

Supplementary Information

Carbon Corrosion in Low-Temperature CO₂ Electrolysis Systems

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Supplementary Figures

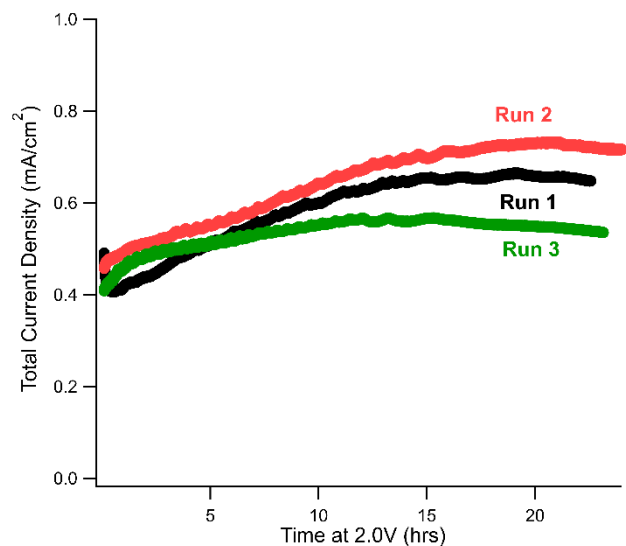


Figure S1: Current density measured during replicate carbon corrosion experiments in phosphate electrolyte solution (5mM, pH = 8). Corrosion voltage held at 2.0V (vs Ag/AgCl) for 24hrs.

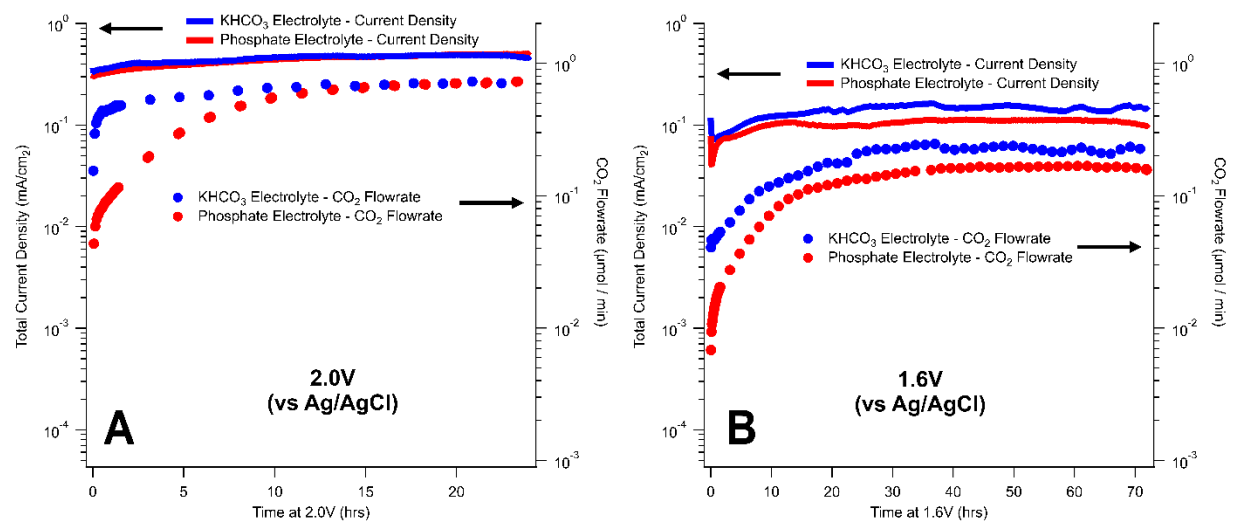


Figure S2: Comparison of carbon corrosion rates in phosphate (red) and bicarbonate (blue) electrolyte solutions. Current density (lines, left axis) and CO₂ evolved (dots, right axis) are plotted against time for experiments held at 2.0V vs Ag/AgCl for 24 hrs (A) or 1.6V vs Ag/AgCl for 72hrs (B).

