Summary for Public Release

Project Title: Electrochemical Production of Formic Acid from Carbon Dioxide in Solid Electrolytes
Funding Opportunity Announcement: DE-FOA-0002203
Topic Area 7: Scalable CO_2 Electrocatalysis
Applicant Name: University of Delaware

Liquid products generated from electrochemical CO_2 reduction reaction (CO_2RR) are typically in a mixture with aqueous electrolytes (such as $KHCO_3$), which requires energy- and cost-intensive downstream product separation processes. In this project, the team proposes to revolutionize the reactor design for directly generating high-purity formic acid solutions via CO_2RR without purification. Electrochemically generated formate ions (from CO_2RR on cathode) and protons (from water oxidation on anode) move across the anion and cation exchange membranes, respectively, are recombined to form formic acid molecules within the porous solid electrolyte layer, which can be collected and carried out as pure formic acid solutions via the deionized (DI) water stream flowing through the pores within the PSE layer. A wide range of liquid fuel concentrations can be flexibly obtained via tuning the product generation rate and DI water flow rate. Those electrolyte-free formic acid products can be easily integrated with downstream bioreactors for further product upgrading.

The team has diverse expertise to tackle the technical challenges associated with solid electrolyte based CO_2 electrolyzers. The key team members include Feng Jiao (PI, University of Delaware), Haotian Wang (Rice University), Wilson Smith (National Renewable Energy Laboratory), Kenneth Neyerlin (National Renewable Energy Laboratory), and Todd Brix (OCO, Inc.). The duration of the project is 36 months. At the end of project, the team expects to bring the proposed technology to TRL-5 and explores its commercialization potential towards market.