, 2473-2482 (2021).
Dimeric Cu transition metal complex [Cu2(tris(2-benzimidazolylmethyl)amine)2Cl2]Cl2 immobilized on nafion-coated mesoporous carbon, on carbon paper	TMC	Cu, O	Nafion	Nafion 117	(CEM)	CO2	-1.28 V vs. RHE	-9 mA/cm2	42	M. Balamurugan et al., Electrocatalytic Reduction of CO2 to Ethylene by Molecular Cu-Complex Immobilized on Graphitized Mesoporous Carbon. Small 16, 2000955 (2020).
CuO nanoplates mixed with MWCNTs, on GDL	Supported	Cu, O, C	Nafion	Fumatech FAA	(AEM)	CO	-0.69 V -iR vs. RHE	-500 mA/cm2	42	R. Xia, J.-J. Lv, X. Ma, F. Jiao, Enhanced multi-carbon selectivity via CO electroreduction approach. Journal of Catalysis 398, 185-191 (2021).
Binuclear Cu phenanthroline TMC mixed with graphite powder, on carbon paper	TMC	Cu, C	Nafion	Glass frit	(DIAPH)	CO2	-1.25 V vs. RHE	-6 mA/cm2	42	N. Liu et al., Heterogenized Molecular Electrocatalyst Based on a Hydroxo-Bridged Binuclear Copper(II) Phenanthroline Compound for Selective Reduction of CO2 to Ethylene. Advanced Materials n/a, 2309526.
{111}-rich 6 nm Cu NPs supported on Cu-tetrahydroxy-1,4-quinone (THQ) MOF, on glassy carbon	MOF	Cu	Nafion	Nafion 117	(CEM)	CO2	-1.4 V vs. RHE	-14 mA/cm2	42	Z.-H. Zhao et al., A Cu(111)@metal–organic framework as a tandem catalyst for highly selective CO2 electroreduction to C2H4. Chemical Communications 57, 12764-12767 (2021).
CuOx NPs with carbon nitride shell, on carbon paper	Core/shell	Cu, O, C, N	C3N4	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-40 mA/cm2	42	W. Lin et al., A Cu2O-derived Polymeric Carbon Nitride Heterostructured Catalyst for the Electrochemical Reduction of Carbon Dioxide to Ethylene. ChemSusChem 14, 3190-3197 (2021).
Cu-TMC (Copper(II) meso -tetra(4-carboxyphenyl)porphine) NSs, on glassy carbon	TMC	Cu	Nafion	Nafion 211	(CEM)	CO2	-1.2 V vs. RHE	-8 mA/cm2	41	M. Sun, Z. Tao, X. Xu, S. Min, L. Kang, Effect of morphology and structure of CuTCPP nanomaterials on the electrocatalytic CO2 reduction to methane and ethylene. Applied Catalysis A: General 666, 119406 (2023).
Ultrafine Cu NPs supported on graphdiyne, on GDL	Supported	Cu, C	Nafion	Fumatech FAA–3	(AEM)	CO	-1.0 V vs. RHE	-24 mA/cm2	40	W. Rong et al., Size-Dependent Activity and Selectivity of Atomic-Level Copper Nanoclusters during CO/CO2 Electroreduction. Angewandte Chemie International Edition 60, 466-472 (2021).
Eleborate electrospun fiber-network, eventually yielding conductive CNT/PTFE fibers with half-exposed porous µm-sized CuO particles, on carbon paper	Supported	Cu, O, C	PTFE	Nafion 117	(CEM)	CO2	-1.4 V vs. RHE	-121 mA/cm2	40	Y. Li, Z. Pei, D. Luan, X. W. Lou, Superhydrophobic and Conductive Wire Membrane for Enhanced CO2 Electroreduction to Multicarbon Products. Angewandte Chemie International Edition 62, e202302128 (2023).
"Cu catalyst" supported on mixed carbon powder (Lonza KS-44) with a Cu/C ratio of 0.5, made into a GDE	Supported	Cu, C	Dibutyle phtalate	Nafion 417	(CEM)	CO2	-3.5 V vs. SCE	?	38	K.-R. Lee, J.-H. Lim, J.-K. Lee, H.-S. Chun, Reduction of carbon dioxide in 3-dimensional gas diffusion electrodes. Korean Journal of Chemical Engineering 16, 829-836 (1999).
CuO 'nanospindles' (resembles plates) supported on C60/fullerene, on GDL	Supported	Cu, O, C	-	Nafion 117	(CEM)	CO2	-1.8 V - iR vs. RHE	-563* mA/cm2	37	B. Zhao et al., C60-Stabilized Cu+ Sites Boost Electrocatalytic Reduction of CO2 to C2+ Products. Advanced Energy Materials 13, 2204346 (2023).
CuOX NPs supported on graphite phase carbon nitride (C3N4), on carbon paper	Supported	Cu, O, C, N	Nafion	Nafion 117	(CEM)	CO2	-1.0 V - iR vs. RHE	-14 mA/cm2	37	Z. Yan, T. Wu, Highly Selective Electrochemical CO2 Reduction to C2 Products on a g-C3N4-Supported Copper-Based Catalyst. International Journal of Molecular Sciences 23, 14381 (2022).
Air-calcined Cu NPs supported on N-doped carbon formed at 700 °C, on carbon paper	Supported	Cu, O, C, N	Nafion	Nafion 117	(CEM)	CO2	-1.25 V - iR vs. RHE	-11 mA/cm2	36	H.-J. Yang et al., Promoting Ethylene Selectivity from CO2 Electroreduction on CuO Supported onto CO2 Capture Materials. ChemSusChem 11, 881-887 (2018).
Crystalline copper(II) Phthalocyanine supported on Vulcan	Supported	Cu, C	Nafion	Nafion 424	(CEM)	CO2	-1.7 V	-35	35	S. Kusama, T. Saito, H. Hashiba, A. Sakai, S. Yotsuhashi, Crystalline Copper(II) Phthalocyanine Catalysts for Electrochemical Reduction of Carbon Dioxide in Aqueous

XC-72R, on glassy carbon							vs. RHE	mA/cm2		Media. ACS Catal 7, 8382-8385 (2017).
Pre-reduction of Cu TMC (cuprous 7,7,8,8-tetracyanoquinodimethane)-derived Cu NPs, on GDL	TMC	Cu	Nafion	"Membrane"	?	CO	-0.61 V - iR vs. RHE	-330 mA/cm2	35	H. Du et al., In situ formed N-containing copper nanoparticles: a high-performance catalyst toward carbon monoxide electroreduction to multicarbon products with high faradaic efficiency and current density. Nanoscale 14, 7262-7268 (2022).
Pre-reduced dual atom Cu SAC supported on N-doped carbon, on carbon paper	Supported, SAC	Cu, C, N	Nafion	Nafion 117	(CEM)	CO2	-1.23 V vs. RHE	-35 mA/cm2	35	G. Sun et al., Dual-atom Cu2/N-doped carbon catalyst for electroreduction of CO2 to C2H4. Applied Catalysis A: General 651, 119025 (2023).
CuO NPs supported on N-doped C, on GDL	Supported	Cu, C, N	Nafion	Sustainion X37 50	(AEM)	CO2	-0.72 V -iR vs. RHE	-400 mA/cm2	35	Y. Zhang et al., Multicarbons generation factory: CuO/Ni single atoms tandem catalyst for boosting the productivity of CO2 electrocatalysis. Science Bulletin 67, 1679-1687 (2022).
Imidazolium-functionalized cationic covalent triazine framework-stabilized Cu NPs supported on Ketjen Black, on glassy carbon	COF	Cu, C	Nafion, imidazolium-functionalized cationic covalent triazine framework	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-12 mA/cm2	35	M.-J. Mao et al., Imidazolium-Functionalized Cationic Covalent Triazine Frameworks Stabilized Copper Nanoparticles for Enhanced CO2 Electroreduction. ChemCatChem 12, 3530-3536 (2020).
Metallic 50 nm Cu NWs supported on Ketjen EC300J, on carbon paper	Supported	Cu, C	Polyvinylidene fluoride	Nafion 212	(CEM)	CO	-1.1 V vs. RHE	-84 mA/cm2	34	H. Zhang et al., Cu nanowire-catalyzed electrochemical reduction of CO or CO2. Nanoscale 11, 12075-12079 (2019).
"Activated" Cu NPs embedded in self-assembled coordination polyer ([Cu2(μ-Br)2(PPh3)2(μ-DPB)]n), on carbon paper (C2H4 activity increases with time)	TMC	Cu	[Cu2(μ-Br)2(PPh3)2(μ-DPB)]n	Astom Co. ASE	(AEM)	CO2	-1.34 V vs. RHE	-35 mA/cm2	34	N. Sakamoto et al., Self-assembled Cuprous Coordination Polymer as a Catalyst for CO2 Electrochemical Reduction into C2 Products. ACS Catal 10, 10412-10419 (2020).
Powdered electroplated (40 °C/14 V/60 min) CuOx particles supported on graphene oxide, pressure sprayed on carbon fiber paper	Supported	Cu, O, C	-	Nafion 117	(CEM)	CO2	-0.99 V - iR vs. RHE	-41 mA/cm2	34	N. Rashid, M. A. Bhat, U. K. Goutam, P. P. Ingole, Electrochemical reduction of CO2 to ethylene on Cu/CuxO-GO composites in aqueous solution. RSC Advances 10, 17572-17581 (2020).
Pre-reduced CuOx NPs supported on polymer-derived N-doped carbon fibers prepared via electrospinning and calcination (400 °C/Ar), on glassy carbon	Supported	Cu, O, C, N	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-12 mA/cm2	34$^{\Delta}$	J. Han et al., Insight into the effect of surface coverage of carbon support on selective CO2 electroreduction to C2H4 over copper-based catalyst. Applied Surface Science 609, 155394 (2023).
