UC San Diego
JACOBS SCHOOL OF ENGINEERING
NanoEngineering

UC SAN DIEGO NANOENGINEERING SEMINAR

Monday, April 29, 2019
Seminar Presentation: 11:00am – 12:00pm
SME 248

"A Material-Centric Approach to the Designer-Catalyst Challenge"

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Abstract: Solar and wind are becoming economical, aided by rapidly declining cost and increasing efficiencies. As renewable energy gains momentum, electrochemical processes that use electrical energy to transform readily available chemical resources (such as water and carbon dioxide) into energy-dense fuels and high-valued chemicals represents an opportunity ripe for development. Presently, these transformations are not cost-effective because of the sluggish kinetics of the electrochemical reactions. Past studies have attributed these limitations to the catalyst's inability to stabilize reaction intermediates; even precious-metal catalysts have challenges. In this presentation, I will describe how we verify this hypothesis by directly measuring the relationship between the intermediate stabilization and the catalysis kinetics. Our approach uses advanced deposition tools to prepare single-orientation surfaces of metal oxides with high structural perfections. We utilize these advances, in combination with surface science and spectroscopy tools, to measure the effectiveness of the intermediate stabilization. From this measurement, we then experimentally establish the relationship between the intermediate stabilization and the electrochemical kinetics. I will discuss the implications of these results, which include new insights on the mechanisms of electrochemical transformations and how we can explore new phases not accessible via thermochemical means to realize higher-performing catalysts.

Biosketch: Jin Suntivich is an Assistant Professor in Materials Science and Engineering at Cornell University, NY. Jin's research focuses on the use of concepts in materials and optical science to create model experiments to advance our fundamental knowledge of electrochemical transformations. His laboratory currently focuses on using advanced deposition and self-assembly methods in connection with surface science tools and ultrafast spectroscopy to study the electrochemical-transformation mechanisms. His group uses these studies to test existing structure-property relation postulates to identifying new strategies for designing higher-performing materials for energy storage, catalysis, and photonics. Jin received his doctoral degree in Materials Science and Engineering from Massachusetts Institute of Technology, MA, and bachelor's degrees in Materials Science and Engineering, and Integrated Science from Northwestern University, IL. Prior to joining Cornell, he was a Ziff Postdoctoral Fellow at Harvard University, MA, where he studied the connection between surface science, electrochemistry, and ultrafast spectroscopy in titanium oxides.