

# **Seminar Series**

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**School of Materials Science and Engineering**

**Thursday, February 19, 2009**

**5:00 PM – Room 200 Olin Hall**

## **"Hierarchical Structures in Fuel Cell Electrocatalysts Applications of Nanoscience and Nanotechnology for Power Generation"**

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Nano-structured materials play a vital role in electrochemical power source technologies: batteries, super capacitors and fuel cells. Their main role is in increasing of volumetric (and in some cases, gravimetric) power density, energy density and the rate of drain. Nano-materials contribute to the enhancement of the catalytic properties of the electrodes, dramatically improve interconnectivity of porous matrixes and revolutionize mass-transport characteristics on micro- and meso-scale. Detailed understanding of these processes allows even broader exploration of nano-materials for energy conversion. Structural properties of these materials are making possible new design solutions and provoke a new stage in power source systems engineering. All these will bring substantial benefit if manufacturing of such materials could meet the demand in volume, performance and reproducibility.

This presentation focuses mainly on the spray-based (aerosol-based) methods to manufacture electrocatalyst powders for fuel cell and related applications. The spray-based process results in formation of unique spherical, micron-sized aggregates consisting of sub-micron electrocatalyst particles where the nanometer sized active phases (Pt, Pt-Ru, Pt-Sn, metal alloys, metal oxides, composite and non-noble metal electrocatalysts) are highly dispersed on the surface of carbon supports. Such hierarchical catalysts structures are advantageous in enhancement of the fuel cell performance since they correspond to the different levels of transport in the corrugated electrode matrixes. A wide variety of materials can be made by these methods in which not only the composition but also the microstructure can be varied. It is the combination of these attributes - control over microstructure at a number of different length scales and composition, simultaneously - that is extremely important to the performance of the electrocatalyst powder in a fuel cell. The talk will also address the issues of processing, digital printing and devise design that arise from the unique properties of nano-structured materials.

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### ***Bio***

*Dr. Plamen B. Atanassov is the Associate Professor of Chemical and Nuclear Engineering and Director of the Center for Emerging Energy Technologies at University of New Mexico, Albuquerque, NM. Dr. Atanassov received his M.S. degree in chemical physics from University of Sophia in 1987, and PhD degree in chemistry from Bulgarian Academy of Sciences in 1995. He then worked in different academic and industrial institutions, and joined UNM in 2000 as assistant professor of Chemical and Nuclear Engineering. Dr. Atanassov is involved in fuel cell research and in teaching the next generation of engineers to develop better fuel cell technology. He is leading several student teams in researching novel materials for fuel cells, bio sensors, and bio fuel cells. Using nanotechnology approaches Atanassov's group design new materials to address key issues in fuel cell development, in particular, the durability and affordability of fuel cell materials.*