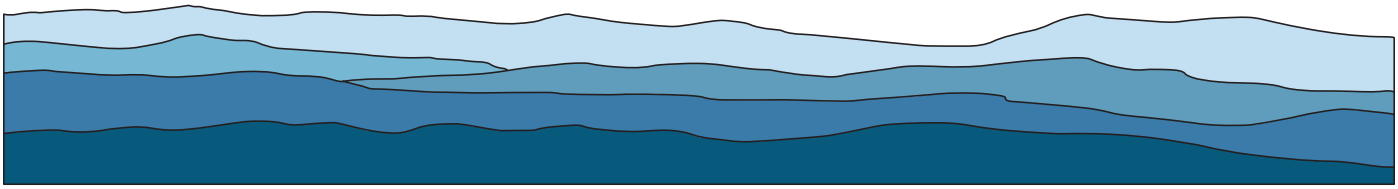
HIGHLANDS IN CHEMISTRY SEMINAR SERIES



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UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

"Understanding and Controlling Electrochemistry for Electrolyzers and Batteries"

FEBRUARY 21, 2020

2:30PM

HAHN HALL NORTH 140

FACULTY HOST:
FENG LIN

This talk addresses the electrochemical reactivity associated with electrolyzers and batteries. Relevant to electrolyzers we show that electrodeposition of CuAg or CuSn alloy films under suitable conditions yields high surface area catalysts for the active and selective electroreduction of CO_2 to multi-carbon hydrocarbons and oxygenates. Alloy films containing Ag exhibit the best CO_2 electroreduction performance. Alloy films containing Sn exhibit greater efficiency for CO production relative to either Cu along or CuAg at low overpotentials. In-situ Raman and electroanalysis studies suggest the origin of the high selectivity towards C_2 products to be a combined effect of the enhanced stabilization of the Cu_2O overlayer and the optimal availability of the CO intermediate due to the Ag or Sn incorporated in the alloy. Sn-containing films exhibit less Cu_2O relative to either the Ag-containing or neat Cu films, likely due to the increased oxophilicity of the admixed Sn.

Relevant to batteries, we discuss solid electrolytes (SEs) which have become a practical option for lithium ion and lithium metal batteries due to their improved safety over commercially available ionic liquids. The most promising of the SEs are the thiophosphates whose excellent ionic conductivities at room temperature approach those of commercially-utilized electrolytes. Hybrid solid-liquid electrolytes exhibit higher ionic conductivities than their bare solid electrolyte counterparts due to decreased grain boundary resistance, enhanced interfacial contact with electrodes, and decreased degradation at the interface. Spectroscopic and structural studies on these latter materials lead to new formulations exhibiting advantageous properties.

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