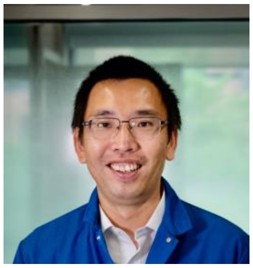

Materials Engineering Program
Texas Center for Superconductivity at Univ. of Houston
Center for Integrated Bio and Nano Systems
10:00 am, Friday, Oct. 13, 2023

This seminar will be held in hybrid mode.

Face to Face: **at HSC 102.** Zoom:
https://uh-edu-cougarnet.zoom.us/j/97136580701
Meeting ID: 971 3658 0701

CO_2 Electrolysis Systems for Chemical and Food Production

Dr. Feng Jiao
Washington University in St. Louis

Abstract: As our society faces the pressing challenges of climate change and global warming, driven in part by increasing atmospheric CO_2 levels, reducing CO_2 emissions has become a critical mission in the pursuit of a sustainable future. Traditional chemical industry processes often rely on fossil fuels, which inevitably emit substantial quantities of CO_2. In response, electrochemical processes have garnered interest for their potential to be more environmentally friendly and exhibit a smaller carbon footprint when powered by renewable energy sources. Our research group is currently dedicated to the development of CO_2 electrolysis devices that convert CO_2 into value-added chemicals and fuels through innovative electrocatalyst design and reactor engineering. In this presentation, we will showcase our recent work on a two-step tandem CO_2 electrolysis system. We have reported an internally coupled purification strategy that significantly enhances acetate concentration and purity in CO electrolysis.[1] This approach employs an alkaline-stable anion exchange membrane with high ethanol permeability and a selective ethanol partial oxidation anode to regulate the CO reduction product stream.We successfully demonstrated a stable 120-hour continuous operation of the CO electrolyzer at a current density of 200 mA cm-2 and a full-cell potential of less than 2.3 V, consistently producing a 1.9 M acetate product stream with a purity of 97.7%. This performance is among the best reported in the literature. The ability to convert CO_2 into acetate has opened the possibility of developing an electrochemical-biological hybrid approach to produce food from CO_2, offering much higher efficiency than natural photosynthetic pathways.[2]

Bio: Professor Feng Jiao holds a BSc in Chemistry from Fudan University in China and a PhD in Chemistry from the University of St Andrews in the United Kingdom. Following the completion of his postdoctoral training at the Lawrence Berkeley National Laboratory, he joined the faculty at the University of Delaware in 2010. Then, he was promoted to full professor in 2021 and served as the Director of the Center for Catalytic Science & Technology. In August 2023, Professor Jiao joined the Department of Energy, Environmental & Chemical Engineering at Washington University in St. Louis as the Elvera and William R. Stuckenberg Professor. He also serves as the founding director of the Center for Carbon Management. The Jiao research group is developing innovative electrochemical devices to address critical energy and sustainability challenges. Professor Jiao has published over 100 research papers, which have collectively received more than 17,000 citations. His contributions have been recognized with several awards and honors, including his election as a Fellow of the Royal Society of Chemistry, the receipt of the NSF CAREER Award, and recognitions as a 2020 Emerging Investigator by the Journal of Materials Chemistry A and a 2020 Scialog Fellow for the Negative Emission Science (NES) initiative.

References:

1. S. Overa, B. Crandall, B. Shrimant, D. Tian, B. H. Ko, H. Shin, C. Bae and F. Jiao*. Enhancing acetate selectivity by coupling anodic oxidation in carbon monoxide electroreduction. Nature Catalysis 5, 738-745 (2022). 10.1038/s41929-022-00828-w
2. E. C. Hann, S. Overa, M. Harland-Dunaway, A. F. Narvaez, D. N. Le, M. L. Orozco-Cardenas, F. Jiao* and R. E. Jinkerson*. A hybrid inorganic-biological artificial photosynthesis system for energy-efficient food production. Nature Food 3, 461 (2022). 10.1038/s43016-022-00530-x