Cu2O NPs mixed with N-doped graphene (Figure S20), on a GDL	Supported	Cu, O, C, N	Nafion	-	(n/a)	CO2	-1.9 V vs. RHE	-200 mA/cm2	34	Y. Wang et al., Effect of Charge on Carbon Support on the Catalytic Activity of Cu2O toward CO2 Reduction to C2 Products. ACS Applied Materials & Interfaces 15, 23306-23315 (2023).
Cu NCs anchored/immobilized on N-doped graphene oxide, unknown substrate	Supported	Cu, C	-	?	(CEM)	CO2	-1.0 V vs. RHE	-11 mA/cm2	33	S. Kuang et al., Stable Surface-Anchored Cu Nanocubes for CO2 Electroreduction to Ethylene. ACS Applied Nano Materials 3, 8328-8334 (2020).
Cu2O NCs supported on graphitic carbon nitride (g-C3N4), on carbon paper	Supported	Cu, C, N	-	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-13 mA/cm2	32	J. Zhang et al., Unveiling the Synergistic Effect between Graphitic Carbon Nitride and Cu2O toward CO2 Electroreduction to C2H4. ChemSusChem 14, 929-937 (2021).
Cu-based TMC (Cu(N,N'-bis-(salicylidene)-o-phenylenediamine) supported on carbon black, on a GDL	TMC	Cu, C	Nafion	Fumasep FAA-130	(AEM)	CO2	-1.1 V vs. RHE	-303 mA/cm2	32	L.-J. Zhu et al., Copper–Supramolecular Pair Catalyst Promoting C2+ Product Formation in Electrochemical CO2 Reduction. ACS Catal 13, 5114-5121 (2023).
Cu2O NPs supported on a Cu MOF (CU-BDC / terephthalic acid), on carbon paper	MOF	Cu	Nafion	Nafion 117	(CEM)	CO2	-1.19 V vs. RHE	-7 mA/cm2	32	C. Liu et al., Highly Selective CO2 Electroreduction to C2+ Products over Cu2O-Decorated 2D Metal–Organic Frameworks with Rich Heterogeneous Interfaces. Nano Letters 23, 1474-1480 (2023).
Cu NPs (20 wt%) supported on thermally annealed (800 C) polypyrrole-derived N-functionalized porous carbon, on graphite	Supported	Cu, C, N	-	Nafion 212	(CEM)	CO2	-1.05 V - iR vs. RHE	-11 mA/cm2	31	H. Han et al., Selective electrochemical CO2 conversion to multicarbon alcohols on highly efficient N-doped porous carbon-supported Cu catalysts. Green Chemistry 22, 71-84 (2020).
4 nm Cu NPs supported on "moderate" density Cu-SAC/carbon, on GDL	Supported, SAC	Cu, C	Nafion D-521	FAA-3-PK-130	(AEM)	CO2	-0.6 V - iR vs. RHE	-383 mA/cm2	31	J. Feng et al., Modulating adsorbed hydrogen drives electrochemical CO2-to-C2 products. Nature Communications 14, 4615 (2023).

High loading 72 nm Cu2O NCs supported on ionic liquid-functionalized graphite sheets, on glassy carbon	Supported	Cu, O, C, N	Nafion	Nafion 117	(CEM)	CO2	-1.15 V vs. RHE	-8 mA/cm2	31	W. Wang et al., Interface-induced controllable synthesis of Cu2O nanocubes for electroreduction CO2 to C2H4. Electrochimica Acta 306, 360-365 (2019).
Cu NPs supported on a Cu MOF ([perylene tetracarboxylic di-(propyl imidazole)-Cu-Cl2(H2O)2]n), on a GDL	MOF	Cu	Nafion, perylene tetracarboxylic di-(propyl imidazole)	?	?	CO2	-1.9 V vs. RHE	-73 mA/cm2	31	Y. Zhang et al., A tandem effect of atomically isolated copper–nitrogen sites and copper clusters enhances CO2 electroreduction to ethylene. Nanoscale 15, 1092-1098 (2023).
Phosphate-buffered saline-treated CuO NPs-turned-nanoshees supported on Vulcan XC-72R, on carbon paper	Supported	Cu, O, C, P	Nafion	-	(n/a)	CO2	-1.4 V vs. RHE	-25 mA/cm2	30	T. Gao et al., Phosphate-Derived Copper-Based Catalysts for Efficient CO2 Reduction to Multicarbon Products. Energy & Fuels 37, 19053-19062 (2023).
Few (~4) atom Cu SACs prepared with a cyclohexene:Cu ratio of 60 supported on CNTs, on Toray carbon paper	Supported, SAC	Cu, C	Nafion	-	(n/a)	CO2	-1.4 V vs. RHE	-21 mA/cm2	29	A. Guan et al., Atomic-Level Copper Sites for Selective CO2 Electroreduction to Hydrocarbon. ACS Sustainable Chemistry & Engineering 9, 13536-13544 (2021).
Cu2O NCs supported on N-doped carbon "shells" (involving ZnO NP templating - may be a trace contaminant), on glassy carbon	Supported	Cu, O, C, N	Nafion	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-10 mA/cm2	25	H. Ning et al., Cubic Cu2O on nitrogen-doped carbon shells for electrocatalytic CO2 reduction to C2H4. Carbon 146, 218-223 (2019).
MOF-derived high loading Cu SAC supported on N-doped carbon nanosheet calcined at 800 °C, on carbon paper	Supported, MOF	Cu, C, N	Nafion	Nafion 117	(CEM)	CO2	-1.4 V vs. RHE	-28 mA/cm2	25	A. Guan et al., Boosting CO2 Electroreduction to CH4 via Tuning Neighboring Single-Copper Sites. ACS Energy Letters 5, 1044-1053 (2020).
Electroreduced Cu MOF (Cu3(1,3,5-benzenetricarboxylate)2)-derived CuOx NPs supported on N-doped graphene, on carbon paper (ambiguously reported)	Supported, MOF	Cu, O, C, N	Nafion	Nafion 117	(CEM)	CO2	-1.9 V vs. RHE	-15 mA/cm2	24	W.-Y. Zhi et al., Efficient electroreduction of CO2 to C2-C3 products on Cu/Cu2O@N-doped graphene. Journal of CO2 Utilization 50, 101594 (2021).
CuOx NCs supported (23 wt%) on Vulcan XC-27R, on glassy carbon	Supported	Cu, O, C	Nafion	Nafion 212	(CEM)	CO2	-0.97 V - iR vs. RHE	-14 mA/cm2	22	T. Möller et al., Electrocatalytic CO2 Reduction on CuOx Nanocubes: Tracking the Evolution of Chemical State, Geometric Structure, and Catalytic Selectivity using Operando Spectroscopy. Angewandte Chemie International Edition 59, 17974-17983 (2020).
Cu NPs supported on N-doped (0.17 at.%) carbon, on GDL	Supported	Cu, C, N	Nafion	FAB-PK-130	(CEM)	CO	-0.91 V -iR vs. RHE	-580 mA/cm2	22	Z. Liu et al., Surface Energy Tuning on Cu/NC Catalysts for CO Electroreduction. ACS Catal 12, 12555-12562 (2022).
Cu2O NCs supported on N-doped reduced graphene oxide, on glassy carbon	Supported	Cu, O, C, N	Nafion	Nafion 117	(CEM)	CO2	-1.4 V vs. RHE	-12 mA/cm2	20	H. Ning et al., N-doped reduced graphene oxide supported Cu2O nanocubes as high active catalyst for CO2 electroreduction to C2H4. Journal of Alloys and Compounds 785, 7-12 (2019).
7nm Cu NPs supported on pyridinic-N rich graphene, on carbon paper	Supported	Cu, C, N	Polyvinylidene fluoride	Nafion 212	(CEM)	CO2	-0.9 V vs. RHE	-311[‖] mA/cm2	19	Q. Li et al., Controlled assembly of Cu nanoparticles on pyridinic-N rich graphene for electrochemical reduction of CO2 to ethylene. Nano Energy 24, 1-9 (2016).
Oleylamine-stabilized Cu-NWs supported on CNPs, on glassy carbon, cleaned (ligand removal) via photonic curing method	Supported	Cu, C	Nafion	Nafion 117	(CEM)	CO2	-1.2 V - iR vs. RHE	?	19	Y. Hou et al., Photonic Curing: Activation and Stabilization of Metal Membrane Catalysts (MMCs) for the Electrochemical Reduction of CO2. ACS Catal 9, 9518-9529 (2019).
CuOx NCs supported on Vulcan XC-27R, on GDL	Supported	Cu, O, C	Nafion	Selemion AMV	(AEM)	CO2	-1.38 V - iR vs. RHE	-600 mA/cm2	15	T. Möller et al., Electrocatalytic CO2 Reduction on CuOx Nanocubes: Tracking the Evolution of Chemical State, Geometric Structure, and Catalytic Selectivity using Operando Spectroscopy. Angewandte Chemie International Edition 59, 17974-17983 (2020).
Cu NPs supported on ENSACO-350 G, on glassy carbon	Supported	Cu, C	Nafion	Nafion 117	(CEM)	CO2	-1.08 V -iR vs. RHE	-4 mA/cm2	15	D. Choukroun et al., Bifunctional Nickel–Nitrogen-Doped-Carbon-Supported Copper Electrocatalyst for CO2 Reduction. The Journal of Physical Chemistry C 124, 1369-1381 (2020).
Cu NPs supported on Vulcan XC72, on glassy carbon	Supported	Cu, C	Nafion	Nafion 117	(CEM)	CO2	-1.1 V -iR vs. RHE	-4 mA/cm2	12	D. Choukroun et al., Bifunctional Nickel–Nitrogen-Doped-Carbon-Supported Copper Electrocatalyst for CO2 Reduction. The Journal of Physical Chemistry C 124, 1369-1381 (2020).
