

Electrocatalytic Reduction of CO₂ using Pendant Lewis-Acid Ruthenium Complexes

Thomas Campbell Chemistry Senior Seminar

Anthropogenic sources of CO₂, primarily the combustion of fossil fuels, have increased steadily since the industrial revolution. One solution to this problem is the reduction of CO₂ back into usable fuels such as methanol. This research focuses on creating ruthenium complexes to catalyze the reduction of CO₂ to methanol (CH₃OH). Specifically, a bidentate carbene ligand appended with a pendant Lewis acid site was synthesized. This ligand was added to Ru polypyridyl complexes resulting in either a saturated complex or one with an open coordination site where the Lewis acids were part of the secondary coordination sphere. The electrochemistry of these complexes was studied *via* cyclic voltammetry in acetonitrile under argon or CO₂. Several of the new complexes displayed electrocatalytic behavior under CO₂ with the most active complex being the Ru-carbene with an open coordination site. Comparison to Ru complexes that are not appended with pendant Lewis acids reveal the secondary coordination environment is germane to the observed activity. While the increased activity under CO₂ exhibited by these complexes indicates that reduction is occurring, further characterization of products by bulk electrolysis is needed to confirm the results of CO₂ reduction and to determine catalytic activity.