Stevens Institute of Technology

Nanotechnology Graduate Program

Interfacial Nanomechanics: Applications in Sensing and Characterization

Wednesday September 30 2009

Burchard 118, 11 am

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The realization that many interfacial molecular phenomena result in mechanical responses at the nanoscale together with recent advances in measuring displacement with extreme high resolution offer unprecedented opportunities for development of devices ranging from sensors to surface characterization. Exploiting nanoscale mechanics for molecular recognition is a paradigm shift in sensor technology. The adsorption-induced deflection of a cantilever beam reflects the interplay between the strain energy increase of the beam and the free energy reduction of a reaction, providing an ideal tool for investigating the connection between mechanics and chemistry of reactions. Since free energy reduction is common for all reactions, the cantilever array forms a universal platform for label-free detection of various chemical and biological interactions. While the science underlying chemical-to-mechanical free energy transduction is still being understood, the technological potential can be truly realized if multiple interactions can be detected simultaneously. This talk will focus on achieving true chemical selectivity using a cantilever-based multimodal approach that includes photothermal, thermomechanical, and photoacoustic signals. I will also discuss application of these methods in SPM for chemical imaging.

Dr. Thomas Thundat is a Corporate Fellow and the leader of the Nanoscale Science and Devices Group at the Oak Ridge National Laboratory. He is also a research professor at the University of Tennessee, Knoxville, and a visiting professor at the University of Burgundy, France. He received his Ph.D in physics from State University of New York at Albany in 1987. He is the author of over 245 publications in refereed journals, 45 book chapters, and 29 patents. Dr. Thundat is the recipient of many awards that include the U.S. Department of Energy's Young Scientist Award, R&D 100 Awards, ASME Pioneer Award, Discover Magazine Award, Scientific American 50 Award, Jesse Beams Award, Nano 50 Award, Battelle Distinguished Inventor, ORNL and UT-Battelle Awards for invention, publication, and Research and Development. Dr. Thundat is an elected Fellow of the APS, the ECS, and the AAAS. Dr. Thundat's research is currently focused on novel physical, chemical, and biological detection using micro and nano mechanical sensors. His expertise includes physics and chemistry of interfaces, solid-liquid interface, biophysics, scanning probes, nanoscale phenomena, and quantum confined atoms.

Co-sponsored by the ECE Department

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