Table S1. Summary of catalysts for direct electrochemical CO_2/CO-to-C_{3+} conversion.

Category	Catalyst [a]	Feed	Electrolyte	pH [b]	Major C_{3+} product(s) [c]	Reference electrode	Potential (V) [d]	j_{C3+} (mA cm^{-2}) [e]	Optimal FE (%) [e]	Ref.
Single-crystal Cu	Cu(111)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.55	0.07	1.3	[1]
	Cu(11 9 9)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.48	0.09	1.8	[1]
	Cu(755)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.43	0.13	2.5	[1]
	Cu(533)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.42	0.08	1.6	[1]
	Cu(211)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.38	0.20	4.0	[1]
	Cu(311)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.37	0.21	4.2	[1]
	Cu(511)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.36	0.40	7.9	[1]
	Cu(711)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.34	0.60	12.0	[1]
	Cu(911)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.36	0.47	9.4	[1]
	Cu(11 1 1)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.37	0.33	6.6	[1]
	Cu(100)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.40	0.26	5.1	[1]
	Cu(810)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.38	0.20	3.9	[1]
	Cu(610)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.37	0.23	4.5	[1]
	Cu(510)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.38	0.30	6.0	[1]
	Cu(310)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.42	0.27	5.4	[1]
	Cu(210)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.52	0.07	1.3	[1]
	Cu(332)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.51	0.04	0.70	[1]
	Cu(331)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.55	0.05	0.90	[1]
	Cu(110)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.58	0.07	1.34	[1]
	Cu(650)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.59	0.04	0.86	[1]
	Cu(320)	CO_2	0.1 M $KHCO_3$	6.8	PrD+AlOH+1-PrOH	SHE	−1.52	0.07	1.3	[1]
Nanostructured Cu or OD-Cu	Cu NPs < 100 nm	CO_2	1 M $KHCO_3$	7.8	AcO+AlOH+1-PrOH	Ag/AgCl	−1.50	~7	~7	[2]

Cu NPs < 100 nm	CO	1 M $KHCO_3$	8.3	AcO+AlOH+1-PrOH	Ag/AgCl	−1.50	~31	~28	[2]
Cu 5 µm	CO_2	1 M $KHCO_3$	7.8	AcO+AlOH+1-PrOH	Ag/AgCl	−1.30	~3	~4	[2]
Cu 5 µm	CO	1 M $KHCO_3$	8.3	AcO+AlOH+1-PrOH	Ag/AgCl	−1.30	~7	~7	[2]
trans-CuEn	CO_2	0.1 M $CsHCO_3$	6.8	1-PrOH	RHE	−0.75	0.80	~4	[3]
BCF-Cu_2O	CO	1 M KOH	14	1-PrOH	RHE	−0.45	0.85	19.3	[4]
Cu/Cu_2O@NG	CO_2	0.2 M KI	5.17	1-PrOH	RHE	−1.90	~1.60	~10	[5]
Cu nanocavity	CO	1 M KOH	14	1-PrOH	RHE	−0.56	7.8 ± 0.5	21 ± 1	[6]
3-shell HoMSs	CO_2	0.5 M $KHCO_3$	7.5	1-PrOH	RHE	−0.65	11	~15	[7]
2-shell YSNPs	CO	1 M KOH	14	1-PrOH	Hg/HgO	−1.90	11	22	[8]
OD-Cu NCs	CO_2	0.1 M $KHCO_3$	6.8	1-PrOH	RHE	−0.95	1.74	8.8	[9]
HF-Cu	CO	1 M KOH	14	1-PrOH	RHE	−0.45	8.5	20	[10]
Cu AD	CO	1 M KOH	14	1-PrOH	RHE	−0.47	11	23	[11]
$Cu(OH)_2$-D	CO_2	0.1 M $KHCO_3$	6.8	1-PrOH	RHE	−0.98	~4	11	[12]
$Cu(OH)_2$-D	CO_2	1 M KOH	14	1-PrOH	RHE	−0.54	~17.5	7	[12]
CuOD-Cu	CO_2	0.1 M $KHCO_3$	6.8	1-PrOH	RHE	−0.94	4.61	17.9	[13]
CuOD-Cu	CO_2	1 M $KHCO_3$	7.8	1-PrOH	RHE	−0.94	8.51	6.96	[13]
R-Cu/Au	CO	1 M KOH	14	1-PrOH	RHE	−0.58	21.5	48.0	[14]
Cu_2S–Cu-V	CO_2	0.1 M $KHCO_3$	6.8	1-PrOH	RHE	−0.95	2.5 ± 0.1	8 ± 0.7	[15]
DSV-rich CuS_x	CO_2	0.1 M $KHCO_3$	6.8	1-PrOH	RHE	−1.05	3.10	15.4	[16]
Cu_2O-Cl	CO_2	0.1 M KCl	3.98	1-PrOH	RHE	−1.6	0.96	8.7	[17]
O-plasma Cu	CO_2	0.1 M $KHCO_3$	6.8	1-PrOH	RHE	−1.00	~3.2	~9	[17]
Cu_2O–I	CO	1 M KOH	14	C_3-C_6 AcE	RHE	−0.72	55	22	[18]

