UNH Materials Science Seminar

13:10-14:00, Wednesday, September 30, 2009
Kingsbury N343
University of New Hampshire

Determining elastic properties of carbon-carbon composites and bulk pyrolytic carbon using nanoindentation

Nikolay Timoshchuk
Department of Mechanical Engineering, UNH

C/C composites combine attractive characteristics such as light weight, exceptional strength and stiffness with excellent refractory properties, making them suitable for severe-environment applications such as atmospheric reentry, solid rocket motor exhaust, and disk brakes in high performance military and commercial aircraft, high speed trains and racing cars. C/C composites produced using chemical vapor infiltration (CVI) have a complex hierarchical structure that consists of carbon fibers surrounded by layers of pyrolytic carbon (PyroC) with different nanostructure and anisotropic material properties.

The main goal of this research is to develop a high spatial resolution method to extract anisotropic elastic properties of C/C composites from nanoindentation measurements and characterize the spatial variations in elastic properties of PyroC. Current techniques to estimate modulus from nanoindentation data (load vs. penetration depth) are based on Sneddon's solution for isotropic materials and are not applicable for evaluating the elastic properties of C/C composites. We will present a comparison between modulus estimates using the isotropic model to modulus estimates using ultrasonic methods for bulk PyroC. We will also describe our observations of discontinuities in loading curves normal to the macroscopic growth planes of PyroC that we attribute to delamination.

Host: Professor Todd Gross x2445