Stevens Institute of Technology

Nanotechnology Graduate Program

Synthesis and characterization of gold nanoparticles

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A recent renaissance of research on the catalysis of gold nanoparticles has been inspired by the discovery of the unique function these small particles have as they approach particle size dimensions where the inert bulk properties become less relevant and the active surfaces on quantum confined particles provides sites for new reaction pathways. The unique ability of gold nanoparticles to selectively activate oxygen to form a peroxo intermediate and ultimately hydrogen peroxide from gas-phase hydrogen and oxygen and their utility for the industrially relevant epoxidation of propylene will be discussed along with DFT calculations and modeling that describes connection between particle size and catalyst activity. One challenge for the utilization of gold as a catalytic metal has been the ability to synthesize uniform particle sizes within microporous frameworks that provide the high surface areas required for industrially relevant reaction rates. In addition, the ability to characterize these particles is also particularly challenging given the highly diffracting network in which these particles reside. A novel synthetic approach to synthesize particles within the microporous framework and the in-situ characterization of the evolution of the gold species involved in particle formation will also be discussed.

Dr. David Barton is currently a Senior Research Scientist at The Dow Chemical Company. He has led a number of multifunctional teams including joint research collaborations with several universities and national labs. His work has focused on the discovery of novel heterogeneous catalysts for the utilization of alternative feedstocks and environmentally benign processes for the chemical industry. He is an expert in in-situ characterization, fundamentals of material synthesis, mechanistic studies, and utilization of high throughput tools for catalyst synthesis and characterization. David has been with Dow for 11 years after earning his PhD in Chemical Engineering at the University of California-Berkeley and his B.S. degree in Chemical Engineering from the University of Minnesota in Minneapolis.

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