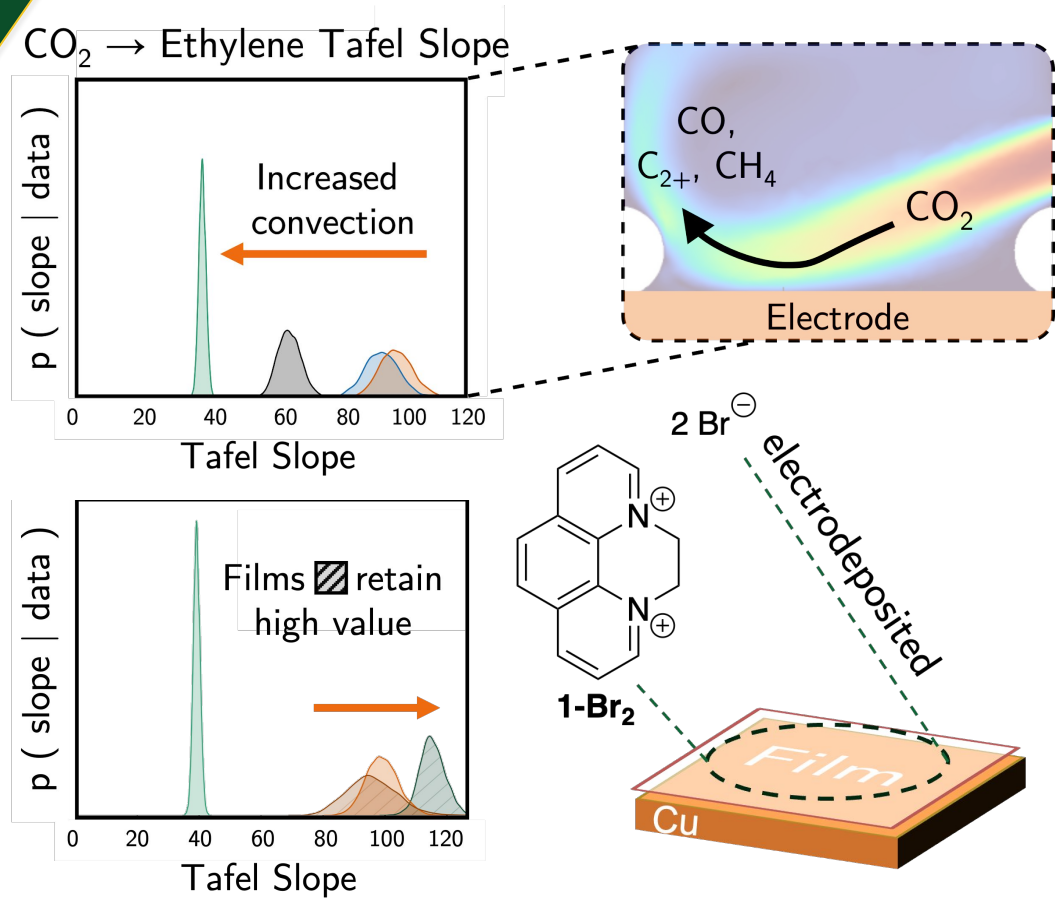
Hydrodynamics Change Tafel Slopes in Electrochemical CO_2 Reduction on Copper



Scientific Achievement:

We find that increased hydrodynamics at the electrode surface results directly in changes to the ethylene and methane Tafel slopes, demonstrating that mass transport is on equal footing with catalyst active sites in determining reaction mechanisms and the ensuing product distribution.

Significance and Impact:

Mass transport is traditionally considered to be in the purview of systems-level engineering, yet the present work shows that CO_2R mechanistic work must be considered in the context of the mass transport conditions.

Research Details:

- We extend our analysis to organic coatings, demonstrating that the films shield the active sites from variability in hydrodynamics and increase the residence time of CO so that it may be further reduced to desirable products.

Work performed at Caltech **PIs: Gregoire, Peters, Agapie, Goddard, & Atwater**

Watkins, N. B.; Schiffer, Z. J.; Lai, Y.; Musgrave, C. B. I.; **Atwater, H. A.; Goddard, W. A. I.; Agapie, T.; Peters, J. C.; Gregoire, J. M.** Hydrodynamics Change Tafel Slopes in Electrochemical CO_2 Reduction on Copper. *ACS Energy Lett.* **2023**, 8,5, 2185–2192. DOI: 10.1021/acsenergylett.3c00442.

Supported by the Office of Basic Energy Sciences' Fuels from Sunlight Hub under Award Number DE-SC0021266