Developing Sustainable Routes for the Production of Fuels and Chemicals

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66-110

Abstract:
This talk will describe recent efforts to develop new, sustainable pathways to the same kinds of fuels and chemicals that are conventionally derived from fossil resources. Technology in this area has tremendous potential to curb CO₂ emissions and to provide clean energy for all. The talk will focus on two particular areas of sustainable technology development in this light: (1) Solar water-splitting for the direct, renewable production of H₂, and (2) CO₂ electrolysis to convert CO₂ into carbon-based fuels and chemicals using renewable electricity as input.

In particular, this talk begin by describing research efforts to develop H₂ evolution catalysts that are active, stable, and comprised of only earth-abundant elements.1-3 Next, we will describe recent efforts to integrate these catalysts onto semiconductor surfaces to provide corrosion protection as well as enhanced interfacial catalysis for PEC water-splitting.4 The talk will then focus on electrocatalyst development for CO₂ conversion to fuels and chemicals.5-7 Based on advanced methods that we have developed to identify and quantify reaction products, we characterize a wide range of catalyst surfaces for CO₂ electrolysis and establish a framework for describing their catalytic activity and selectivity to hydrocarbons and alcohols.7