Supplementary Information

Electrochemical Reactors for the Utilization of Liquid-Phase Carbon Species

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Table S1 Reported utilization of various concentrated carbon capture solutions and their performance across different catalysts.

Capture agent	Catalyst	Cell type	Products	j (mA cm^{-2})	FE(%)	Reference
$NaHCO_3/Na_2CO_3$	Hg	/	$HCOO^-$	/	/	*J. Electrochem. Soc.* **130,** 2387–2390 (1983).
7 M $CsHCO_3$	$Pt/(PQ^{2+}\cdot Pd)_n$	/	$HCOO^-$	/	85	*J. Am. Chem. Soc.* **106**, 3673-3675 (2002)
2.8 M $KHCO_3$	Pd/C	H-cell	$HCOO^-$	/	98	*J. Am. Chem. Soc.* **137**, 4701-4708 (2015).
30% MEA with 0.1% CTAB	In	H-cell	CO	/	38	*ChemSusChem* **10**, 4109-4118 (2017).
1.25 M CHP-H_2CO_3	Ag	MEA	CO	78	30	*Green Chem.* **20**, 620-626 (2018).
1 M K_2CO_3	Ag	MEA	CO	100	28	*ACS Energy Lett.* **4,** 1427-1431 (2019).
3 M $KHCO_3$	Ag	MEA	CO	25	81	*Joule* **3**, 1487-1497 (2019).
3 M $KHCO_3$	Ag	MEA	CO	100	82	*ACS Energy Lett.* **5,** 2165-2173 (2020).
3 M $KHCO_3$	Bi/C	MEA	$HCOO^-$	100	64	*ACS Energy Letters* **5,** 2624-2630 (2020).
30% MEA	Ag	MEA	CO	50	72	*Nat. Energy* **6,** 46-53 (2020).
1.5 M $CsHCO_3$	Ag foam	MEA	CO	100	80	*ChemElectroChem* **8,**

						2094-2100 (2021).
1.5 M $KHCO_3$	Sn	H-cell	$HCOO^-$	6	18	*Electrochem* **2,** 64-70 (2021).
1 M NH_4HCO_3	Br-Ag(OR)	H-cell	CO	14	78	*Energy* **216,** 119250 (2021).
2 M AMP in PC	Pb foil	Flow cell	$HCOO^-$	25	50	*Ind. Eng. Chem. Res.* **60,** 4269-4278 (2021).
2 M $KHCO_3$ with 1 mM CKC	Sn	H-cell	$HCOO^-$	2	66	*J. CO_2 Util.* **48,** 101521 (2021).
3 M $KHCO_3$	Ag foam	MEA	CO	100	59	Energy Environ. Sci. **15,** 705-713 (2022).
3 M $KHCO_3$	Ag foam	MEA	CO	100	40	*ACS Cent. Sci.* **8,** 749-755 (2022).
2.5 M NH_4HCO_3	Bi	MEA	$HCOO^-$	100	82	*ACS Energy Lett.* **7,** 4483-4489 (2022).
3 M $KHCO_3$	Ag foam	MEA	CO	50	68	*ACS Energy Lett.* **7,** *834-842 (2022).*
3 M $KHCO_3$ with 3 mM CTAB	Cu foam	MEA	CH_4	400	27	*ACS Energy Lett.* **7,** 1712-1718 (2022).
3 M $KHCO_3$	Ag	MEA	CO	100	68	*ACS Energy Lett.* **7,** 2382-2387 (2022).
3 M $KHCO_3$	Ni-N-C	MEA	CO	100	67	*ACS Appl. Mater. Interfaces* **14,** 54840-54847 (2022).
3 M $KHCO_3$	Cu/Ag bilayer	MEA	C_{2+}	100	42	*ChemSusChem* **15,**

