Supporting information

CO_2 ELECTROREDUCTION TOWARD ETHYLENE ON COPPER PHOSPHATE-DERIVED CATALYSTS IN ALKALINE FLOW CELL

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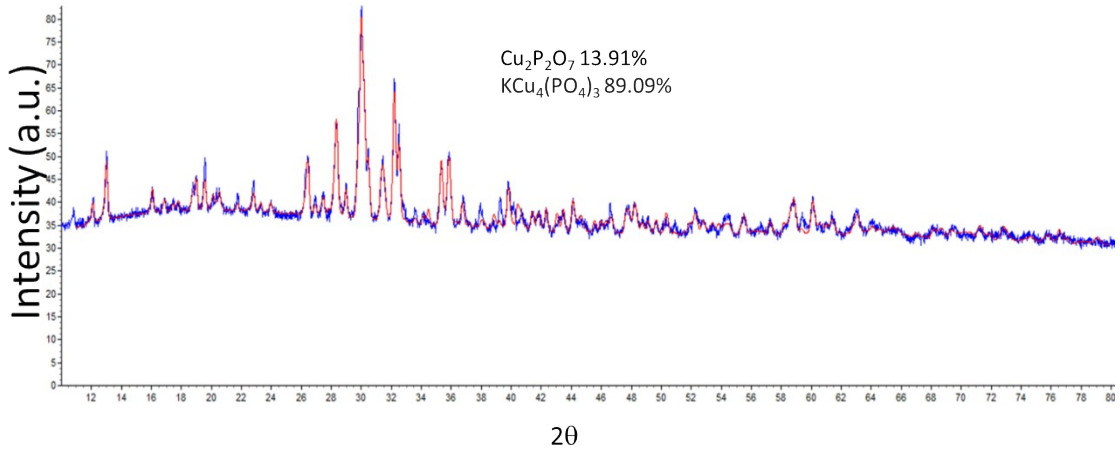


Figure S1: XRD of annealed copper phosphate.

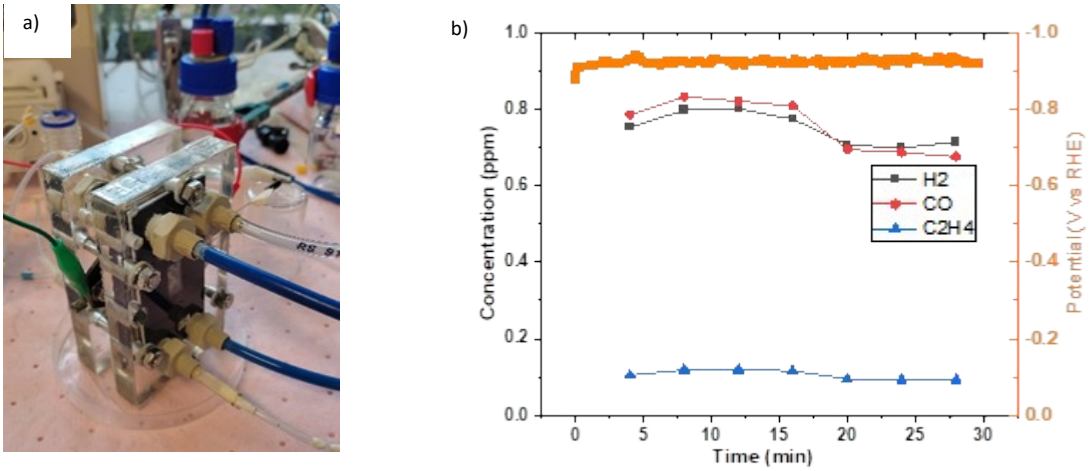


Figure S2: a) Picture of the flow cell, b) Online GC response for gas product and corresponding potential as a function of time in 1M KOH and at 150 mA cm^{-2}.

