Table 1 Summary of metal nanoclusters for CO_2 reduction reaction.

Cluster	Catalyst	Support	Particle size (nm)	Product	Activity				Ref.
					FE (%)	Current density (mA cm^{-2})	Potential (V vs. RHE)	Stability (h)	
Cu	Cu clusters/DRC	Defect-rich carbon	≈1	CH$_4$	81.7	-18	-1	40	[1]
Cu	CuHHTP	metal-organic framework	3.5	CH$_4$	73	-10.8	-1.4	-	[2]
Cu	CuNC-DCD	ZIF-8 incorporated with dicyandiamide	1	CO	93.5	-11.25	-0.05	-	[3]
Au	Au50Pb50	metallic Pb NPs	~5	CH$_4$	2.8	-0.3	-1.07	3	[4]
Ni	A-Ni-NSG	N-doped graphene	~0.2	CO	98	-22	-0.5	100	[5]
Ni	NiNx-600	XC-72R carbon	-	CO	~100	-61.85	-1.2	10	[6]
Fe	Fe-N-PC	Porous carbon nanosphere	~2	CO	>90	-11.4	-0.49	-	[7]
Sb	Sb-Cu$_2$O	Cu$_2$O	12-15	CO	96	-37.3	-0.8	40	[8]
In$_2$O	Ag$_2$-In$_8$/CNC	Ag NP	~5	HCOOH	95.5	-3.53	-0.9	7	[9]
MoP	MoP-Im	-	8-10	C$_2$H$_5$OH	77.4	-90	-0.2	110	[10]
Cu	EOR-Cu(bipy)Br	-	~1	CH$_4$	~50	-300	-0.8	-	[11]
	ER-Cu(bipy)Br	-	~2.5	C$_2$H$_4$	20-40	-150-350	-0.8	-	
SnO$_x$	SnO$_x$/ZC	ZIF 8-derived carbon	~1	HCOOH	90.5	-200	-0.67	10	[12]
PdMo	Pd$_7$Mo$_1$/ZC	ZIF 8-derived carbon	~2-4	CO	~40	-200	-0.9	-	[13]
PdNi	Pd$_2$Ni$_8$/ZC	ZIF 8-derived	~2	CO	95.3	-200	-0.56	-	[14]

carbon

___

REFERENCES

1.	Q. Hu, Z. Han, X. Wang, G. Li, Z. Wang, X. Huang, H. Yang, X. Ren, Q. Zhang, J. Liu and C. He. Facile Synthesis of Sub-Nanometric Copper Clusters by Double Confinement Enables Selective Reduction of Carbon Dioxide to Methane. *Angewandte Chemie International Edition*, 2020, **59**, 19054–19059.

2.	J.-D. Yi, R. Uikuan Xie, Z. A.-L. Xie, G.-L. Chai, T.-F. Liu, R.-P. Chen, Y.-B. Huang and R. Cao. Highly Selective CO_2 Electroreduction to CH_4 by In Situ Generated Cu_2O Single-Type Sites on a Conductive MOF: Stabilizing Key Intermediates with Hydrogen Bonding. *Angewandte Chemie*, 2020, **132**, 23849–23856.

3.	L. Yan, X.-D. Liang, Y. Sun, L.-P. Xiao, B.-A. Lu, G. Li, Y.-Y. Li, Y.-H. Hong, L.-Y. Wan, C. Chen, J. Yang, Z.-Y. Zhou, N. Tian and S.-G. Sun. Evolution of Cu single atom catalysts to nanoclusters during CO_2 reduction to CO†. *Chemical Communications*, 2022, **58**, 2488–2491.

4.	A. M. Ismail, G. F. Samu, H. C. Nguyën, E. Csapó, N. López and C. Janáky. Au/Pb Interface Allows the Methane Formation Pathway in Carbon Dioxide Electroreduction. *ACS Catal*, 2020, **10**, 5681–5690.

5.	H. Bin Yang, S. F. Hung, S. Liu, K. Yuan, S. Miao, L. Zhang, X. Huang, H. Y. Wang, W. Cai, R. Chen, J. Gao, X. Yang, W. Chen, Y. Huang, H. M. Chen, C. M. Li, T. Zhang and B. Liu. Atomically dispersed Ni(i) as the active site for electrochemical CO_2 reduction. *Nat Energy*, 2018, **3**, 140–147.

6.	Q. Hao, D.-X. Liu, R. Deng and H.-X. Zhong. Boosting Electrochemical Carbon Dioxide Reduction on Atomically Dispersed Nickel Catalyst. *Front Chem*, 2022, **9**,.

7.	Y. Chen, L. Zou, H. Liu, C. Chen, Q. Wang, M. Gu, B. Yang, Z. Zou, J. Fang and H. Yang. Fe and N Co-Doped Porous Carbon Nanospheres with High Density of Active Sites for Efficient CO_2 Electroreduction. *The Journal of Physical Chemistry C*, 2019, **123**, 16651–16659.

8.	J. Zeng, M. R. Fiorentin, M. Fontana, M. Castellino, F. Risplendi, A. Sacco, G. Cicero, M. A. Farkhondehfal, F. Drago and C. F. Pirri. Novel Insights into Sb-Cu Catalysts for Electrochemical Reduction of CO_2. *Appl Catal B*, 2022, **306**, 121089.

9.	D. Bhalothia, H.-Y. Liu, S.-H. Chen, Y.-T. Tseng, W. Li, S. Dai, K.-W. Wang and T.-Y. Chen. The sub-nanometer In_2O clusters on Ag nanoparticles with highly selective electrochemical CO_2 reduction to formate. *Chemical Engineering Journal*, 2024, **481**, 148295.

10.	M. Esmaeilirad, A. Kondori, N. Shan, M. T. Saray, S. Sarkar, A. M. Harzandi, C. M. Megaridis, R. Shahbazian-Yassar, L. A. Curtiss, C. U. Segre and M. Asadi. Efficient electrocatalytic conversion of CO_2 to ethanol enabled by imidazolium-functionalized ionomer confined molybdenum phosphide. *Appl Catal B*, 2022, **317**, 121681.

11. H. Zhang, Y. Yang, Y. Liang, J. Li, A. Zhang, H. Zheng, Z. Geng, F. Li and J. Zeng. Molecular Stabilization of Sub-Nanometer Cu Clusters for Selective CO2 Electromethanation. *ChemSusChem*, 2022, **15**, e202102010.

12. H. Kim, K. Lee and C. W. Lee. 1 nm Tin Oxide Cluster for the Electrochemical Conversion of Carbon Dioxide to Formate at Low Overpotential. *Int J Energy Res*, 2024, **2024**, 1367542.

13. D. T. Wijaya and C. W. Lee. Pd–Mo bimetallic catalysts for electrochemical reduction of carbon dioxide to carbon monoxide. *Journal of Electroanalytical Chemistry*, 2024, **953**, 118007.

14. D. T. Wijaya, A. Haryanto, H. W. Lim, K. Jin and C. W. Lee. Sub-2 nm mixed metal oxide for electrochemical reduction of carbon dioxide to carbon monoxide. *Journal of Energy Chemistry*, 2023, **84**, 303–310.