						e202201329 (2022).
CO_2-capture solution	Ag	MEA	CO	200	46	*EES Catal.* **1,** 54-61 (2023).
5 M MEA	Ni-N/C	MEA	CO	50	65	*Energy Environ. Sci.* **15,** 4301-4312 (2022).
DAC solution	SnO_2/C	MEA	$HCOO^-$	50	16	*Energy Fuels* **36,** 13115-13123 (2022).
2 M $KHCO_3$	Ag NP	MEA	CO	100	40	*J. CO_2 Util.* **57,** 101878 (2022).
3 M TREA	Coral-Ag/C	MEA	CO	200	30	*Nat. Commun.* **13,** 7482 *(2022).*
1 M AMP	Ag	H-cell	CO	/	45	*Renewable Energy* **189,** 444-453 (2022).
2 M KCl + 2 M MEA	Ag	H-cell	CO	/	19	*ACS Catal.* **13,** 12322-12337 (2023).
0.1 M $KHCO_3$	Cu_2O/C	MEA	C_{2+}	60	48	*ACS Energy Lett.* **9,** 110-117 (2023).
3 M $KHCO_3$	Ag foam	MEA	CO	100	57	*ACS Energy Lett.* **8,** 1779-1784 (2023).
3 M $KHCO_3$	Sn	MEA	$HCOO^-$	100	71	*Cell Rep. Phys. Sci.* **4,** 101662 (2023).
3 M $KHCO_3$	Ag	MEA	CO	100	66	*J. Am. Chem. Soc.* **145,** 25933-25937 (2023).
CO_2 loaded 0.7 M MEA	Ag	/	CO	4	9	*Joule* **7,** 1260-1276 (2023).
1.5 M K_2CO_3	Cu/CoPc-CNTs	MEA	C_{2+}	300	47	*Joule* **7,** 1277-1288 (2023).

2 M $KHCO_3$ with 0.02 M DTAB	Ag	MEA	CO	100	70	*Molecules* **28 7,** 1951 (2023).
2 M $KHCO_3$	Ag	MEA	CO	13b	77	*Nanomaterials* **13,** 2314 *(2023).*
5 M K_2CO_3	Cu-Ag	MEA	C_2H_4	10b	10	*ACS Appl. Energy Mater.* **7,** 1224-1233 (2024).
Carbon capture solution	Ag-$Cu(OH)_2$	MEA	C_{2+}	100	22	ACS Energy Lett. **9,** 2326-2332 (2024).
3 M $KHCO_3$	Ni-N-C	MEA	CO	100	59	*AlChE J.* **70**, e18465 (2024).
3 M $KHCO_3$ with APCA	Ag	MEA	CO	100	51	*AlChE J.* **70**, e18599 (2024).
3 M $KHCO_3$	Ag@TiO2/CP	H-cell	CO	3	60	*Angew. Chem., Int. Ed.* **63**, e202404758 (2024).
EDA+KCl+CATB+H_2O	Ag	Flow cell	CO	/	52	*Chem. Eng. J.* **498**, 155056 (2024).
3 M $KHCO_3$	Ag PVD	MEA	CO	100	82	*ChemSusChem* e202401631 (2024).
3 M $KHCO_3$	Bi	MEA	$HCOO^-$	300	85	*EES Catal.* **2**, 1277-1284 (2024).
3 M $KHCO_3$	Ni-SAC	MEA	CO	186b	93	*Energy Environ. Sci.* **17**, 3570-3579 (2024).
1 M K_2CO_3	Ag	MEA	CO	200	43	*Energy Fuels* **38**, 6223-6229 (2024).
0.5 M $KHCO_3$	CoPc@CNT	Cross-flow MEA	CO	300	96	*Joule* **8**, 1999-2015 (2024).

5 M K_2CO_3	Ag	MEA	CO	100	30	*Joule* **8**, 3106-3125 (2024).
AMP-CO_2	Pb	H-cell	$HCOO^-$	1.3	80	*Nat. Commun.* **15**, 9207 (2024).
2 M K-GLY	Ni-N/C	MEA	CO	50	64	*Nat. Commun.* **15**, 7849 (2024).
30 wt% aqueous amine solution	Ag NPs/CP	H-cell	CO	/	45	*Sep. Purif. Technol.* **355**, 129575 (2025).

Table S2. Composition and concentrations of the natural seawater.

Constituents	Natural oceanwater (mM)
Na^+	480.61
Mg^{2+}	54.13
Ca^{2+}	10.52
K^+	10.46
NH_4^+	n.a.

Li^+	n.a.
Cl^-	559.39
SO_4^{2-}	28.935
HCO_3^-	1.891
CO_3^{2-}	0.189
Br^-	0.863
NO_3^-	n.a.
CH_3COO^-	n.a.
F^-	0.07