Electronic Supporting Information

Tuning Nanocavities of Au@Cu₂O Yolk-Shell Nanoparticles for Highly Selective Electroreduction of CO₂ to Ethanol at Low Potential

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This file includes Figure S1-S8 and Table S1.



Fig. S1 (a, b) Low and high magnification TEM images, (c) HRTEM image and (d) size distribution histogram of Au NPs.



Fig. S2 Geometry of the Au@Cu₂O composite particle.



Fig. S3 TEM images and corresponding R and R1 distribution of different samples: (a-c) Au@Cu₂O-SC, (d-f) Au@Cu₂O-MC, (g-i) Au@Cu₂O-LC.



Fig. S4 (a) LSV curves of Au@Cu₂O-MC in Ar- and CO₂-saturated 0.1 M KHCO₃ electrolyte, and (b) comparison of LSV curves in CO₂-saturated 0.1 M KHCO₃ electrolyte of different samples at the scan rate of 50 mV s⁻¹.

Sample	V <i>vs</i> . RHE	FE _{C2H5OH}	Durability (h)	Electrolyte	Set-up	Ref.
Au@Cu ₂ O	-0.3	52.3	13.5	0.1 M KHCO ₃	H-cell	This Work
HF-Cu	-0.33	32	3.33	1 M KOH	Flow- cell	Nat Catal. 2019, 2, 251
Cu ₂ S-Cu-V	-0.95	15	17	0.1 M KHCO ₃	H-cell	Nat. Catal. 2018, 1, 421
Cu-C ₃ N ₄	-1.0	5	16.67	0.1 M KHCO ₃	H-cell	J. Am. Chem. Soc. 2017, 139, 18093
Activated Cu Mesh	-1.0	13	6	0.5 M KHCO ₃	H-cell	ACS Catal. 2017, 7, 7946
Cu/CNs	-1.2	63	6.25	0.1 M KHCO ₃	H-cell	<i>ChemistrySelect</i> 2016, 1, 6055
Ag-Cu ₂ O	-1.2	35%	3	0.2 M KCl	H-cell	ACS Catal. 2017, 7, 8594
Cu-Ag Alloys (6%)	-0.68	25.9	-	1 M KOH	Flow- cell	J. Am. Chem. Soc. 2018, 140, 5791
3.6 µm film Cu ₂ O/Cu discs	-0.99	16	1	0.1 M KHCO ₃	Flow- cell	ACS Catal. 2015, 5, 2814
Polycrystallin e Copper	-1.0	7.9	1.5	0.1 M KHCO ₃	H-cell	<i>ChemElectroChem</i> 2016, 3, 1012
Cu-N ₄	-1.2	55	1	0.1 M CsHCO ₃	H-cell	Angew. Chem. Int. Ed. 2019, 58, 15098
Ag/Cu	-0.67	41	2.17	1 M KOH	Flow- cell	J. Am. Chem. Soc. 2019, 141, 8584
AuCu/Cu-SC	-1.0	29	24	0.5 M KHCO ₃	H-cell	Small 2019, 15 1902229
GO-VB ₆ -Cu	-0.25	56.3	10	0.1 M KHCO ₃	H-cell	<i>J. CO₂ Util.</i> 2019, 33 452
Cu _x Au _y NW Arrays	-0.7	48	8	0.1 M KHCO ₃	H-cell	J. Energy Chem. 2019, 37, 176

Table S1. Performance comparison of FE_{C2H5OH} of CO_2RR catalysts



Fig. S5 Comparison of Faradaic efficiencies of hydrogen for different samples under a range of potentials.



Fig. S6 CV curves measured at different scan rates from 10, 20, 30, 40 to 50 mV s⁻¹ in 0.1 M KHCO₃ for (a) Au@Cu₂O-SC, (b) Au@Cu₂O-MC, (c) Au@Cu₂O-LC.



Fig. S7 The C_{dl} for different samples.



Fig. S8 (a) TEM image and (b) XRD pattern of Au@Cu₂O-MC after CO_2RR .