†value given in main text and in tabular form in SI is different - took tabular value										

[§]not a typo, indeed 2 °C										
[#]Main text and SI give different numbers, we report the number in the main text										
[Δ]Total FE only computes to ca. 59 % - furthermore, SI states 34 % (reported herein) whilst text states 37 % FE C2H4										
[↓]SI erroneously reports partial jC2H4@80.73 % C2H4 as 60.15, report here image-extracted jtotal										

Table 23. W/Sr/Se/Sc/Sb/Ru/Rh/Pt/Mo/Mn/In/Ge/Bi-based Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Selenized Cu NWs (Cu/Se ratio of 1.8:1) supported on Cu foam	Atomically mixed/Crystalline	Cu, Se	-	Nafion 115	(CEM)	CO2	-1.1 V vs. RHE	-15 mA/cm2	55	Y. Mi, X. Peng, X. Liu, J. Luo, Selective Formation of C2 Products from Electrochemical CO2 Reduction over Cu1.8Se Nanowires. ACS Applied Energy Materials 1, 5119-5123 (2018).
Cu10Sb1 NPs, on carbon paper - prepared via co-precipitation	Alloyed/Doped	Cu, Sb	Nafion	Nafion 117	(CEM)	CO2	-1.19 V vs. RHE	-29 mA/cm2	50	S. Jia et al., Efficient electrocatalytic reduction of carbon dioxide to ethylene on copper–antimony bimetallic alloy catalyst. Chinese Journal of Catalysis 41, 1091-1098 (2020).
Cu/In alloy prepared via co-electrodeposition with single-atom In sites, on carbon fiber	Alloyed/Doped	Cu, In	-	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-53 mA/cm2	49	T. Yao et al., Atomic Indium-Doped Copper-Based Catalysts for Electrochemical CO2 Reduction to C2+ Products. ChemCatChem n/a, e202400137.
Bi-doped oxygen vacancy-rich CuO nanoribbons, on carbon paper	Alloyed/Doped	Cu, Bi, O	Nafion	Nafion 117	(CEM)	CO2	-1.05 V -iR vs. RHE	-9 mA/cm2	48	W. Li et al., Lowering C−C coupling barriers for efficient electrochemical CO2 reduction to C2H4 by jointly engineering single Bi atoms and oxygen vacancies on CuO. Applied Catalysis B: Environmental 318, 121823 (2022).
Bi-doped Cu (3.7 wt% > 1.15 at. % Bi) derived from Bi-CuS precursor, on GDL	Alloyed/Doped	Cu, Bi	-	FAA-3-PK-130	(AEM)	CO2	-0.75 V -iR vs. RHE	-450 mA/cm2	48	Y. Cao et al., Single Atom Bi Decorated Copper Alloy Enables C−C Coupling for Electrocatalytic Reduction of CO2 into C2+ Products**. Angewandte Chemie International Edition n/a, e202303048.
Al-doped CuOx NCs ("CuGe-II"), on Toray GDL	Alloyed/Doped	Cu, Ge, O	Nafion	FAA-3-PK-130	(AEM)	CO2	?	-900 mA/cm2	47	P. Li et al., p–d Orbital Hybridization Induced by p-Block Metal-Doped Cu Promotes the Formation of C2+ Products in Ampere-Level CO2 Electroreduction. Journal of the American Chemical Society 145, 4675-4682 (2023).
Oxygen vacancy-rich CuOx NPs with atomically dispersed Sb atoms, on glassy carbon	Single atom	Cu, Sb, O	Nafion	Nafion 117	(CEM)	CO2	-1.1 V vs. RHE	-8 mA/cm2	46	S. Chu et al., Single atom and defect engineering of CuO for efficient electrochemical reduction of CO2 to C2H4. SmartMat 3, 194-205 (2022).
Bi-doped Cu (3.7 wt% > 1.15 at. % Bi) derived from Bi-CuS precursor, on glassy carbon	Alloyed/Doped	Cu, Bi	-	Nafion 117	(CEM)	CO2	-1.15 V -iR vs. RHE	-25 mA/cm2	43	Y. Cao et al., Single Atom Bi Decorated Copper Alloy Enables C−C Coupling for Electrocatalytic Reduction of CO2 into C2+ Products**. Angewandte Chemie International Edition n/a, e202303048.
Core/shell NPs with Cu shell and Cu4W10 core, supported on carbon black, on GDL	Core/shell, A-supports-B	Cu, W, C	Nafion	?	(AEM)	CO2	-1.0 V vs. RHE	-200 mA/cm2	42	D. Xiang et al., Theory-guided synthesis of heterostructured Cu@Cu0.4W0.6 catalyst towards superior electrochemical reduction of CO2 to C2 products. Materials Today Physics 33, 101045 (2023).
Selenized Cu NWs (Cu/Se ratio of 1.8:1) supported on Cu foam	Atomically mixed/Crystalline	Cu, Se	-	Nafion 115	(CEM)	CO2	-1.1 V vs. RHE	-13 mA/cm2	41	Y. Mi, X. Peng, X. Liu, J. Luo, Selective Formation of C2 Products from Electrochemical CO2 Reduction over Cu1.8Se Nanowires. ACS Applied Energy Materials 1, 5119-5123 (2018).
Sb-doped oxygen vacancy-rich CuO nanoribbons, on carbon paper	Alloyed/Doped	Cu, Sb, O	Nafion	Nafion 117	(CEM)	CO2	?	-5 mA/cm2	40	W. Li et al., Lowering C−C coupling barriers for efficient electrochemical CO2 reduction to C2H4 by jointly engineering single Bi atoms and oxygen vacancies on CuO. Applied Catalysis B: Environmental 318, 121823 (2022).
CuPtx NPs prepared via ultrasonic-assisted galvanic replacement (atomic ratio not reported, likely Cu1Pt0.008) of commercial Cu NPs (100 nm), on GDL	Core/shell	Cu, Pt	Nafion	FAA-PK-130	(AEM)	CO	-0.63 V - iR vs. RHE	-709 mA/cm2	39	J. Li et al., Enhanced multi-carbon alcohol electroproduction from CO via modulated hydrogen adsorption. Nature Communications 11, 3685 (2020).
SrCuO2 pre-catalyst supported on vulcan, on GDL	Atomically mixed/Crystalline	Cu, Sr, O	Nafion	FAA_3-PK-130	(AEM)	CO2	-0.83 V -iR vs. RHE	-200 mA/cm2	37	X. K. Lu, B. Lu, H. Li, K. Lim, L. C. Seitz, Stabilization of Undercoordinated Cu Sites in Strontium Copper Oxides for Enhanced Formation of C2+ Products in Electrochemical CO2 Reduction. ACS Catal 12, 6663-6671 (2022).
Se/Cu NPs (54 nm) distributed on porous carbon, derived from calcination (450 °C) of Se-doped Cu MOF	Alloyed/Doped	Cu, Se	Nafion	FAB–PK–130	(AEM)	CO2	-0.83 V - iR vs. RHE	-239 mA/cm2	35	S. Li et al., Operando Reconstruction of Porous Carbon Supported Copper Selenide Promotes the C2 Production from CO2RR. Advanced Functional Materials 34, 2311989 (2024).
Atomically dispersed Rh-doped Cu2O (Rh:Cu = 0.004) MPs (ca. 1 µm) with rhombic dodecahedral shape , on carbon	Alloyed/Doped	Cu, Rh	Nafion	Nafion 117	(CEM)	CO2	-1.0 V	-12	27	C. Feng et al., Promoting C–C coupling for CO2 reduction on Cu2O electrocatalysts with

paper							vs. RHE	mA/cm2		atomically dispersed Rh atoms. Chemical Communications 60, 5550-5553 (2024).
Atomically dispersed Rh-doped Cu2O (Rh:Cu = 0.004) MPs (ca. 1 µm) with rhombic dodecahedral shape , on GDL	Alloyed/Doped	Cu, Rh	Nafion	FAA-3-PK-130	(AEM)	CO2	-0.65 V - iR vs. RHE	-178 mA/cm2	26	C. Feng et al., Promoting C–C coupling for CO2 reduction on Cu2O electrocatalysts with atomically dispersed Rh atoms. Chemical Communications 60, 5550-5553 (2024).
Thermodynamically unstable Cu9In1 NPs prepared via thermal shock, on carbon nanotubes	Alloyed/Doped, A-supports-B	Cu, In	-	FAA-3	(AEM)	CO	-0.70 V -iR vs. RHE	-50 mA/cm2	26	C. Yang et al., Overcoming immiscibility toward bimetallic catalyst library. Science Advances 6, eaaz6844 (2020).
CuPt NPs (1:0.00797 at. ratio) prepared via galvanic replacement of Cu NPs (100 nm), on SGL 29BC GDL	Core/shell	Cu, Pt	Nafion	FAA-3-PK-130	(AEM)	CO2	?	-500 mA/cm2	25	X. Li et al., Enhanced CO Affinity on Cu Facilitates CO2 Electroreduction toward Multi-Carbon Products. Small 19, 2302530 (2023).
Mn(OH)x overlayer on Cu-sputtered PTFE GDL	Overlayer, Mixed-phase/Janus	Cu, Mn, O	-	FAA-3-PK-130	(AEM)	CO2	?	?	23	M. Luo et al., Hydroxide promotes carbon dioxide electroreduction to ethanol on copper via tuning of adsorbed hydrogen. Nature Communications 10, 5814 (2019).
