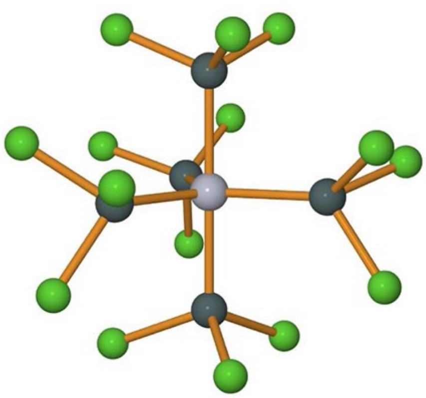
Controlling Catalysts:

Applications in Energy Technology and Diabetic Care

Anastasios Angelopoulos, PhD

Catalysts increase the rate of chemical reactions, and controlling these reactions can have a tremendous impact on a wide variety of fields, from nanotechnology to medical care. Angelopoulos' most recent research has focused on electrocatalysts and polymetric catalysts, which are used to enhance the efficiency of energy production and medical diagnostics.



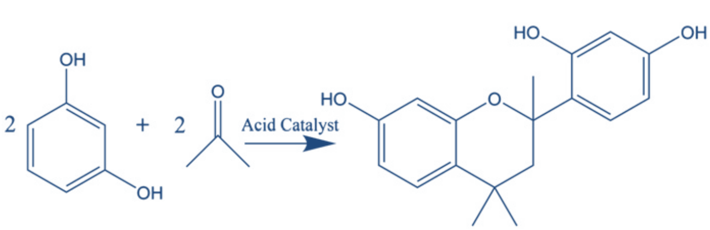
Pt (silver)-Sn (dark green)-C1 (light green) precursor complex for nanoparticle synthesis.

Electrocatalysts for Energy Applications

By controlling nanoparticle formation, scientists can harness the unusual material properties present at such small atomic levels. So Angelopoulos and colleagues are working to monitor, in the real-time, the production of precious metal nanoparticles such as platinum (Pt) using simultaneous small- and wide-angle X-ray scattering and X-ray absorption. Researchers believe that if we can control Pt nanoparticle size and structure, we can also control and optimize their catalytic reactions involved in energy production, including in the water-gas shift reaction, hydrogen production, and metal-air batteries. Such control over these structures at the nanoparticle level could have profound applications in electrocatalysis, optics, and heterogenous synthesis.

Polymetric Catalysts for Chemical Sensing

Angelopoulos and colleagues have recently developed a prototype for a device that could make breath analysis easier. Their device measures the level of gaseous acetone, an organic compound that often signifies metabolic conditions in the bloodstream, particularly diabetes. Breath analysis as a testing device is growing in popularity because it is less invasive than blood testing; however, existing testing methods often require bulky equipment and off-site laboratory testing. The group hopes their findings will lead to a portable optical sensing device for real-time, non-invasive acetone analysis.



(Above, right) The prototype of the device

(Left) Reaction scheme for condensation reaction of acetone and resorcinol.

More about Dr. Angelopoulos

Angelopoulos, an Associate Professor of Chemical Engineering, specializes in colloid and surface chemistry. His research prior to joining UC included investigations on the permselectivity of polymeric membranes for the U.S. Army, heterogeneous catalysis in printed circuit fabrication for the IBM Corporation, and nanoparticle coating methods for the GM Corporation. His teaching at UC has earned him a National Science Foundation Research Experiences for Undergraduates Mentor Award as well as the prestigious Neil Wandmacher Teaching Award for Young Faculty in 2012. He has received highly competitive grants from the Petroleum Research Fund of the ACS, the General Motors Corporation, and local business consortia.

Recent Publications

- S. St. John, N. Hu, D.W. Schaefer, **A.P. Angelopoulos,** “Time-Resolved, In-Situ, Small-And Wide-Angle X-Ray Scattering to Monitor Pt Nanoparticle Structure Evolution Stabilized by Adsorbed $SnCl_3$ Ligands During Synthesis,” *J. Phys. Chem C* 117 (2013) 7924-7933.
- A.D. Worrall, J.A. Bernstein, and **A.P. Angelopoulos**, “Portable Method of Measuring Gaseous Acetone Concentrations,” *Talanta* 112 (2013) 26-30.
- S. St. John, Z. Nan, N. Hu, D.W. Schaefer, **A.P. Angelopoulos**, “A Nanoscale-Modified LaMer Model for Particle Synthesis from Tin-Platinum Complexes,” *Journal of Materials Chemistry A,* 31 (2013) 8903-8916 submitted