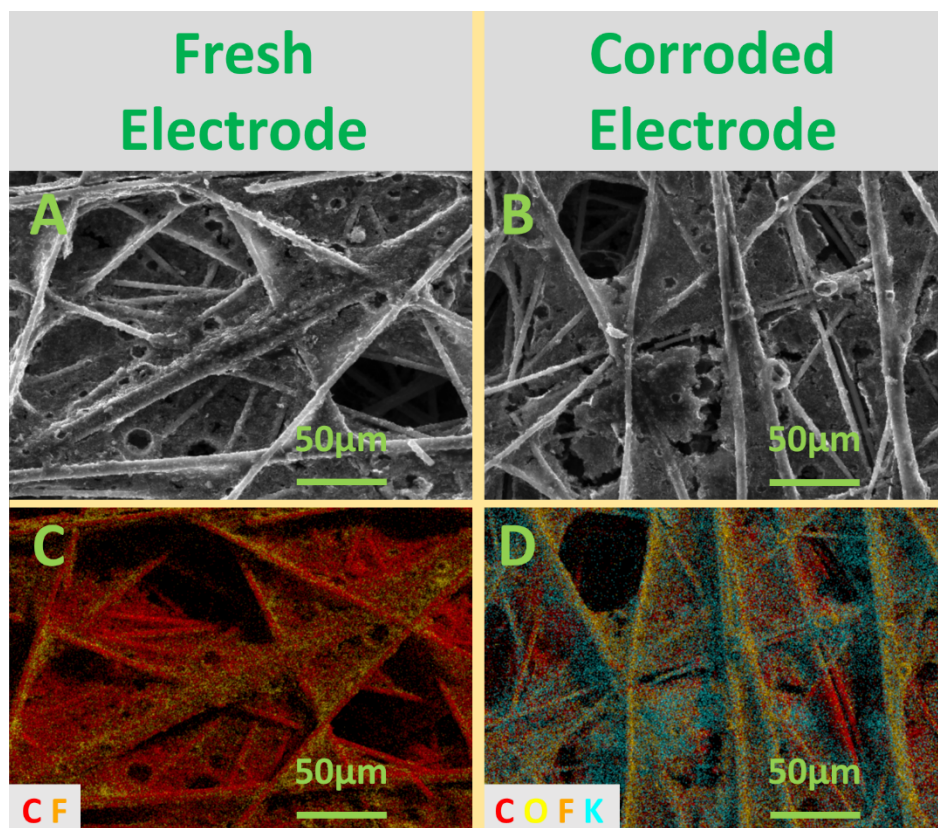


Figure S3: SEM images and EDS mapping of a fresh (A, C) and corroded (B, D) AvCarb GDL on the macroporous carbon fiber side. Corrosion conditions were 48hrs at 2.0V vs Ag/AgCl in bicarbonate electrolyte solution. SEM images of the macroporous fiber layer (A, B) are displayed along with the corresponding EDS map (C, D) for those images.