Mn/Cu alloy (9.7 at. % Mn) NPs, on GDL	Alloyed/Doped	Cu, Mn	Nafion	X37-50 Grade T	(AEM)	CO2	-0.8 V vs. RHE	-136 mA/cm2	21	Y. Chen et al., Tailoring the *CO and *H Coverage for Selective CO2 Electroreduction to CH4 or C2H4. Small n/a, 2308004.
Alloy/mixed metal Sr/Cu (1:3 ratio) microparticles, on GDL - obtained via reduction of mixed nitrate salt with NaBH4 over 12h period	Alloyed/Doped	Cu, Sr	Nafion	NEOSEPTA, AHA	(AEM)	CO2	-0.8 V vs. RHE	-173 mA/cm2	21	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angewandte Chemie International Edition 61, e202213423 (2022).
Cu/Sb (2 at. % Sb) thin film on Si wafer prepared via DC sputtering	Alloyed/Doped	Cu, Sb	-	"Selemion"	(AEM)	CO2	-1.15 V vs. RHE	?	20	Y. Lai et al., The sensitivity of Cu for electrochemical carbon dioxide reduction to hydrocarbons as revealed by high throughput experiments. Journal of Materials Chemistry A 7, 26785-26790 (2019).
Commercial Cu NPs with Ru shell prepared through galvanic displacement, on Cu foil	Core/shell	Cu, Ru	Nafion	Selemion AMV	(AEM)	CO2	-1.55 V vs. RHE	-8 mA/cm2	19	J. T. Billy, A. C. Co, Reducing the onset potential of CO2 electroreduction on CuRu bimetallic particles. Applied Catalysis B: Environmental 237, 911-918 (2018).
Alloy/mixed metal Sc/Cu (1:3 ratio) microparticles, on GDL - obtained via reduction of mixed nitrate salt with NaBH4 over 12h period	Alloyed/Doped	Cu, Sc	Nafion	NEOSEPTA, AHA	(AEM)	CO2	-0.8 V vs. RHE	-204 mA/cm2	18	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angewandte Chemie International Edition 61, e202213423 (2022).
Partial Mo overlayer (forming aggregates) sputter-deposited on {100}-oriented Cu-modified Si(100) substrate	Mixed-phase/Janus	Cu, Mo	-	Selemion® AMV	(AEM)	CO2	-1.0 V - iR vs. RHE	-8 mA/cm2	16	Y. F. Nishimura et al., Guiding the Catalytic Properties of Copper for Electrochemical CO2 Reduction by Metal Atom Decoration. ACS Applied Materials & Interfaces 13, 52044-52054 (2021).
Alloy/mixed metal W/Cu (1:3 ratio) microparticles, on GDL - obtained via reduction of mixed nitrate salt with NaBH4 over 12h period	Alloyed/Doped	Cu, W	Nafion	NEOSEPTA, AHA	(AEM)	CO2	-0.6 V vs. RHE	-104 mA/cm2	14	M. Xie et al., Fast Screening for Copper-Based Bimetallic Electrocatalysts: Efficient Electrocatalytic Reduction of CO2 to C2+ Products on Magnesium-Modified Copper. Angewandte Chemie International Edition 61, e202213423 (2022).

Table S25. Multi-elemental Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Ag/Au (3:1 ratio) alloy, highly defective, cubic wireframe NPs (59 nm) post-modified with epitaxially deposited Cu 'overlayer', on GDL	A-supports-B, alloyed/doped	Ag, Au, Cu	-	Fumasep FAB-PK-130	(AEM)	CO2	-0.65 V - iR vs. RHE	- 305 mA/cm2	77	L. Xiong et al., Breaking the Linear Scaling Relationship by Compositional and Structural Crafting of Ternary Cu–Au/Ag Nanoframes for Electrocatalytic Ethylene Production. Angewandte Chemie International Edition 60, 2508-2518 (2021).
Single atom Cu sites enclosed in an Ir-containing Zr-based MOF framework with rod-like morphology, on carbon cloth	Single atom, Atomically mixed/Crystalline	Cu, Ir, Zr	Nafion	Nafion 212	(CEM)	CO2	-1.0 V vs. RHE	-28 mA/cm2	71	Q. Mo et al., Engineering Dual Sites into the Confined Nanospace of the Porphyrinic Metal–Organic Framework for Tandem Transformation of CO2 to Ethylene. ACS Sustainable Chemistry & Engineering, (2024).
Ag/Au (3:1 ratio) alloy, highly defective, cubic wireframe NPs (59 nm) post-modified with epitaxially deposited Cu 'overlayer', on glassy carbon	A-supports-B, alloyed/doped	Ag, Au, Cu	Nafion	"Nafion"	(CEM)	CO2	-1.2 V vs. RHE	-13 mA/cm2	69	L. Xiong et al., Breaking the Linear Scaling Relationship by Compositional and Structural Crafting of Ternary Cu–Au/Ag Nanoframes for Electrocatalytic Ethylene Production. Angewandte Chemie International Edition 60, 2508-2518 (2021).
Single atom Cu sites enclosed in an Ir-containing Zr-based MOF framework with rod-like morphology, on GDL	Single atom, Atomically mixed/Crystalline	Cu, Ir, Zr	Nafion	Nafion 212	(CEM)	CO2	-1.0 V vs. RHE	-80^{PP} mA/cm2	67	Q. Mo et al., Engineering Dual Sites into the Confined Nanospace of the Porphyrinic Metal–Organic Framework for Tandem Transformation of CO2 to Ethylene. ACS Sustainable Chemistry & Engineering, (2024).
Cu2O microcubes (1 µm) decorated with small Pd/Ag NPs (20-50 nm, 0.49 and 0.39 wt%, respectively), prepared via galvanic displacement, mixed with carbon black, on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, Ag, Pd, C	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-31 mA/cm2	63	X. Xu et al., Pd-Decorated Cu2O–Ag Catalyst Promoting CO2 Electroreduction to C2H4 by Optimizing CO Intermediate Adsorption and Hydrogenation. ACS Applied Materials & Interfaces 16, 16243-16252 (2024).
Cu8Zn6Mn alloy (89.3:1.53:3.92 at. %) NPs, on GDL	Alloyed/Doped	Cu, Mn, Zn	Nafion	X37-50 Grade T	(AEM)	CO2	-1.4 V vs. RHE	-758 mA/cm2	58	Y. Chen et al., Tailoring the *CO and *H Coverage for Selective CO2 Electroreduction to CH4 or C2H4. Small n/a, 2308004.
Trimetallic Cu10La1Cs1 (mol ratio: 10:0.16:0.14) prepared via co-electroplating, on carbon paper	Mixed-phase/Janus	Cu, La, Cs	-	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-37 mA/cm2	57	S. Jia et al., Preparation of trimetallic electrocatalysts by one-step co-electrodeposition and efficient CO2 reduction to ethylene. Chemical Science 13, 7509-7515 (2022).
Exfoliated Mg/Al LDH nanosheets spraycoated onto a Cu-sputtered GDL	Overlayer	Cu, Mg, Al	Nafion	AMVN	(AEM)	CO2	-2.8 V vs. RHE	-300 mA/cm2	55	Y. N. Xu et al., Tuning the Microenvironment in Monolayer MgAl Layered Double Hydroxide for CO2-to-Ethylene Electrocatalysis in Neutral Media. Angewandte Chemie 135, e202217296 (2023).
Au nanoneedle-impregnated inside of the channels of Zr-based MOF with Cu-TMC sites mixed with CNPs, on glassy carbon	Mixed-phase/Janus, Atomically mixed/Crystalline	Cu, Zr, Au	-	Nafion 115	(CEM)	CO2	-1.2 V vs. RHE	-12 mA/cm2	53	X. Xie et al., Au-activated N motifs in non-coherent cupric porphyrin metal organic frameworks for promoting and stabilizing ethylene production. Nature Communications 13, 63 (2022).
Trimetallic Cu10Zn1Cs1 prepared via co-electroplating, on carbon paper	Mixed-phase/Janus	Cu, Zn, Cs	-	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-33 mA/cm2	48	S. Jia et al., Preparation of trimetallic electrocatalysts by one-step co-electrodeposition and efficient CO2 reduction to ethylene. Chemical Science 13, 7509-7515 (2022).
Commercial CuOx NPs (5.8 mg/cm2!) supported on scaffold of exfoliated Mg/Al LDH, on GDL	Mixed-phase/Janus, A-supports-B	Cu, Mg, Al, O	Nafion	SELEMION AMV	(AEM)	CO	-0.7 V -iR vs. RHE	-1773 mA/cm2	46	S. Kwon, J. Zhang, R. Ganganahalli, S. Verma, B. S. Yeo, Enhanced Carbon Monoxide Electroreduction to >1 A cm−2 C2+ Products Using Copper Catalysts Dispersed on MgAl Layered Double Hydroxide Nanosheet House-of-Cards Scaffolds. Angewandte Chemie International Edition 62, e202217252 (2023).
Simultaneous galvanic displacement of Zn substrate with Cu and Pb, with traces of Zn present after reaction (0.6-1.1 %), mixed with carbon black, on glassy carbon	Alloyed/Doped, atomically mixed/crystalline	Cu, Pb, Zn, C	Nafion	Nafion 117	(CEM)	CO2	-1.2 V -iR vs. RHE	?	45	M. Li et al., Engineering Surface Oxophilicity of Copper for Electrochemical CO2 Reduction to Ethanol. Advanced Science 10, 2204579 (2023).
Trimetallic Cu10La1Zn1 prepared via co-electroplating, on carbon paper	Mixed-phase/Janus	Cu, La, Zn	-	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-30 mA/cm2	43	S. Jia et al., Preparation of trimetallic electrocatalysts by one-step co-electrodeposition and efficient CO2 reduction to ethylene. Chemical Science 13, 7509-7515 (2022).
