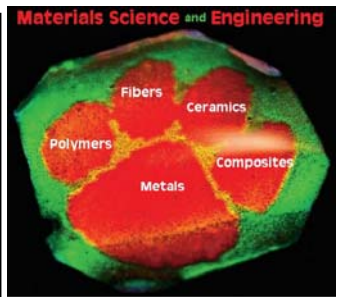


# Seminar Series

Sponsored by  
**School of Materials Science and Engineering**  
Thursday, September 6, 2007  
5:00 PM – Room 200 Olin Hall



## **"Focused Nanoscale Electron Beam Induced Processing: Experimentation, Simulation, and Applications"**

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### Abstract

The rapid and precise direct-write growth of nanoscale features by electron-beam-induced deposition (EBID) and etching (EBIE) requires the optimization of the growth parameters to maintain nanoscale feature dimensions. The tremendous and complex EBID parameter space includes the precursor gas pressure, the primary electron beam energy, the electron beam current, surface diffusion rates of adsorbed precursor species, thermal effects on desorption, and the cascade of electron species produced by elastic and inelastic scattering processes. These variables affect the probability of precursor dissociation and hence determine the feature growth velocity and the size of the structure through a series of complex, coupled nonlinear interactions. In this presentation, a series of experimental studies will be presented to demonstrate the various electron-gas, gas-solid, and electron-solid interactions that are germane to the electron beam induced processing technique. Subsequently, a dynamic computer simulation based on Monte-Carlo calculation sequences will be described and compared to various experimental observations. Finally various nanoscale device applications will be demonstrated including, field emission devices, lithography mask repair, scanning probe tip editing, and cellular membrane mimics.

### Bio

*Dr. Rack earned his bachelor's degree Magna Cum Laude in Materials Science and Engineering from the Georgia Institute of Technology in 1993, and his Ph.D. in Materials Science and Engineering from the University of Florida in 1997. His dissertation research included thin film deposition, surface analysis, and theoretical modeling of optical transitions in thin film electroluminescent materials. In 1997, Dr. Rack joined Advanced Vision Technologies Inc. (AVT) as a Senior Research Scientist where he led their research on luminescent and field emitter materials and contributed to process development in their vacuum microelectronic devices. In 1999, Dr. Rack joined the faculty in the Microelectronic Engineering Department at the Rochester Institute of Technology. There he taught courses in thin film processing, materials characterization, and microlithography and performed research on VUV optical properties and vacuum microelectronic devices. In 2001 Dr. Rack joined the faculty at the University of Tennessee and is investigating combinatorial thin film processing, and fabrication of nanoscale devices. Dr Rack has authored or co-authored 80 technical papers (2 book chapters and 3 invited review articles) and has contributed to over 130 (25 invited) technical presentations at national and international conferences. He has served on the AVS executive committee, has organized 2 thin film division sessions and is currently serving a 2-year term as the thin film division program chair.*