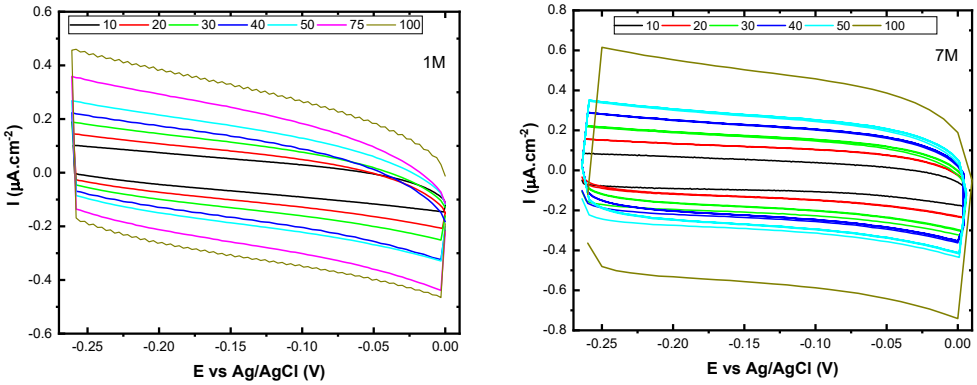


Figure S3: Electrochemical surface area (ECSA) measurements in 1M and 7M KOH for copper phosphate electrodes.

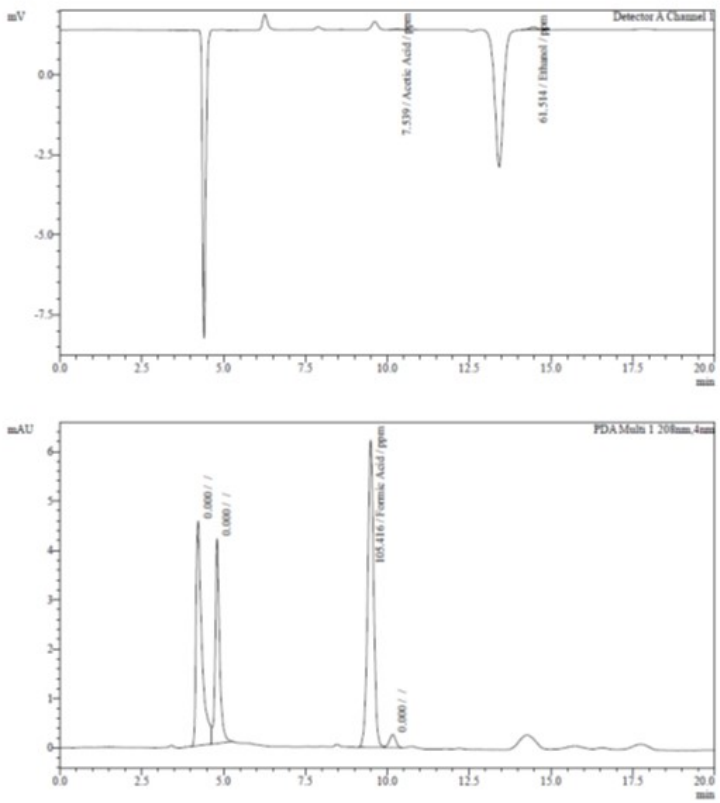


Figure S4: HPLC chromatograms obtained using a catalyst loading of 1 mg.cm^{-2} and a current density of -200 mA.cm^{-2}

