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Symposium: EN18: Multiscale Designing and Constructing Photocatalytic Materials for Solar Fuels

Abstract Title: Polymeric Interfaces for Renewable Fuel Production

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Abstract Body:

Rational design of soft-to-hard material interfaces offers new opportunities to control matter and energy across the nano- and meso-scales, thus providing a chemical strategy to tailor the structural and physical properties of surfaces with molecular level precision. In the context of energy transduction, interfacing molecular catalysts with solid-state substrates is a promising approach to developing hybrid materials for generating solar fuels. However, effective integration of the requisite components, while controlling their redox properties and stability, remains a major challenge. Taking inspiration from nature, where specific amino acid residues and soft-material coordination environments control the redox properties of metal centers in proteins during enzymatic catalysis, we show that thin-film polymer surface coatings provide a novel strategy for assembling human-engineered catalysts onto solid supports. This presentation describes recent results from our laboratory aimed at better understanding the electrochemical and optical properties of hydrogen production catalysts assembled onto polymer-modified electrode surfaces. The polymer immobilization method results in unique electronic and vibrational spectroscopic signals associated with the immobilized molecular species. In addition, the use of discrete polymer architectures, coupled with rational synthetic modifications to the catalyst's ligand environment, affords control over the chemical stability and redox potentials of surface immobilized molecular complexes, spanning a ~250 mV range.