

2008-2009 Graduate Seminar Series

The Department of Mechanical Engineering – Engineering Mechanics

Proudly Presents

Professor Hamid Garmestani Georgia Institute of Technology



Dr. Hamid Garmestani joined the School of Materials Science and Engineering at the Georgia Institute of Technology in January 2003 as a professor. He received his education from Cornell University (Ph.D. 1989 in Theoretical and Applied Mechanics) and the University of Florida (B.S. 1982 in Mechanical Engineering, M.S. 1984 in Materials Science and Engineering). After serving a year as a post-doctoral fellow at Yale University, he joined the Mechanical Engineering Department at FAMU-FSU College of Engineering in 1990. Dr. Garmestani's research and teaching activity is focused on microstructure/property relationship in advanced materials including textured polycrystalline, nano-composites, magnetic, superplastic and thin film layered structures. Using statistical continuum mechanics (higher order probability functions), the microstructure of these materials (texture, microtexture) is correlated with property and processing conditions. He has developed advanced techniques such as magnetic texturing and superplastic forming in focusing in microstructure design. In a recent development, a novel methodology "Spray Pyrolysis" was developed to produce gradient porous structures for Cathode materials used in Fuel cells. Microscopy techniques such as SEM/TEM together with OIM and x-ray texture analysis have been used to obtain mesoscopic information in polycrystalline (and semi-crystalline polyethylene) materials.

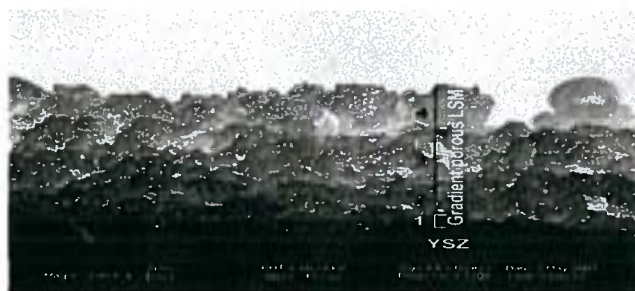
He is the associate editor of two International Materials Journals (Journal of Engineering Materials and Technology and International Journal of Plasticity,...). He was awarded "Superstar in Research" by FSU-CRC in year 2000. He was also the recipient of the 2000 Engineering Research Award of the FAMU-FSU College of Engineering and recipient of the Faculty Award for Research from NASA. He is presently funded through DOE, Idaho National Lab, Pacific Northwest National lab, NAVY, NSF and DTRA. He has published more than 200 Technical papers (120 in refereed Journals).

Thursday, Oct. 9, 2008 3:00 – 4:00 p.m. Room 112, ME-EM Bldg.

The Role of Nano-structures in Microstructure Design of Solid Oxide Fuel Cells

A methodology for microstructure design of fuel cell materials is developed to incorporate the influence of nano-structures and their gradients active cathode and anode in Solid Oxide Fuel Cells. The synthesis of these structures requires a fine nano-porous layer between the electrolyte and the electrode (usually known as active cathode or anode structures). These layers have been deposited using a novel spray pyrolysis technique. Statistical continuum mechanics theory is used to link mechanical, magnetic, and transport properties to microstructures represented from the different layers (from nano-to micro porous regions).

Statistical models on predicting elastic properties and electrical conductivity have been developed and published by the PI [1-2]. These models are based on the calculation of the effective properties based on a perturbation from the average properties. In this formulation a correlation function is used to represent the microstructure that takes into account continuity, morphology, shape or distribution of the constituents. The results show that the effective properties in fuel cell materials can be predicted through a multi-scale model based on statistical continuum mechanics of higher order correlation functions. Embedding this model into a microstructure sensitive design framework, microstructure optimization was performed. By adjusting fabrication parameters directed by MSD, the microstructure can be tailored to maximize performance.



SEM cross-section image of the gradient porous LSM made by multiple spray pyrolysis denositions.