HIGHLANDS IN CHEMISTRY SEMINAR SERIES

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"The Electrochemical Conversion of CO_2 to CO with Polymer-Encapsulated Co Catalysts: Modulating Activity and Selectivity by Controlling the Catalyst's Coordination Environment"

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2:30PM

ZOOM

FACULTY HOST:
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One of the primary barriers to the large-scale implementation of intermittent renewable energy sources such as solar and wind is effective energy storage. The selective electrochemical reduction of CO_2 in the CO_2 reduction reaction (CO_2RR) is a crucial strategy for storing energy from these intermittent sources in the form of chemical bonds (e.g. solar fuels). State-of-the-art solid-state catalyst materials can produce useful products such as methanol and ethylene, but typically do so non-selectively with a variety of products including H_2 from competitive water reduction. Alternatively, molecular catalysts show promise for the selective reduction of CO_2 to single products, typically CO or formic acid, but usually perform with lower overall activity compared to solid-state analogues. My research group is focused on the development of new catalytic systems that reduce CO_2 with the selectivity of molecular catalysts but operate with the activity of solid-state catalyst materials.

In this talk, I will present some of our recent studies exploring the use of polymer encapsulation to increase the catalytic activity and selectivity of molecular catalyst for the CO_2RR. In particular, we have shown that encapsulating cobalt phthalocyanine, a moderate catalyst for the CO_2RR in aqueous phosphate solution, within an encapsulating polyvinylpyridine polymer leads to a dramatic enhancement in its activity and selectivity for the CO_2RR. Using a combination of electroanalytical studies and *in situ* electrochemical X-ray absorbance measurements, we have shown that the encapsulating polymer modulates all coordination spheres surrounding the catalyst active site, and that this has a profound impact on the catalytic performance and mechanism.

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