**Transition Metal Oxide Nanosheets: Synthesis, Tuning, and Catalysis  
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**Abstract:**  In a matter of decades nanomaterials have seeped their way into almost every field. 2D nanomaterials, especially transition metal oxides (TMOs), are new platforms for use in fields such as catalysis, photovoltaics, batteries, and more due to their amenable geometry, enhanced reactivity, and high degree of tunability. However, despite the exciting results, implementation of nanomaterials on the macro scale is minimal. Reasons for this include environmental concerns and industry inertia, but at its heart lies a fundamental scientific issue: lack of structure control and property relationships.

In this talk, two projects will be presented demonstrating how synthesis and characterization can be used in hand-in-hand to better understand structure-property relationships and reaction mechanisms. In the first work, a new environmentally benign method, “hard-templating,” is developed to synthesize the thinnest iron oxide nanosheets ever reported. This new material is then compared to its nanoparticle and nanowire analogues and shown to have potential as future a CO2 conversion catalyst. In the second work, small organic functional groups such as toluene and p-xylene, are covalently bound to the surface of copper oxide nanosheets vastly altering their hydrophobicity and catalytic stability. Together these projects demonstrate: 1) methods for controllably synthesizing new classes of nanomaterials, 2) the importance and reactivity of 2D TMO surfaces, and 3) how a fundamental understanding of reaction mechanisms and structure-property relationships are essential for developing new and improved catalysts.

**Biography:**

Dr. Zachary Fishman is a postdoctoral associate whose research lies at the nexus of nanomaterials, energy, and the environment. He is a member of the Hu group in the Department of Chemical and Environmental Engineering and part of the  Energy Sciences Institute at Yale University. He obtained his undergraduate degree in Chemical and Biological Engineering at Rensselaer Polytechnic Institute and went on to obtain a PhD at Yale University working with Professor Lisa Pfefferle tuning the optical and catalytic properties of 2D transition metal oxides for CO2 conversion. Currently, Zachary is working on a number of projects including: 1) establishing structure-property relationships of acid-stable (Ti,Mn)Ox water oxidation electrodes using X-ray Absorption Fine Structure, and 2) fabricating high color conversion nanoporous GaN-quantum dot µLEDs. In the future, Zachary plans to develop a research program centered around using *in* *situ* spectroscopy to understand reactions that occur at the interface of solid-liquid and solid-gas phase in order to nanoengineer next generation catalysts and tackle challenges in energy and the environment. Feel free to contact him at [zachary.fishman@yale.edu](mailto:zachary.fishman@yale.edu)

**When: Thursday, January 24, 2019 at 4:00 pm**

**Where: CLASSROOM BLDG. 204W**