Produce Formate from CO_2 Using Gas Diffusion Electrodes

Meyer/UNC

Scientific Achievement

Designed Ir pincer catalyst loaded gas diffusion electrodes (GDEs) and used for efficient, selective electrochemical reduction of CO_2 to formate in water.

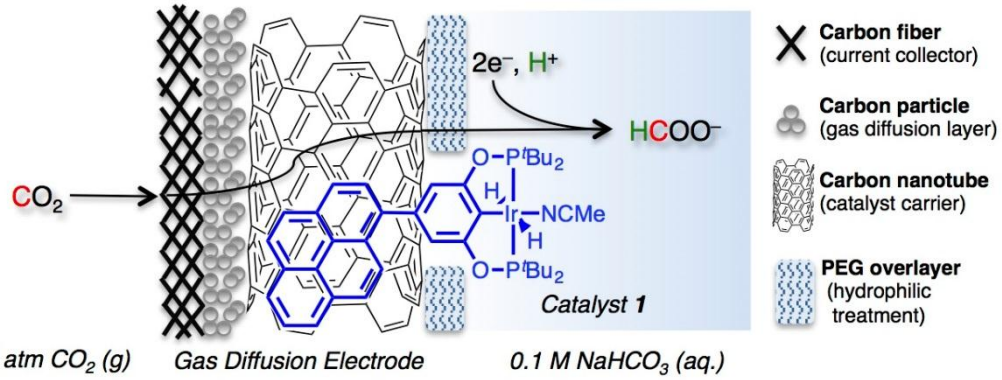
Significance and Impact

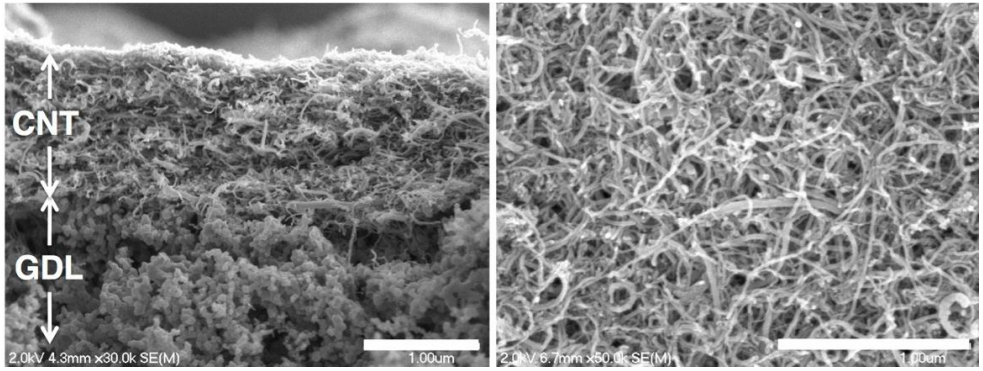
A breakthrough in CO_2 reduction science and technology.

A convenient, viable path to integrating organometallic catalysts into devices.

Research Details

- Synthesized pyrene-containing iridium pincer catalyst **1**, and stabilized on CNT thin films using non-covalent interaction.
- GDE consists of functional layered structures, and operates in a CO_2/GDE/electrolyte configuration, significantly facilitating CO_2 transport.
- Achieved current density of 15 mA/cm^2 at –1.4 V (vs. NHE), turnover numbers of 200,000, and turnover frequency of 10/s (long lived, stable catalyst configuration).





Structure and Operation of GDE: (Top) GDE immobilized with Ir pincer dihydride catalyst **1** for electrochemical reduction of CO_2 to formate at the interface of CO_2/water. (Bottom) SEM images of GDE showing intersection (left) and top-down (right) views. (GDL = gas diffusion layer, 50 μm thick; CNT = multi-walled carbon nanotube, 1.2 μm thick)

Work was performed at University of North Carolina at Chapel Hill

Kang, P.; Zhang, S.; Meyer, T.J. and Brookhart, M.S., Angewandte Chemie International Edition, **2014**, *manuscript in revision.*