B-doped Cu (1.4 at. % B; NaBH4 as reductant and Boron source) NPs (0.5 mg/cm2) mixed with Zn NSs (0.01 mg/cm2) and PTFE, on GDL	Alloyed/Doped	Cu, B, Zn	-	FAB-PK-75	(AEM)	CO2	-0.5 V -iR vs. RHE	-200 mA/cm2	40	Y. Song et al., B-Cu-Zn Gas Diffusion Electrodes for CO2 Electroreduction to C2+ Products at High Current Densities. Angewandte Chemie International Edition 60, 9135-9141 (2021).

Trimetallic Cu10Zn1Co1 prepared via co-electroplating, on carbon paper	Mixed-phase/Janus	Cu, Zn, Co	-	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-26 mA/cm2	38	S. Jia et al., Preparation of trimetallic electrocatalysts by one-step co-electrodeposition and efficient CO2 reduction to ethylene. Chemical Science 13, 7509-7515 (2022).
Consecutive galvanic replacement-prepared Ag/Ru-doped (4% and 1 %, XPS) CuOx NPs, on Cu-sputtered PTFE GDL	Alloyed/Doped	Cu, Ag, Ru	Nafion	"Sustainion"	(AEM)	CO	?	-600 mA/cm2	38	X. Wang et al., Efficient electrosynthesis of n-propanol from carbon monoxide using a Ag–Ru–Cu catalyst. Nature Energy 7, 170-176 (2022).
CNP and graphite layers on top of CuZnO/CuZnAl2O4 catalyst prepared via co-precipitation and calcination (800 °C) midlayer , on Cu-sputtered PTFE GDL	Atomically mixed/Crystalline, A-supports-B, Alloyed/Doped	Cu, Zn, Al, O, C	Nafion	FAA-3-PK-130	(AEM)	CO2	-1.1 V vs. RHE	-400 mA/cm2	36	Z.-Y. Zhang et al., Cu-Zn-based alloy/oxide interfaces for enhanced electroreduction of CO2 to C2+ products. Journal of Energy Chemistry 83, 90-97 (2023).
Pd-doped, agglomerated defective Ag/CuOx nanosheets derived from CuOx NPs with Au seed ("Pd0.7Cu40.0Ag59.3"), on a GDL	Mixed-phase/Janus	Cu, Pd, Ag, Au	Nafion	Nafion 117	(CEM)	CO2	-1.0 V vs. RHE	-502 mA/cm2	35	D. L. Haoyu Sun, Yuanyuan Min, Yingying Wang, Yanyun Ma, Yiqun Zheng, Hongwen Huang, Hierarchical Palladium-Copper-Silver Porous Nanoflowers as Efficient Electrocatalysts for CO2 Reduction to C2+ Products. Acta Phys. -Chim. Sin. 40, 2307007- (2024).
Consecutive galvanic replacement-prepared Ag/Au-doped CuOx NPs, on Cu-sputtered PTFE GDL	Alloyed/Doped	Cu, Ag, Au	Nafion	"Sustainion"	(AEM)	CO	?	-400 mA/cm2	34	X. Wang et al., Efficient electrosynthesis of n-propanol from carbon monoxide using a Ag–Ru–Cu catalyst. Nature Energy 7, 170-176 (2022).
Consecutive galvanic replacement-prepared Ag/Pd-doped CuOx NPs, on Cu-sputtered PTFE GDL	Alloyed/Doped	Cu, Ag, Pd	Nafion	"Sustainion"	(AEM)	CO	?	-600 mA/cm2	34	X. Wang et al., Efficient electrosynthesis of n-propanol from carbon monoxide using a Ag–Ru–Cu catalyst. Nature Energy 7, 170-176 (2022).
Simultaneous galvanic displacement of Zn substrate with Cu and Sn (Cu/Sn wt of ca. 40), with traces of Zn present after reaction (0.6-1.1 %), mixed with carbon black, on glassy carbon	Alloyed/Doped, atomically mixed/crystalline	Cu, Sn, Zn, C	Nafion	Nafion 117	(CEM)	CO2	-1.3 V -iR vs. RHE	-19 mA/cm2	33	M. Li et al., Engineering Surface Oxophilicity of Copper for Electrochemical CO2 Reduction to Ethanol. Advanced Science 10, 2204579 (2023).
Simultaneous galvanic displacement of Zn substrate with Cu and Ag, with traces of Zn present after reaction (0.6-1.1 %), mixed with carbon black, on glassy carbon	Alloyed/Doped, atomically mixed/crystalline	Cu, Ag, Zn, C	Nafion	Nafion 117	(CEM)	CO2	-1.1 V -iR vs. RHE	?	33	M. Li et al., Engineering Surface Oxophilicity of Copper for Electrochemical CO2 Reduction to Ethanol. Advanced Science 10, 2204579 (2023).
Trimetallic Cu10Ag1Zn1 prepared via co-electroplating, on carbon paper	Mixed-phase/Janus	Cu, Ag, Zn	-	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-26 mA/cm2	31	S. Jia et al., Preparation of trimetallic electrocatalysts by one-step co-electrodeposition and efficient CO2 reduction to ethylene. Chemical Science 13, 7509-7515 (2022).
Cu NCs with a non-equilibrium Cu/Ag/Pd alloy shell (Cu79Ag16Pd5), on a GDL	Alloyed/Doped, core/shell	Cu, Ag, Pd	Nafion	"Nafion"	(CEM)	CO2	-1.1 V -iR vs. RHE	?	31	C. D. Koolen et al., Low-temperature non-equilibrium synthesis of anisotropic multimetallic nanosurface alloys for electrochemical CO2 reduction. Nature Synthesis 3, 47-57 (2024).
High entrypy AuAgPtPdCu NPs (16 +- 10 nm) with single atom Cu sites, on glassy carbon	Atomically mixed/Crystalline, alloyed/doped	Au, Ag, Pt, Pd, Cu	Nafion	?	?	CO2	-0.3 V vs. RHE	-14 mA/cm2	30	S. Nellaiappan et al., High-Entropy Alloys as Catalysts for the CO2 and CO Reduction Reactions: Experimental Realization. ACS Catal 10, 3658-3663 (2020).
Trimetallic Cu10La1Ag1 prepared via co-electroplating, on carbon paper	Mixed-phase/Janus	Cu, La, Ag	-	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-18 mA/cm2	28	S. Jia et al., Preparation of trimetallic electrocatalysts by one-step co-electrodeposition and efficient CO2 reduction to ethylene. Chemical Science 13, 7509-7515 (2022).
Trimetallic Cu10Ag1Au1 prepared via co-electroplating, on carbon paper	Mixed-phase/Janus	Cu, Ag, Au	-	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-26 mA/cm2	27	S. Jia et al., Preparation of trimetallic electrocatalysts by one-step co-electrodeposition and efficient CO2 reduction to ethylene. Chemical Science 13, 7509-7515 (2022).
Chemically dealloyed (5 M NaOH, 50 °C) Al90Cu7.5Ce2.5 ribbons, with remaining traces of Al (2.2 at %), on GDL	Mixed-phase/Janus	Cu, Ce, Al	Nafion	Fumasep FAS-50	(AEM)	CO2	-0.7 V - iR vs. RHE	- 98 mA/cm2	23	T. Kou et al., Amorphous CeO2–Cu Heterostructure Enhances CO2 Electroreduction to Multicarbon Alcohols. ACS Materials Letters 4, 1999-2008 (2022).
Trimetallic Cu10Ag1Co1 prepared via co-electroplating, on carbon paper	Mixed-phase/Janus	Cu, Ag, Co	-	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-18 mA/cm2	22	S. Jia et al., Preparation of trimetallic electrocatalysts by one-step co-electrodeposition and efficient CO2 reduction to ethylene. Chemical Science 13, 7509-7515 (2022).

Exfoliated B/Cu-based MOF ("BIF-104(Cu)") nanosheets decorated with ultrasmall AgOx NPs mixed with carbon black, on glassy carbon	Mixed-phase/Janus, A-supports-B	Cu, B, Ag, C	Nafion	Nafion 117	(CEM)	CO2	-1.2 V vs. RHE	-4 mA/cm2	21	P. Shao et al., Enhancing CO2 Electroreduction to Ethylene via Copper–Silver Tandem Catalyst in Boron-Imidazolate Framework Nanosheet. Advanced Energy Materials 13, 2300088 (2023).
Tensile strained Cu overlayer (32 nm) on NiTi sheet	Overlayer	Cu, Ti, Ni	-	Nafion 117	(CEM)	CO2	-1.1 V -iR vs. RHE	-11 mA/cm2	20	M. Du, X. Zhao, G. Zhu, H.-Y. Hsu, F. Liu, Elastic strain controlling the activity and selectivity of CO2 electroreduction on Cu overlayers. Journal of Materials Chemistry A 9, 4933-4944 (2021).
La0.9Sr0.1CuO3 particles, on GDE (little information provided)	Atomically mixed/Crystalline	Cu, La, Sr	?	Nafion 417	(CEM)	CO2	?	-120 mA/cm2	20	A. F. Sammells, R. L. Cook, in Electrochemical and Electrocatalytic Reactions of Carbon Dioxide, B. P. Sullivan, Ed. (Elsevier, Amsterdam, 1993), pp. 217-262.
Gd0.9Sr0.1CuO3 particles, on GDE (little information provided)	Atomically mixed/Crystalline	Cu, Gd, Sr	?	Nafion 417	(CEM)	CO2	?	-240 mA/cm2	20	A. F. Sammells, R. L. Cook, in Electrochemical and Electrocatalytic Reactions of Carbon Dioxide, B. P. Sullivan, Ed. (Elsevier, Amsterdam, 1993), pp. 217-262.