Doped or alloyed Cu	$Cu_{91}Pd_9$	CO_2	0.5 M $KHCO_3$	7.5	1-PrOH	RHE	−0.65	1.15	13.7	[19]
	$Cu_{98}Au_2$	CO_2	1 M KOH	14	1-PrOH	RHE	−0.41	12.7	18.2	[20]
	$Cu_{96}Ag_4$	CO	1 M KOH	14	1-PrOH	RHE	−0.46	4.5	33	[21]
	$Cu_{95}Ag_4Ru_1$	CO	1 M KOH	14	1-PrOH	RHE	−0.46	111	37	[22]
	$CuAg_{5\%}N_{20h}$	CO	1 M CsOH	14	1-PrOH	RHE	−1.00	67.5	45	[23]
	$Cu_{94}Ag_6$	CO_2	1 M $CsHCO_3$ + 0.3 M CO_2	5.4 ± 0.4	2-PrOH	RHE	−0.73	12.0	39.6	[24]
	$Cu_{94}Ag_6$	CO_2	1 M $CsHCO_3$ + 3 M CO_2		2-PrOH	RHE	−0.70	59.3	56.7	[24]
	Pb-Cu	CO	1 M KOH	14	1-PrOH	RHE	−0.68	38	47	[25]
CuSA	Cu-SA/NPC	CO_2	0.1 M $KHCO_3$	6.8	AcO	RHE	−0.36	2.35	36.7	[26]
Non-Cu	MoS_2	CO_2	0.1 M Na_2CO_3	6.8	1-PrOH	RHE	−0.59	0.25	3.5	[27]
	Ni_3Al	CO_2	0.1 M K_2SO_4	4.5	1-PrOH	Ag/AgCl	−1.38	0.04	1.9	[28]
	PD-Ni	CO_2	0.1 M $KHCO_3$	6.8	C_3 to C_6 HCs	RHE	−1.20	0.91	6.5	[29]
	NiP_2	CO_2	0.5 M $KHCO_3$	7.5	methylglyoxal	RHE	−0.10	0.39	84	[30]
	Ni_2P	CO_2	0.5 M $KHCO_3$	7.5	2,3-furandiol	RHE	0.00	0.02	71	[30]
	ImF-Mo_3P	CO_2	1 M KOH	14	C_3H_8	RHE	−0.80	359	91	[31]

a. Some abbreviations for catalysts: NPs, nanoparticles; trans-CuEn, transformed Cu-NP ensemble; BCF, branching cubic framework; NG, nitrogen-doped graphene; HoMSs, hollow multi-shell structures; YSNPs, yolk−shell nanoparticles; OD-Cu, oxide-derived Cu; NCs, nanocrystals; HF-Cu, highly fragmented Cu; Cu AD, Cu adparticle; $Cu(OH)_2$-D, $Cu(OH)_2$-derived Cu; CuOD-Cu, CuO-derived Cu; R-Cu/Au, reconstructed Cu assisted with Au NPs; Cu_2S–Cu-V, core–shell Cu_2S–Cu with Cu vacancy; DSV, double sulfur vacancies; Cu_2O-Cl, chlorine-induced bi-phasic Cu_2O-Cu; Cu_2O-I, iodine-modified Cu_2O; $CuAg_{5\%}N_{20h}$, nitride-derived Cu with 5 mol% Ag and 20-h nitridation duration; Cu-SA/NPC, single-atom Cu encapsulated on nitrogen-doped porous carbon; PD-Ni, phosphate-derived Ni; ImF-Mo_3P, imidazolium-functionalized Mo_3P.

b. The values of pH were either directly adopted from the original study or estimated based on Ref.32.

c. Abbreviations for products: PrD, propionaldehyde; AlOH, allyl alcohol; 1-PrOH, 1-propanol; AcO, acetone; AcE, acetate ester; 2-PrOH, 2-propanol; HCs, hydrocarbons; C_3H_8, propane.

d. The values of potential were directly adopted from the original study, and some of these values were not subjected to *i*R-correction.

e. j_{C3+}, partial current density of C_{3+}; FE, Faradaic efficiency.

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