# Designing catalysts using atomic layer deposition

Presented by
Stacey Bent, Stanford University Jagdeep and Roshni Singh Professor in the School of Engineering
Department of Chemical Engineering

Tuesday, April 25th 2017 4:30pm
Havemeyer 209
*Reception will be held at 4:00pm in Mudd 801*

With the intensifying global need for alternative energy and fuels, there is strong interest in the development of efficient catalysts that can drive the chemical conversion of renewable resources into useful products. This talk will describe the use of an emerging synthetic strategy, atomic layer deposition (ALD), to generate nanoscale catalyst materials with a high level of control over composition, structure, and thickness. Two catalytic applications will be described. The first example is the conversion of synthesis gas (CO + $H_2$) to synthetic liquid fuels and high-value chemicals using supported metal, heterogeneous catalysts. The promotion of rhodium-based catalysts, which have intrinsic selectivity towards desirable higher oxygenate production, is explored using various metal oxides deposited by ALD. The interactions between catalyst and promoter are studied using a variety of experimental techniques complemented by theory and the promoted catalysts are shown to have an increase in activity and higher oxygenate selectivity relative to unpromoted Rh nanoparticles. The second application is electrocatalysis for water splitting to produce hydrogen for fuel. We show that nanometer thick electrocatalyst layers of earth abundant materials deposited by ALD are active for the oxygen evolution reaction, an important reaction in the conversion of sunlight to fuels. We also demonstrate use of this layer-by-layer synthetic strategy to explore other metal oxides for electrocatalysis, to study charge transport limitations in the catalysts, and to achieve compositional control over ternary metal oxide and doped metal oxide thin films. The potential of atomic layer deposition to synthesize nanoscale materials for catalytic applications will be discussed.