Pr0.9Sr0.1CuO3 particles, on GDE (little information provided)	Atomically mixed/Crystalline	Cu, Pr, Sr	?	Nafion 417	(CEM)	CO2	?	-240 mA/cm2	17	A. F. Sammells, R. L. Cook, in Electrochemical and Electrocatalytic Reactions of Carbon Dioxide, B. P. Sullivan, Ed. (Elsevier, Amsterdam, 1993), pp. 217-262.
[PP]Used value from LSV, rather than text value										
[UU]Indeed 2 °C, not a typo										

Table S26. (In-) organic core/shell-Cu											
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
Electroplated Cu modified via grafting an aryl diazonium-based polymeric coating (without Nafion toplayer), on GDL	Core/shell (in-)organic	Cu, O	Aryl diazonium-based polymer	Sustainion X37-50	(AEM)	CO	-2.5 V vs. ANODE	-179 mA/cm2	86	H. Wu et al., Selective and energy-efficient electrosynthesis of ethylene from CO2 by tuning the valence of Cu catalysts through aryl diazonium functionalization. Nature Energy, (2024).
CuO NPs coated with 1-dodecanethiol, on GDL	Core/shell (in-)organic	Cu, O	Nafion, 1-dodecanethiol	?	(AEM)	CO2	-1.2 V vs. RHE	-304 mA/cm2	80	Y. Yao et al., A surface strategy boosting the ethylene selectivity for CO2 reduction and in situ mechanistic insights. Nature Communications 15, 1257 (2024).
Ionic liquid-coated Cu-MOF (Cu3(1,3,5-Benzenetricarboxylic acid)2), on glassy carbon	Core/shell (in-)organic	Cu	Nafion, 1,3,5-Benzenetricarboxylic acid (BTC), 1-Butyl-3-methylimidazolium nitrate (BmimNO3)	Nafion 117	(CEM)	CO2	-1.49 V vs. RHE	-34 mA/cm2	77	Y. Sha et al., Anchoring Ionic Liquid in Copper Electrocatalyst for Improving CO2 Conversion to Ethylene. Angewandte Chemie International Edition 61, e202200039 (2022).
CuOx NPs (large size distribution) mixed with PTFE, on carbon paper	Core/shell (in-)organic	Cu, O	Nafion, PTFE	FKB PK 130	(AEM)	CO2	-1.38 V vs. RHE	-88 mA/cm2	72	Y. Wang et al., Benzyl alcohol promoted electrocatalytic reduction of carbon dioxide and C2 production by Cu2O/Cu. Chemical Engineering Journal 485, 149800 (2024).
Hydrophobic Cu NPs electroplated from a PTFE-containing solution, on carbon paper	Core/shell (in-)organic	Cu	PTFE	Nafion 117	(CEM)	CO2	-1.25 V vs. RHE	-35 mA/cm2	67	T. Deng et al., Polymer Modification Strategy to Modulate Reaction Microenvironment for Enhanced CO2 Electroreduction to Ethylene. Angewandte Chemie International Edition 63, e202313796 (2024).
Polystyrene vinylbenzyl imidazolium chloride (PSMIM, 0.25 wt%) coated CuO NSs, on carbon paper	Core/shell (in-)organic	Cu, O	Polystyrene vinylbenzyl imidazolium chloride (PSMIM)	X37-50 Grade T	(AEM)	CO2	-1.05 V vs. RHE	-119 mA/cm2	62	D. Wang et al., Regulating the local microenvironment on porous Cu nanosheets for enhancing electrocatalytic CO2 reduction selectivity to ethylene. Journal of Materials Chemistry A 12, 11968-11974 (2024).
Water-insoluble organosuperbase-modified Cu2O NCs, on GDL	Core/shell (in-)organic	Cu	Nafion, 1,8-bis(dimethylamino) naphthalene	Nafion 117	(CEM)	CO2	?	-300 mA/cm2	60	L. Fan et al., Proton sponge promotion of electrochemical CO2 reduction to multi-carbon products. Joule 6, 205-220 (2022).
Water-insoluble organosuperbase-modified Cu NPs, on GDL	Core/shell (in-)organic	Cu	Nafion, 1,8-bis(dimethylamino) naphthalene	Nafion 117	(CEM)	CO2	-1.0 V -iR vs. RHE	-200 mA/cm2	52	L. Fan et al., Proton sponge promotion of electrochemical CO2 reduction to multi-carbon products. Joule 6, 205-220 (2022).
Partially PVP-capped Cu NPs grown from Au seed, supported on Vulcan XC-72, on GDL	Core/shell (in-)organic	Cu	Nafion, PVP capping	Fumapem FAA-3-PK-130	(AEM)	CO2	-0.85 V - iR vs. RHE	-200 mA/cm2	52	Q. Fan et al., Manipulating Cu Nanoparticle Surface Oxidation States Tunes Catalytic Selectivity toward CH4 or C2+ Products in CO2 Electroreduction. Advanced Energy Materials 11, 2101424 (2021).
Cationic tetrabutylammonium-coated electroplated CuO dendrites (1.75 mg/cm2), on 121 Wet Proofing-modified GDL	Core/shell (in-)organic	Cu, O, N	Nafion, Tetrabutylammonium	Selemion AMV	(AEM)	CO	-0.60 V vs. RHE	-1223 mA/cm2	50	M. P. L. Kang, H. Ma, R. Ganganahalli, B. S. Yeo, Surfactant-Enhanced Formation of Ethylene from Carbon Monoxide Electroreduction on Copper Catalysts. ACS Catal, 116-123 (2023).

Table S27. (In-) organic overlayer Cu										
Electromaterial description	**Catalyst type**	**Majority elements**	**Polymeric / (in-) organic additives**	**Membrane**	**Membrane type**	**Reactant**	**E**	**j**	**FE C2H4 (max)**	**Reference**
50 µm Cu-exchanged stannosilicate UZAR-S3 'mixed matrix membrane' toplayer, on a PVA/Chitosan midlayer, on a commercial 70 nm Cu NPs with chitosan bio-based polymeric binder underlayer, on Toray TGP-H-60 GDL (exact conditions ambiguously reported)	Overlayer	Cu	Chitosan, Cu exchanged stannosilicate UZAR-S3, polyvinylalcohol	Sustainion X-37 50 grade	(AEM)	CO2	-0.87 V vs. RHE	-10 mA/cm2	98	A. Marcos-Madrazo, C. Casado-Coterillo, J. Iniesta, A. Irabien, Use of Chitosan as Copper Binder in the Continuous Electrochemical Reduction of CO2 to Ethylene in Alkaline Medium. Membranes 12, 783 (2022).
Nafion overlayer covering a catalyst layer comprised of electroplated Cu modified via grafting an aryl diazonium-based polymeric coating, on GDL	Overlayer	Cu, O	Nafion, Aryl diazonium-based polymer	Sustainion X37-50	(AEM)	CO2	-3.85 V vs. ANODE	-602 mA/cm2	89	H. Wu et al., Selective and energy-efficient electrosynthesis of ethylene from CO2 by tuning the valence of Cu catalysts through aryl diazonium functionalization. Nature Energy, (2024).
Poly-N-(6-aminohexyl)acrylamide-coated electrodeposited Cu dendrites on GDL	Overlayer	Cu	Poly-N-(6-aminohexyl)acrylamid e	?	(n/a)	CO2	-0.47 V -iR vs. RHE	?	87	X. Chen et al., Electrochemical CO2-to-ethylene conversion on polyamine-incorporated Cu electrodes. Nature Catalysis 4, 20-27 (2021).
N1-/N3-substituted imidazolium-based overlayer on Cu plate	Overlayer	Cu	N1-substituted (1,10-phenanthrolinyl) and N3-substituted (n-butyl) imidazolium	"Hangzhou Huamo Technology Co., Ltd"	(AEM)	CO2	-1.24 V vs. RHE	-6 mA/cm2	73	B. Cheng et al., Selective CO2 Reduction to Ethylene Using Imidazolium-Functionalized Copper. ACS Applied Materials & Interfaces 14, 27823-27832 (2022).
N-arylpyridinium electrodeposition-modified Cu-sputtered PTFE GDL	Overlayer	Cu	N,N'-(1,4-phenylene) bispyridinium salt	Fumapem FAA-3-PK-130	(AEM)	CO2	-0.83 V -iR vs. RHE	-325 mA/cm2	72	F. Li et al., Molecular tuning of CO2-to-ethylene conversion. Nature 577, 509-513 (2020).
Poly-N-(6-aminohexyl)acrylamide-coated electrodeposited Cu dendrites on GDL	Overlayer	Cu	Poly-N-(6-aminohexyl)acrylamid e	?	(n/a)	CO2	-0.97 V -iR vs. RHE	-433 mA/cm2	72	X. Chen et al., Electrochemical CO2-to-ethylene conversion on polyamine-incorporated Cu electrodes. Nature Catalysis 4, 20-27 (2021).
Sputtered Cu with Carbon NP midlayer and graphite toplayer, on PTFE GDL	Overlayer	Cu, C	CNPs, Graphite	Fumasep FAB-PK-130	(AEM)	CO2	-0.57 V - iR vs. RHE	-100 mA/cm2	70	C.-T. Dinh et al., CO2 electroreduction to ethylene via hydroxide-mediated copper catalysis at an abrupt interface. Science 360, 783-787 (2018).
Electroplated Cu (60 s @ 400 mA/cm2) from CuBr2/tartrate/1 M KOH-containing bath with active CO2 flow (though CO also seems to work), with Carbon NP midlayer and graphite toplayer, on Cu-sputtered PTFE GDL (ambiguously reported)	Overlayer	Cu, C	CNPs/Nafion, Graphite/Nafion	Fumapem FAA-3-PK-130	(AEM)	CO2	-0.67 V - iR vs. RHE	-280 mA/cm2	70	Y. Wang et al., Catalyst synthesis under CO2 electroreduction favours faceting and promotes renewable fuels electrosynthesis. Nature Catalysis, (2019).
