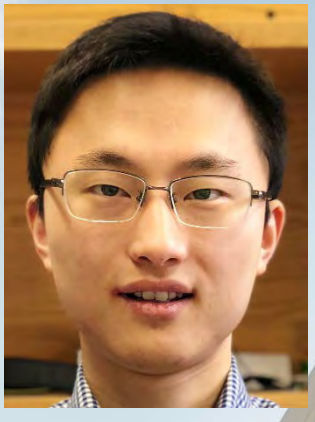
MIT Chemical Engineering Department

Spring 2018 Seminar Series

http://web.mit.edu/cheme/news/seminar.html

Physical and Chemical Tuning of Catalysts for Renewable Energy Applications



Haotian Wang

The Rowland Institute at Harvard University

Thursday, February 1, 2018

4:15pm, refreshments at 4:00pm

66-110

Abstract:

The development of active and earth-abundant catalysts for energy storage and chemicals/fuels production is becoming increasingly important, particularly in fundamental electrochemical reactions including water splitting, fuel cell catalysis, and carbon dioxide reductions. Engineering the electronic structures of catalytic materials for proper binding with reaction intermediates is critical to deliver optimized performances. In this presentation I will first introduce the unique synergy between catalysis and battery technologies for a systematical and controllable tuning of material properties and thus their catalytic activities. This includes the Li-ion tuning of oxidation states in 2D materials and battery cycling tuning of grain boundaries in metal-oxides for improved water splitting, as well as the battery electrode tuning of Pt lattice strain for controllable fuel cell catalysis. In addition, by dispersing transition metals into isolated single atoms with electronic structures significantly different from their bulk counterparts, we can dramatically suppress the competing hydrogen evolution and deliver an ultra-high CO_2 reduction selectivity of more than 95% under ambient conditions in water. Furthermore, with the tuning of different facet exposure on Cu catalysts, the CO_2 reduction reaction pathway can be successfully shifted from C_1 towards C_2 or C_3 high-value products.