

UNH Materials Science Seminar

13:10-14:00, Wednesday, April 20, 2011

DeMeritt 240

University of New Hampshire

Multidisciplinary Aspects of Indentation

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Indentation is a technique that is very commonly used in material characterization, particularly for the extraction of mechanical properties. This is largely due to the very little specimen preparation involved in a typical indentation test. For heterogeneous materials, robust algorithms exist for the extraction of elastic properties, and others are continuously being developed to find, e.g., plastic properties or residual stresses. The limiting factor in this has been computational power, and also the multi-axial stress field beneath a tip during loading and unloading. Looking beyond properties, indentation is also a very powerful method of characterizing other types of multi-functional behavior, from the observation and analysis of force-depth relations and sub-surface deformation. In this talk, I will present a few examples of our activities in the HMMM (Heterogeneous Materials and Multiscale Mechanics) Lab at Northeastern, using macro-, micro- and nano-indentation to explore material behavior and structure across different systems. In the first discussion, I will present ongoing work to extract plastic anisotropic parameters of, e.g., thin films or sheet metal, by deviating from the typical far-field boundary conditions in experimental practice. In the second, I will present exploration of the intact, inflated mammalian lung, using macroscopic indentation. Using a spherical tip that is transparent to IR radiation, we are able to image alveoli as they are deformed under compression, to gather physiologic and clinically relevant information about lung behavior under different inhaled gases. The indentation tests serve as an initial step, to provide hypotheses for more direct characterization methods.

Andrew Gouldstone received his BS in Materials Science and Engineering and PhD in Metallurgy from MIT in 1996 and 2001, respectively. After this he spent 3 years in the Physiology program at the Harvard School of Public Health, learning Respiratory Physiology. He served as an Assistant Professor in the Center for Thermal Spray Research and Department of Materials Science and Engineering at SUNY Stony Brook for 4 years before joining the Northeastern Department of Mechanical and Industrial Engineering in 2008. He has a joint appointment in Chemical Engineering at NEU. He was an NSF CAREER Award Recipient, for his program "Multi-scale and Multi-disciplinary Aspects of Indentation."

Host: Prof. Todd Gross, x2445