Carbon black NP (XC72R) overlayer on top of Cu-sputtered PTFE GDL	Overlayer	Cu, C	Nafion	Nafion 117	(CEM)	CO2	-0.89 V -iR vs. RHE	-500 mA/cm2	70	Z. Wang et al., Localized Alkaline Environment via In Situ Electrostatic Confinement for Enhanced CO2-to-Ethylene Conversion in Neutral Medium. Journal of the American Chemical Society 145, 6339-6348 (2023).
Aquivion toplayer on N,N'-ethylene-phenanthrolinium electrodeposition-modified Cu-sputtered PTFE GDL	Overlayer	Cu	Aquivion D79-25BS, N,N'-ethylene-phenanthrolinium dibromide	Sustainion X37-50	(AEM)	CO2	-4.4 V vs. ANODE	-330 mA/cm2	69	A. Ozden et al., High-Rate and Efficient Ethylene Electrosynthesis Using a Catalyst/Promoter/Transport Layer. ACS Energy Letters 5, 2811-2818 (2020).
Electroplated Cu (90 s @ 400 mA/cm2) from CuBr2/tartrate/1 M KOH-containing bath with active CO2 flow (though CO also seems to work[insert ref]), with N-tolyl substituted tetrahydro-bipyridine (Py) midlayer and hydrophobic (C4HF7O4S.C2F4)x short sidechain (SSC) ionomer toplayer, on Cu-sputtered PTFE GDL	Overlayer	Cu	N-tolyl substituted tetrahydro-bipyridine, (C4HF7O4S.C2F4)x	Sustainion X37–50 grade 60	(AEM)	CO	-2.5 V vs. ANODE	-164 mA/cm2	65	A. Ozden et al., Cascade CO2 electroreduction enables efficient carbonate-free production of ethylene. Joule 5, 706-719 (2021).
Commercial 25 nm Cu NPs with Hex-Aza COF-based overlayer, on GDL	Overlayer	Cu	Hexaketocyclohexane, 2,3,6,7-tetraamino-phenazine hydrochloride	Sustainion X37-50	(AEM)	CO2	-3.85 V vs. ANODE	-316 mA/cm2	62	A. Ozden et al., Energy- and carbon-efficient CO2/CO electrolysis to multicarbon products via asymmetric ion migration–adsorption. Nature Energy 8, 179-190 (2023).
Electroplated Cu (60 s @ 400 mA/cm2) from CuBr2/tartrate/1 M KOH-containing bath with active CO2	Overlayer	Cu, C	CNPs/Nafion,	Sustainion X37-50	(AEM)	CO2	-3.7 V	-330	60	Y. Wang et al., Catalyst synthesis under CO2 electroreduction favours faceting and

flow (though CO also seems to work), with Carbon NP midlayer and graphite toplayer, on Cu-sputtered PTFE GDL (ambiguously reported)			Graphite/Nafion	grade 60			vs. ANODE	mA/cm^2		promotes renewable fuels electrosynthesis. Nature Catalysis, (2019).
25 nm Cu NPs/nafion mix sprayed on top of nafion pre-covered Cu-sputtered PTFE nanowires	Overlayer	Cu	Nafion	Fumasep FAB-PK-130	(AEM)	CO_2	-1.3 V -iR vs. RHE	-800 mA/cm^2	60	F. P. G. d. Arquer et al., CO_2 electrolysis to multicarbon products at activities greater than 1 A cm-2. Science 367, 661-666 (2020).
Electrodeposited Cu(OH)x dendrites (-200 mA/cm^2 for 10 min from 0.05 M H_2SO_4/2.5 M KCl/7 mM $CuSO_4$ bath with poly(Lys, Phe), with active CO_2 flow), on Cu-sputtered PTFE GDL	Overlayer	Cu, O	poly(Lys, Phe)	Nafion 117	(CEM)	CO_2	-2.3 V vs. Ag/AgCl	-200 mA/cm^2	60	Y. Cao et al., Surface hydroxide promotes CO_2 electrolysis to ethylene in acidic conditions. Nature Communications 14, 2387 (2023).
Electroplated Cu on top of polyaniline pre-functionalized carbon paper	Overlayer	Cu	Polyaniline	Nafion 117	(CEM)	CO_2	-1.2 V -iR vs. RHE	-30 mA/cm^2	59	S. Jia et al., Hierarchical Metal–Polymer Hybrids for Enhanced CO_2 Electroreduction. Angewandte Chemie International Edition 60, 10977-10982 (2021).
1-octadecanethiol-modified electroplated Cu dendrites, on Cu plate	Overlayer	Cu	1-octadecanethiol	Nafion 115	(CEM)	CO_2	-1.5 V -iR vs. RHE	-30 mA/cm^2	56	D. Wakerley et al., Bio-inspired hydrophobicity promotes CO_2 reduction on a Cu surface. Nature materials 18, 1222-1227 (2019).
Spin-coated tricomponent ionic liquid polymer-modified Cu plate	Overlayer	Cu	Various ionic liquids	Selemion AMV	(AEM)	CO_2	-1.08 V -iR vs. RHE	-5 mA/cm^2	56	J. Wang et al., Selective CO_2 Electrochemical Reduction Enabled by a Tricomponent Copolymer Modifier on a Copper Surface. Journal of the American Chemical Society 143, 2857-2865 (2021).
Polypyrrole nanowires-modified Cu NPs, on GDL	Overlayer	Cu	Nafion, Polypyrrole	Fumatech FAB-PK-130	(AEM)	CO	-0.58 V vs. RHE	-33 mA/cm^2	56‡ (69)	Y. Ji, C. Yang, L. Qian, L. Zhang, G. Zheng, Promoting electrocatalytic carbon monoxide reduction to ethylene on copper-polypyrrole interface. Journal of Colloid and Interface Science 600, 847-853 (2021).
Carbon NP/nafion toplayer on a sputtered Cu midlayer with a MOF/nafion-derived underlayer, on a PTFE GDL	Overlayer	Cu, C	Nafion, Cu3(benzene-1,3,5-tricarboxylate)2·xH2O	Sustainion X37-50	(AEM)	CO_2	-3.8 V vs. ANODE	-255 mA/cm^2	54	D.-H. Nam et al., High-Rate and Selective CO_2 Electrolysis to Ethylene via Metal–Organic-Framework-Augmented CO_2 Availability. Advanced Materials 34, 2207088 (2022).
Aquivion toplayer on N,N'-ethylene-phenanthrolinium electrodeposition-modified Cu-sputtered PTFE GDL	Overlayer	Cu	Aquivion D79-25BS, N,N'-ethylene-phenanthrolinium dibromide	Sustainion X37-50	(AEM)	CO	-2.5 V vs. ANODE	-84 mA/cm^2	52	A. Ozden et al., High-Rate and Efficient Ethylene Electrosynthesis Using a Catalyst/Promoter/Transport Layer. ACS Energy Letters 5, 2811-2818 (2020).
Polydopamine-coated rod-like Cu-MOF, on glassy carbon	Overlayer	Cu	Nafion, polydopamine	Nafion 117	(CEM)	CO_2	-1.2 V -iR vs. RHE	-5 mA/cm^2	51	Z.-H. Zhao, H.-L. Zhu, J.-R. Huang, P.-Q. Liao, X.-M. Chen, Polydopamine Coating of a Metal–Organic Framework with Bi-Copper Sites for Highly Selective Electroreduction of CO_2 to C2+ Products. ACS Catal 12, 7986-7993 (2022).
Carbon NP/nafion toplayer on a sputtered Cu midlayer with a calcined MOF-derived/nafion underlayer, on a PTFE GDL	Overlayer	Cu, C	Nafion, Cu3(benzene-1,3,5-tricarboxylate)2·xH2O	Fumasep FAA-3-PK-130	(AEM)	CO_2	-4.1 V (?) vs. ANODE	-525 mA/cm^2	51	D.-H. Nam et al., High-Rate and Selective CO_2 Electrolysis to Ethylene via Metal–Organic-Framework-Augmented CO_2 Availability. Advanced Materials 34, 2207088 (2022).
Cs-exchanged Nafion overlayer (0.7 µm) on Cu sputtered PTFE GDL	Overlayer	Cu	Nafion (Cs)	-	(n/a)	CO	-2.3 V vs. ANODE	-50 mA/cm^2	51	M. A. Adnan, S. K. Nabil, K. Kannimuthu, M. G. Kibria, Modulating Cation and Water Transports for Enhanced CO Electrolysis via Ionomer Coating. ChemSusChem n/a, e202301425.
Polyaniline-coated Cu NPs on glassy carbon	Overlayer	Cu	Nafion, Polyaniline	Quaternary ammonia poly(N-methylpiperidine-co-p-terphenyl)	(AEM)	CO_2	-1.13 V -iR vs. RHE	-35 mA/cm^2	49	X. Wei et al., Highly Selective Reduction of CO_2 to C2+ Hydrocarbons at Copper/Polyaniline Interfaces. ACS Catal 10, 4103-4111 (2020).
Commercial 25 nm Cu NPs with Hex-Aza COF-based overlayer, on GDL	Overlayer	Cu	Hexaketocyclohexane, 2,3,6,7-tetraamino-phenazine hydrochloride	Fumasep FAA-3-50	(AEM)	CO	-2.51 V vs. ANODE	-500 mA/cm^2	49	A. Ozden et al., Energy- and carbon-efficient CO_2/CO electrolysis to multicarbon products via asymmetric ion migration–adsorption. Nature Energy 8, 179-190 (2023).