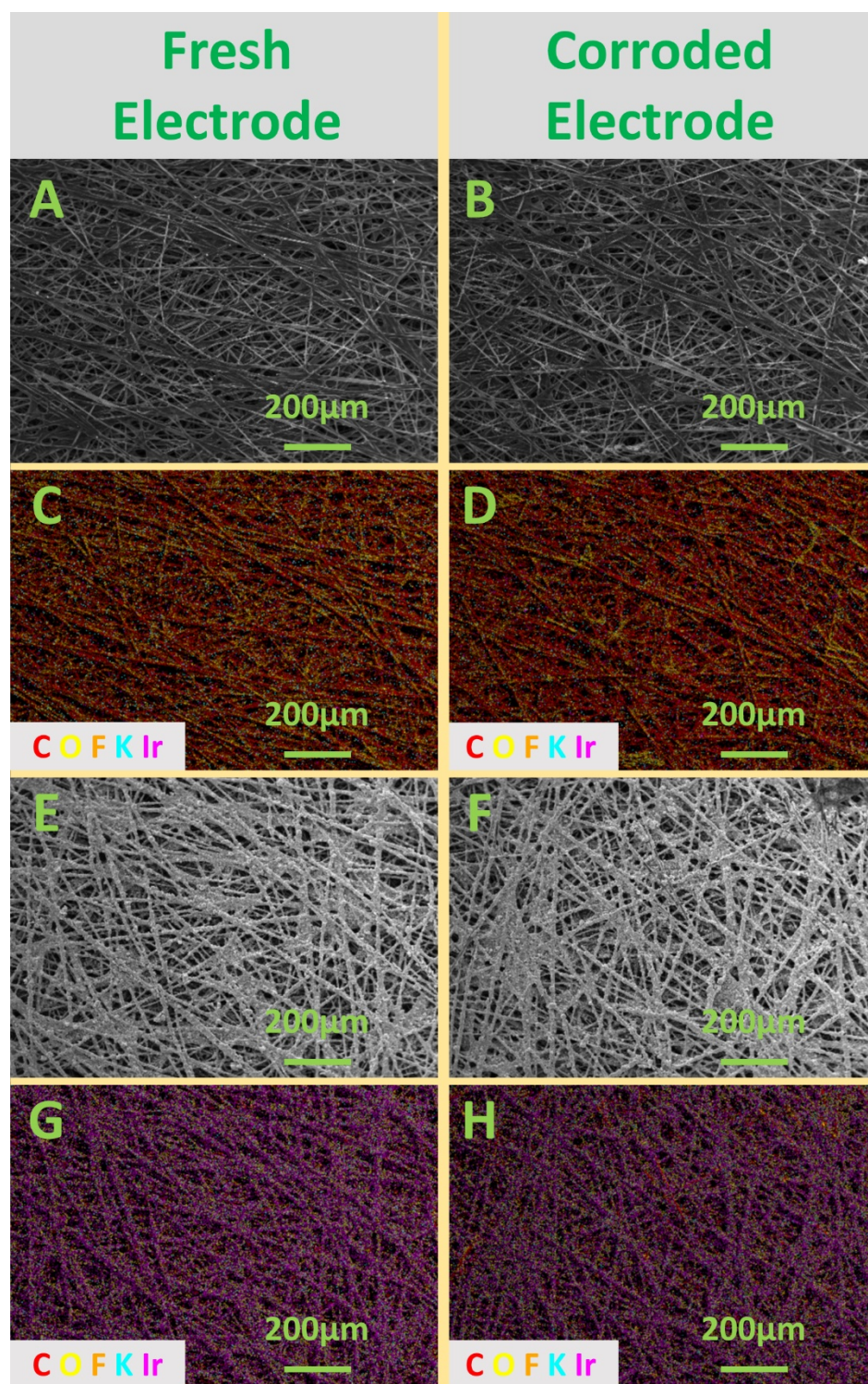


Figure S4: SEM images (A, B, E, F) and EDS mapping (C, D, G, H) of a fresh (left) and corroded (right) IrO₂-coated GDL. Corrosion conditions were 72hrs at 2.0V vs Ag/AgCl in phosphate electrolyte solution. Both the diffusion layer (A, B, C, D) and catalyst layer (E, F, G, H) were imaged and mapped before and after corrosion.

Supplementary Tables

Table S1 Reported properties of GDLs from various manufacturers.

Anode Material	Reported Thickness (μm)	Area Density (g/cm^2)	CFL PTFE Loading (wt. %)	MPL PTFE Loading (wt. %)	Through-Plane Resistivity ($\text{m}\Omega\cdot\text{cm}^2$)
AvCarb GDS 5130	283	70	?	?	11
Sigracet 39BB	315	95	5%	20 – 25%	<13
Toray Paper (TGP-H-120 w/ MPL)	430	~127	8-9%	33 – 35%	?
TiO ₂ Fiber Felt	200-300	-	-	-	-

Table S2: ICP-OES analysis of fresh and spent electrodes from select corrosion experiments involving IrO₂-coated and catalyst-free GDLs in phosphate electrolyte.

Electrode ICP Results					
Corrosion Conditions	IrO ₂ Coated Electrode?	Concentrations (ppm)			
		Cu	Ir	K	P
Fresh Electrode	No	<250	-	<250	<250
2.0V, 24hrs	No	109	230.62	65612.16	603.47
2.0V, 72hrs	Yes	<20	36834.24	19896.34	68.82
1.6V, 168hrs	Yes	37.4	42449.43	20194.23	72.47

Table S3: ICP-OES analysis of fresh and spent phosphate electrolyte solutions from select corrosion experiments involving IrO₂-coated and catalyst-free GDLs.

Electrolyte ICP Results					
Corrosion Conditions	Electrolyte from Experiment with IrO ₂ Coated Electrode?	Concentrations (ppm)			
		Cu	Ir	K	P
Fresh Electrolyte	–	<20	<20	1145.76	185.88
2.0V, 24hrs	No	<20	<20	1023.28	187.75
2.0V, 72hrs	Yes	<20	<20	1169.75	184.55
1.6V, 168hrs	Yes	<20	<20	1390.58	177.93