UNH Materials Science Seminar

11:10-12:00, Thursday, October 5, 2006
DeMeritt Hall 209B
University of New Hampshire

Micromechanical modeling of carbon/carbon composites

Professor Igor Tsukrov
Department of Mechanical Engineering
and Materials Science Program, UNH

A unified approach to predict the overall elastic properties of statistically homogeneous particulate composites is presented. Several first-order micromechanical models are reformulated in terms of the inclusion compliance contribution tensor. This tensor is a convenient tool to evaluate contribution of arbitrarily shaped inclusions and pores to the overall composite properties. The approach is applied to predict the effective elastic moduli of unidirectional and random carbon/carbon composites fabricated by chemical vapour infiltration. The technology of chemical vapour infiltration consists of synthesis of pyrolytic carbon particles from hydrocarbon gas (methane/hydrogen mixture) and their deposition on carbon fibres at elevated pressures and high temperatures. This process results in formation of composites with complex microstructure characterized by the irregular cavity shapes and different length scales of the constituents: the diameter of fibers in such composites is on the order of 10 microns, while some pores reach hundreds of microns in dimensions. The two-step homogenization procedure that overcomes these difficulties is presented.