UC San Diego
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NanoEngineering

UCSD NanoEngineering/Chemical Engineering

Distinguished Seminar

Wednesday, February 26, 2020
Seminar Presentation: 11:00am – 12:00pm
SME room 248

"Electrochemical CO2 Reduction: a Path towards a Carbon Neutral Chemical Industry"

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Abstract: The chemical industry today relies on fossil fuels as its major feedstock and applies a range of energy-intense thermal and/or catalytic processes to convert this feed into different bulk chemicals. These processes are responsible for a sizeable fraction of the anthropogenic CO2 emissions that are contributing to global warming and associated issues such as climate change, rising sea levels, and more erratic weather patterns. The use of CO2 as the feedstock for the production of bulk chemicals such as CO, ethylene, and ethanol via electrochemical CO2 reduction has the potential to reform the chemical industry to be close to carbon neutral. Not only does this approach utilize some of the CO2 that otherwise would be emitted in the atmosphere, it also avoids the sizeable CO2 emissions associated with many of the aforementioned energy demanding thermo-chemical processes that use fossil fuels as the feed.
This presentation will highlight some of our recent efforts in catalyst, electrode, and electrolyzer design and characterization for the electrochemical conversion of CO2 into value-added chemicals. The presentation also will feature techno-economic feasibility and in life-cycle analyses that indicate where the remaining hurdles are on a path to an economic carbon neutral chemical industry. Our efforts, often with collaborators, have led to multiple promising catalysts, electrodes, reactor designs, and processes. This includes a co-electrolysis approach that involves reduction of CO2 on the cathode paired with oxidation of glycerol (a waste product of biofuel production) at the anode as a way to drastically reduce the overall energy requirement of the process.

Biosketch: Paul J.A. Kenis is the Elio E. Tarika endowed Chair and a Professor of Chemical and Biomolecular Engineering at the University of Illinois at Urbana-Champaign, and an investigator of the International Institute for Carbon-Neutral Energy Research between Kyushu University in Japan and UIUC. He received his BS degree in chemistry from Nijmegen Radboud University and his PhD degree in chemical engineering at the University of Twente, both in the Netherlands, after which he was a postdoc at Harvard University.

At Illinois Kenis develops microchemical systems with a range of applications including fuel cells, CO2 electrolysis, protein / pharmaceutical crystallization, and cell biology studies. His recent efforts on CO2 electroreduction pursue suitable catalysts, electrodes, and electrolyzer designs, determining suitable operation conditions, and performing techno-economic and life-cycle analyses to guide the development of systems that can be applied at scale.

Kenis, author of over 200 publications and 14 patents, has been recognized with a 3M young faculty award, a NSF CAREER award, a Xerox award, and the ECS Energy Technology Division research award, and he has been elected a Fellow of the ECS. He is also a coauthor of reports on the prospects of CO2 utilization at scale issued by the US National Academies as well as the global Mission Innovation consortium.