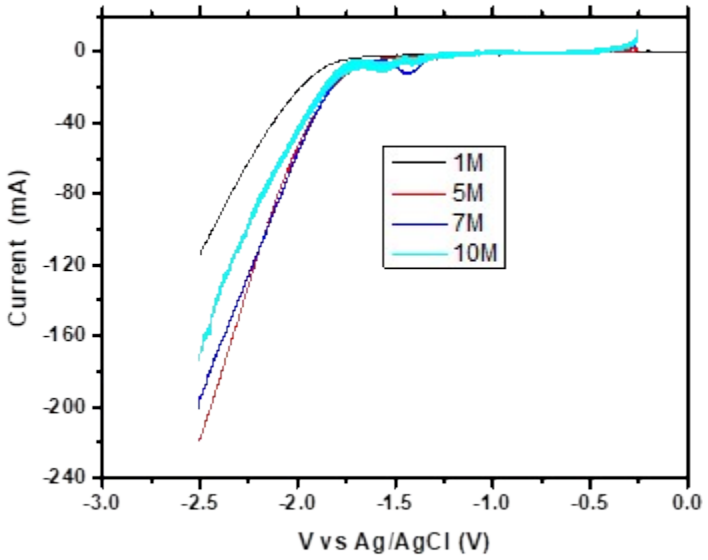
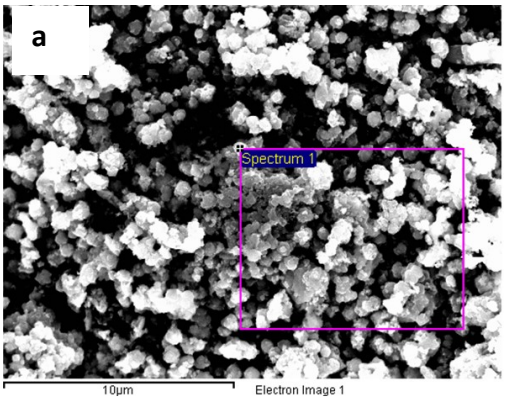
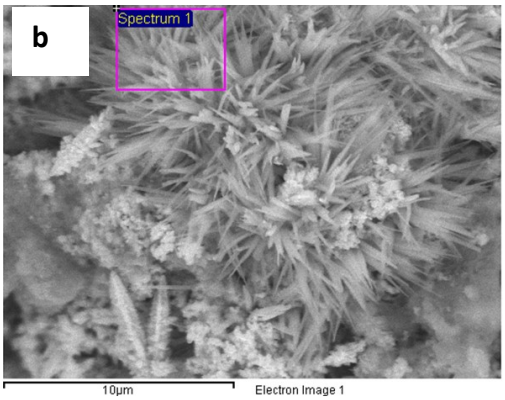


Figure S5: Linear sweep voltammetry curves at different KOH concentrations at 30 $mV.s^{-1}$





Element	Weight%	Atomic%
N	4.50	12.41
O	6.62	15.97
S	29.57	35.59
Cu	59.31	36.03
Totals	100.00	

Element	Weight%	Atomic%
O	32.32	58.80
F	4.27	6.54
Si	0.38	0.40
P	0.43	0.40
K	18.13	13.49
Cu	44.47	20.37
Totals	100.00	

Figure S6: Scanning electron microscopy images with energy dispersive spectroscopy of a) unflooded and b) flooded GDE in 1M KOH.

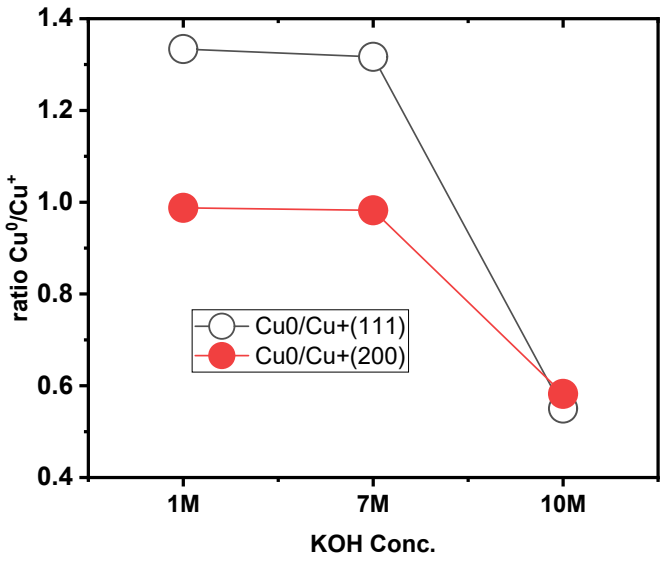


Figure S7: Cu^0/Cu^+ ratio after CO_2ER in a flow-cell electrolyzer with different concentrations of KOH electrolyte.