0.01 mg/cm^2 microporous polymer (combination of ethanoanthracene (EA) and Troger's base (TB) monomers)-coated Cu-sputtered GDL	Overlayer	Cu	Ethanoanthracene, Troger's base	?	(n/a)	CO_2	-0.63 V vs. RHE	-39 mA/cm^2	48	S. C. Perry et al., Polymers with intrinsic microporosity (PIMs) for targeted CO_2 reduction to ethylene. Chemosphere 248, 125993 (2020).

Metallic Cu NPs with nafion toplayer, on GDL	Overlayer	Cu	Nafion	Nafion 117	(CEM)	CO	-1.46 V vs. RHE	-72 mA/cm2	48	D. S. Ripatti, T. R. Veltman, M. W. Kanan, Carbon Monoxide Gas Diffusion Electrolysis that Produces Concentrated C2 Products with High Single-Pass Conversion. Joule 3, 240-256 (2019).
QAPEEK' overlayer on 1 µm-thick Cu layer with nanoscale roughness, sputtered on a GDL	Overlayer	Cu	QAPEEK (quaternary ammonia poly(ether ether ketone))	QAPPT	(AEM)	CO2	-3.46 V vs. ANODE	-600 mA/cm2	48	W. Li et al., Bifunctional ionomers for efficient co-electrolysis of CO2 and pure water towards ethylene production at industrial-scale current densities. Nature Energy 7, 835-843 (2022).
Surface S-doped 'coral-like' CuO MPs, on carbon paper	Overlayer	Cu, S, O	Nafion, thioacetamide	Nafion 117	(CEM)	CO2	-1.3 V vs. RHE	-32 mA/cm2	48	T. Jia et al., Engineering vacancy and hydrophobicity of spherical coral-like CuO catalyst for effective electrochemical CO2 reduction to ethylene. Surfaces and Interfaces 38, 102841 (2023).
Tip-exposed PTFE-coated electrochemically grown Cu nanoneedles scraped off and deposited on a PTFE GDL	Overlayer	Cu	Nafion, PTFE	Fumasep FAB-PK-130	(AEM)	CO2	-0.76 V -iR vs. RHE	-300 mA/cm2	45	B. Yang et al., Accelerating CO2 Electroreduction to Multicarbon Products via Synergistic Electric–Thermal Field on Copper Nanoneedles. Journal of the American Chemical Society 144, 3039-3049 (2022).
Cu plate with in-situ electrodeposited N-functionalized aryl moiety (10 mM)	Overlayer	Cu	N,N′-ethylene-phenanthrolinium-Br2	Selemion AMV	(AEM)	CO2	-1.07 V -iR vs. RHE	-4 mA/cm2	45	A. Thevenon, A. Rosas-Hernández, J. C. Peters, T. Agapie, In-Situ Nanostructuring and Stabilization of Polycrystalline Copper by an Organic Salt Additive Promotes Electrocatalytic CO2 Reduction to Ethylene. Angewandte Chemie 131, 17108-17114 (2019).
Amorphous N-functionalized (34% N)) carbon overlayer on top of Cu-sputtered PTFE GDL	Overlayer	Cu, C, N	-	FAB-PK-130	(AEM)	CO2	-0.59 V -iR vs. RHE	-200 mA/cm2	45	X. Wang et al., Efficient electrically powered CO2-to-ethanol via suppression of deoxygenation. Nature Energy 5, 478-486 (2020).
Pre-reduced gluconic acid-capped (800 mg) OH-rich Cu2O NPs, on GDL	Overlayer	Cu, O	Nafion, Gluconic acid	"Sustainion"	(AEM)	CO2	-0.94 V -iR vs. RHE	-350 mA/cm2	44	C. Li et al., Boosting Electrochemical CO2 Reduction via Surface Hydroxylation over Cu-Based Electrocatalysts. ACS Catal 13, 16114-16125 (2023).
Electrolyte-soaked 60 µm-thick porous (0.44 µm pore size) PTFE support overlayer on top of commercial 25 nm Cu NPs, on GDL	Overlayer	Cu	Nafion	Home-made BPM with TiO2 NP interlayer	(BPM [rev])	CO2	-5.35 V vs. ANODE	-300 mA/cm2	44	K. Xie et al., Bipolar membrane electrolyzers enable high single-pass CO2 electroreduction to multicarbon products. Nature Communications 13, 3609 (2022).
Electroplated Cu (60 s @ 400 mA/cm2) from CuBr2/tartrate/1 M KOH-containing bath with active CO2 flow (though CO also seems to work), with Carbon NP midlayer and graphite toplayer, on Cu-sputtered PTFE GDL (ambiguously reported)	Overlayer	Cu, C	CNPs/Nafion, Graphite/Nafion	Fumapem FAA-3-PK-130	(AEM)	CO2	-1.1 V - iR vs. RHE	n/a	42	Y. Wang et al., Catalyst synthesis under CO2 electroreduction favours faceting and promotes renewable fuels electrosynthesis. Nature Catalysis, (2019).
Hydrophobic pention D18 overlayer on Cu-sputtered PTFE GDL	Overlayer	Cu	Pention D18	Sustainion X37-50, grade 60	(AEM)	CO2	-2.58 V -iR vs. Au/QRE	-200 mA/cm2	42	M. Zhuansun et al., Promoting CO2 Electroreduction to Multi-Carbon Products by Hydrophobicity-Induced Electro-Kinetic Retardation. Angewandte Chemie International Edition 62, e202309875 (2023).
Carbon black NP (XC72R) overlayer on top of Cu-sputtered PTFE GDL	Overlayer	Cu, C	Nafion	Nafion 117	(CEM)	CO	-0.74 V -iR vs. RHE	?	42	Z. Wang et al., Localized Alkaline Environment via In Situ Electrostatic Confinement for Enhanced CO2-to-Ethylene Conversion in Neutral Medium. Journal of the American Chemical Society 145, 6339-6348 (2023).
Carbon NP/nafion toplayer with a MOF/nafion-derived midlayer on a Cu-sputtered PTFE GDL	Overlayer	Cu, C	Nafion, Cu3(benzene-1,3,5-tricarboxylate)2·xH2O	Sustainion X37-50	(AEM)	CO	-2.7 V vs. ANODE	-295 mA/cm2	41	D.-H. Nam et al., High-Rate and Selective CO2 Electrolysis to Ethylene via Metal–Organic-Framework-Augmented CO2 Availability. Advanced Materials 34, 2207088 (2022).
Electrocycled (CVs in 0.3 M KCl) Cu plate with benzimidazole overlayer	Overlayer	Cu	Benzimidazole	?	(n/a)	CO2	-1.07 V vs. RHE	-26 mA/cm2	41	S. Zhong et al., Efficient electrochemical transformation of CO2 to C2/C3 chemicals on benzimidazole-functionalized copper surfaces. Chemical Communications 54, 11324-11327 (2018).
1-methyl-benzimidazolium-functionalized paraterphenyl-trifluoroheptan-2-one polymer on top of on Cu NPs, on carbon paper	Overlayer	Cu	1-methyl-benzimidazolium, paraterphenyl-trifluoroheptan-2-one	QAPPT (?)	(AEM)	CO2	-3.44 V vs. ANODE	-500 mA/cm2	40	L. Xue et al., Dual-Role of Polyelectrolyte-Tethered Benzimidazolium Cation in Promoting CO2/Pure Water Co-Electrolysis to Ethylene. Angewandte Chemie International Edition 62, e202309519 (2023).
Diphenyliodonium salt-derived electrografted overlayer on Cu-sputtered PTFE GDL	Overlayer	Cu	Diphenyliodonium salt	Selemion AMV	(AEM)	CO2	?	-100 mA/cm2	39	N. B. Watkins, Y. Wu, W. Nie, J. C. Peters, T. Agapie, In Situ Deposited Polyaromatic Layer Generates Robust Copper Catalyst for Selective Electrochemical CO2 Reduction at Variable pH. ACS Energy Letters 8, 189-195 (2023).

Commercial spherical Cu microparticles with native CuOx film and nafion toplayer, on GDL	Overlayer	Cu	Nafion	Selemion AMV	(AEM)	CO	-0.78 V -iR vs. RHE	-21 mA/cm2	38	J. Li et al., Effectively Increased Efficiency for Electroreduction of Carbon Monoxide Using Supported Polycrystalline Copper Powder Electrocatalysts. ACS Catal 9, 4709-4718 (2019).
Electropolymerized N-tolyl pyridinium-based overlayer on Cu foil	Overlayer	Cu	N-tolyl pyridinium	Selemion AMV	(AEM)	CO2	-1.41 V -iR vs. RHE	-1 mA/cm2	34	W. Nie, G. P. Heim, N. B. Watkins, T. Agapie, J. C. Peters, Organic Additive-derived Films on Cu Electrodes Promote Electrochemical CO2 Reduction to C2+ Products Under Strongly Acidic Conditions. Angewandte Chemie 135, e202216102 (2023).
Glycine overlayer on top Cu plate	Overlayer	Cu	Glycine	Nafion 117	(CEM)	CO2	-1.9 V vs. RHE	- mA/cm2	24	M. S. Xie et al., Amino acid modified copper electrodes for the enhanced selective electroreduction of carbon dioxide towards hydrocarbons. Energy & Environmental Science 9, 1687-1695 (2016).
Electropolymerized ethynyl and azide-based overlayer with in-situ generated distrubted Cu NPs, on Cu substrate	Overlayer	Cu	Ethynyl-precursor, azide-precursor	Selemion AMV	(AEM)	CO2	-1.3 V vs. RHE	-25 mA/cm2	20	R. Igarashi, R. Takeuchi, K. Kubo, T. Mizuta, S. Kume, On-Surface Modification of Copper Cathodes by Copper (I)-Catalyzed Azide Alkyne Cycloaddition and CO2 Reduction in Organic Environments. Frontiers in Chemistry 7, 860 (2019).

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