Meyer

Redefining Benchmarks for the Electrocatalytic Reduction of CO_2 to Formate

Scientific Achievement

We have discovered an Ir(III) pincer dihydride complex that electrocatalytically reduces CO_2 to formate with a high efficiency (85%) at a rapid rate (20/s) with little to no competitive CO production (<1%).

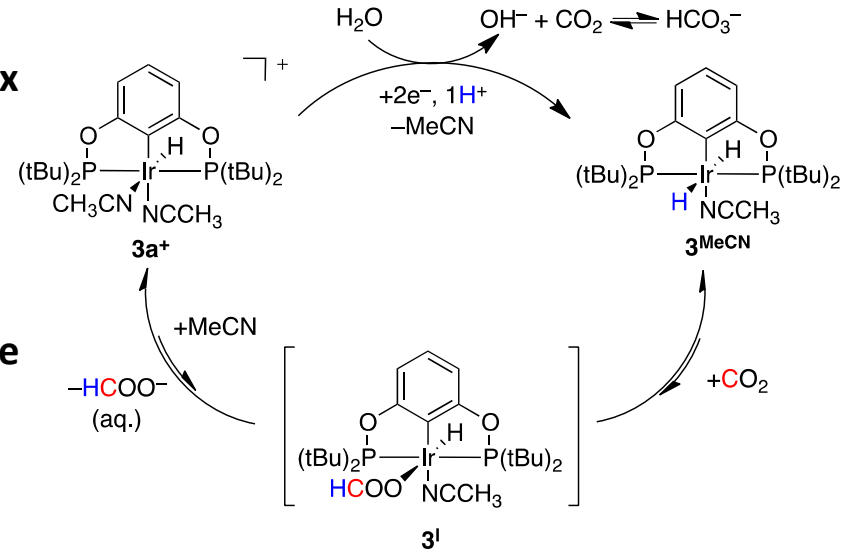
Significance and Impact

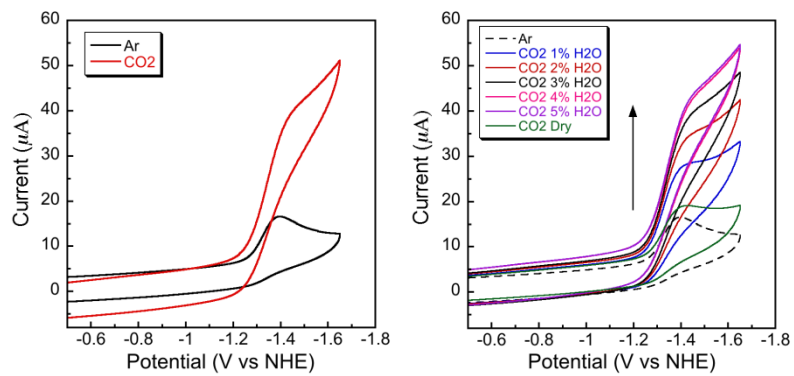
Until now, electrocatalytic reduction of CO_2 to formate using molecular catalysts was largely an inefficient process or was accompanied by the nonselective formation of CO and H_2. The Ir pincer catalyst described in this work overcomes many of these hurdles.

Research Details

- Five-coordinate, 16-electron Ir(III) pincer dihydrides readily insert CO_2 and are electrocatalysts for selective reduction of CO_2 to formate.
- Electrocatalytic CO_2 reduction in acetonitrile occurs at ca. –1.25 V vs NHE in the presence of water (5%).
- Water plays a critical role in decreasing the CO_2 reduction potential and increasing the catalytic rate.

Peng Kang, Chen Cheng, Zuofeng Chen, Cynthia K. Schauer, Thomas J. Meyer, Maurice Brookhart. *J. Am. Chem. Soc.* **2012**, *134, 5500..*





Top: Proposed mechanism for electrocatalytic CO_2 reduction in 5% H_2O/acetonitrile. ***Bottom***: Effect of increasing [H_2O].

Work was performed at the University of North Carolina at Chapel Hill