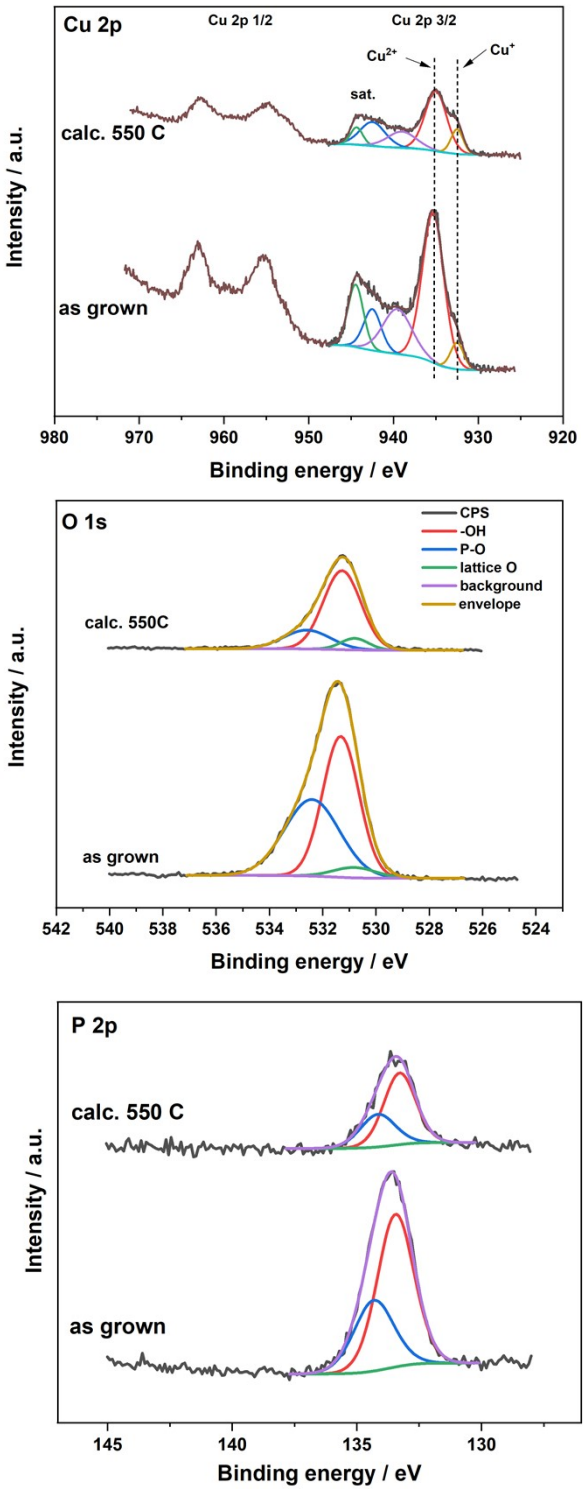


Figure S8: XPS of as-grown and annealed copper phosphate.

Table S1: Comparison of electroreduction performance of phosphate-based copper catalysts with our work

Electrocatalysts	Electrolyte	Cell configuration	FE for major products	Current ($mA\ cm^{-2}$)	Ref
Phosphate modified 3D Cu	MeCN	H-cell	81% HCOOH (-1.45V vs. NHE)	~1.5	1
Polycrystalline Cu3P	0.1M $KHCO_3$		0.9 HCOOH (-0.1 V vs. RHE))	<0.02	2
$Cu_3(PO_4)_2$ nanosheets	0.1M $KHCO_3$	H-cell	67% C_2H_4 (-1.48V vs RHE)	-22.3	3
$Cu_2(PO_4)(OH)$	1M KOH	Flow-cell	~40% C_2H_4 (-1.377V vs. RHE)	112	4
$Cu_2P_2O_7$	0.1M KOH	MEA	39.8% C_2H_4 (3.4V cell voltage)	139.3	5
Phosphate-derived CuO_x/C	0.1M $KHCO_3$	H-cell	~30% C_2H_4 (-1.3 V vs. RHE)	~8	6
Copper phosphate nanospheres	1M KOH	Flow-cell	47% C_2H_4 (-1.4 vs. RHE)	164.5e	7
Copper hydroxyphosphate	0.1M $KHCO_3$	H-cell	37.4% C_2H_4 (-1.6V vs. RHE)	~15	8
CuPO	0.1M KHCO3	H-cell	69.7% C_2H_4 (-1.45V vs RHE)	-23	9
	2M KOH	Flow-cell	52.8% C_2H_4	184.8	
Copper phosphate	1M KOH	Flow-cell	35% C_2H_4 (-1.07V vs RHE)	52.5	This work
	7M KOH	Flow-cell	55% C_2H_4 (-0.97V vs RHE)	80	

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