Friday, March 23, 2018, 4:00 pm
Refreshments: 3:30 pm
SLH 100

Professor Peter Stair

Department of Chemistry
Northwestern University

Gas Phase Routes to Solid Catalyst Materials

The traditional route to solid catalyst materials involves solution phase deposition or liquid-surface reactions. Examples include impregnation, deposition-precipitation, and solution phase grafting of molecular precursors. Atomic Layer Deposition (ALD) is a gas-solid deposition methodology offering enormous potential for the synthesis of advanced heterogeneous catalysts with control of composition and structure at the atomic scale. The ability of ALD to produce conformal oxide coatings on porous, high-surface area materials can provide completely new types of catalyst supports. At the same time, ALD can achieve highly uniform catalytically active metal and oxide phases with (sub-) nanometer dimensions. This lecture will provide examples from Northwestern University and Argonne National Laboratory of ALD being used to synthesize oxide supports, catalytic oxide overlayers, single-site catalysts, metal nanoparticles, and new porous structures. These materials have been characterized by SEM, XRF, ICP, UV-Vis absorption spectroscopy, Raman spectroscopy and evaluated for a variety of catalytic reactions including oxidative and non-oxidative alkane dehydrogenation, combustion, and selective hydrogenation. A particular focus has been the synthesis of supported metal nanoparticles with the development of a procedure in which the metal and support materials are grown sequentially in each ALD cycle. This method makes possible the synthesis of exceptionally small, ca. 0.5 nm, and uniform metal nanoparticles. Through overcoating, the metal particles can be stabilized against sintering and leaching while still remaining active under harsh conditions in both gas and liquid phase reactions. Through proper annealing procedures, the overcoating oxide develops porosity.The lecture will conclude with a perspective on possible additional advances in ALD methodology and synthesis strategies.

Hosted by Professor Richard Brutchey

The scientific community is invited

USC Department of Chemistry
chem.usc.edu