PRF# 57700-UR5

Understanding the electronic perturbation of metal catalysts toward a more efficient, less toxic catalyst for the electrochemical reduction of carbon dioxide to formate

PI John Haan, California State University, Fullerton

The first year of the proposed work has provided an excellent opportunity to: 1) develop a new direction in my lab and 2) involve various undergraduate students in this new direction.

During Summer and Fall 2017, I was on sabbatical and able to spend more time than usual in the research lab. During this time I held weekly meetings with my undergraduate and graduate students (approximately 25 students total). In these meetings we discussed progress and development of new techniques. In addition I spent several hours per week directly interacting with students at the lab bench to teach them and troubleshoot lab techniques in electrochemistry.

This first year of the grant has afforded a new direction in my research lab with an emphasis on reduction of carbon dioxide to make fuels. Our focus has been on production of formate and ethanol from carbon dioxide. So far we have developed benchmark analyses on Sn catalyst for formate production. We are in the process of developing an understanding of how the applied voltage impacts the production of formate. We are also in the process of synthesizing new catalysts (with other safer metals than Sn) in order to more efficiently and safely produce formate.

During this first year we have also forged a new collaboration with Dr. Michael Groves at CSUF. This collaboration involves the application of computational chemistry to strengthen the understanding of the role of metal catalysts as well as prediction of optimal catalyst combinations for more efficient production of formate. This collaboration has greatly strengthened as a result of this grant funding, and it will help strengthen the impact of this work on the scientific community.