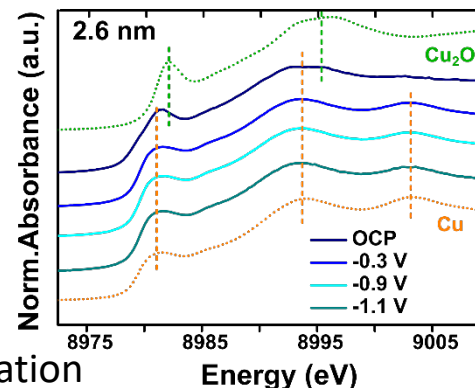
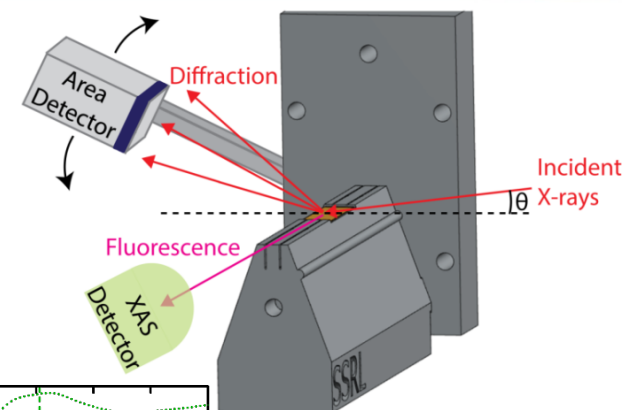


Scientific Achievement

We have probed top 2-3 nm of operating Cu CO₂ reduction catalysts, using *operando* measurements. We find that Cu oxides are reduced before CO₂ reduction begins, and the surface restructures towards the (100) facet under potential.

Significance and Impact

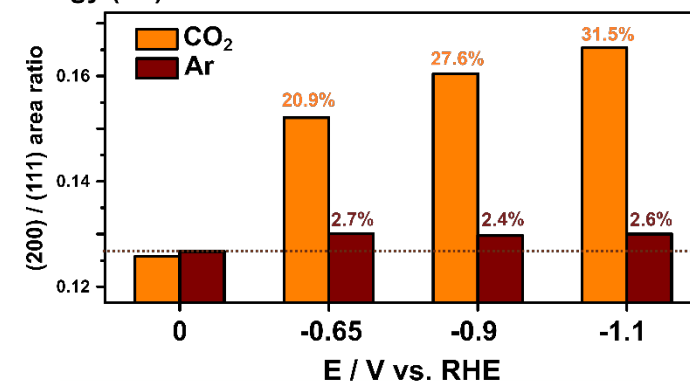
Our study shows that the active catalyst surface is metallic Cu, which restructures under potential only when CO₂ is present, possibly due to adsorbed CO intermediates.



Top: Illustration of flow cell design.

Left: XAS shows all oxides reduced by -0.3 V

Bottom: 20-30% restructuring to (100) facet observed from X-ray diffraction.



Research Details

- ❖ Electrochemical flow cell allows surface characterization during high current operation
- ❖ X-ray spectroscopy shows that all oxide is reduced by -0.3 V
- ❖ 20-30% restructuring towards (100) facet is only partially reversible and is not observed in our Ar control experiment.

Lee, Lin, Farmand, Landers, Feaster, Aviles Acosta, Beeman, Ye, Yano, Mehta, Davis, Jaramillo, Hahn, Drisdell. *J. Am. Chem. Soc.*, 2020, <https://doi.org/10.1021/jacs.0c10017>