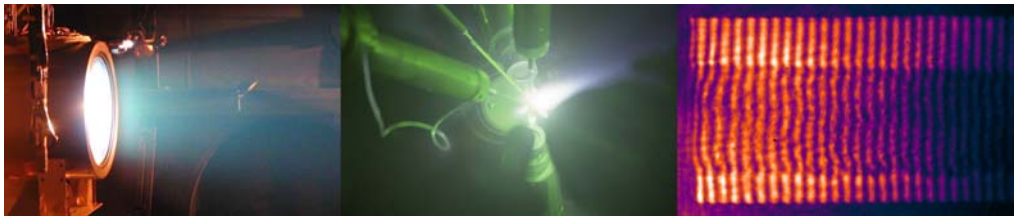

Michigan Institute for Plasma Science and Engineering Seminar

Bottom-Up Solutions to Plasma Synthesis of Nanomaterials

Prof. Mohan Sankaran
Case Western Reserve University

Wednesday, 17 February 2010 - 4:00 pm
Room 1005 EECS Building

(Refreshments will be served after seminar.)

Abstract

Large-scale, low-pressure plasmas are essential to the manufacturing of integrated circuits that are now ubiquitous in consumer electronics. However, challenges have arisen for these top-down approaches to materials processing. Future electronic devices will incorporate nanoscale materials such as nanoparticles, carbon nanotubes, and silicon nanowires that must be prepared from the "bottom-up" because of the current limitations of photolithography. In addition, emerging applications in sensors, energy, and medicine require nanomaterials that are not easily fabricated by current plasma tools. The aim of our research is to develop a new class of plasmas, termed "microplasmas", for nanomaterials synthesis. Unlike conventional plasmas used in materials processing, microplasmas operate at small volumes (less than 1 nanoliter!) and high pressures (up to and exceeding atmospheric). These unique features open new avenues for material synthesis. Vapors of metal-organic precursors can be non-thermally dissociated by the "hot" electrons contained in a microplasma to homogeneously nucleate nanoparticles from gas-phase radicals. Excessive particle growth and agglomeration are limited by short reactor residence times, leading to the formation of uniform particles less than 5 nm in size. The synthesis of nanometer-sized metal particles lends itself to catalytic applications including carbon nanotube and silicon nanowire growth. Recently, we have also coupled microplasmas with liquids or polymeric films to nucleate nanoparticles from metal ions. In this talk, I will discuss these topics in detail, highlighting materials synthesis, characterization, and applications.

About the Speaker: Dr. Mohan Sankaran is the George B. Mayer Asst. Professor of Chemical Engineering at Case Western Reserve University (CWRU). He received his BS in Chemical Engineering from the University of California at Los Angeles in 1998 and his Ph.D. in Chemical Engineering from the California Institute of Technology in 2004. At Caltech, he received fellowships from the National Science Foundation, Intel Foundation, and Applied Materials. In 2000, he was awarded the Constantine G. Economou Prize. He joined the Dept. of Chemical Engineering at CWRU in 2005 as the John Angus Legacy Asst. Professor. As a faculty member, he received the NSF CAREER Award, the CWRU Glennan Fellowship, and the Young Investigator Program Award from AFOSR. His current research interests include microplasmas, nanoparticle synthesis, carbon nanotube and silicon nanowire growth, surface-enhanced Raman spectroscopy, plasma electrochemistry, and electrostatic charging of materials.