MSE SEMINAR

Materials Science and Engineering
Michigan Technological University

Friday, February 24, 2012
3:00 pm – 4:00 pm
Room 610, M&M Building

Mesoscale Anisotropic Deformation and Damage Nucleation In Polycrystalline Ti Alloys

John & Virginia Towers Distinguished Lecture Series

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Abstract

A combination of experimental characterization and crystal plasticity finite element modeling (CPFEM) has been used to study the anisotropic deformation of a number of titanium alloys. Studies have been carried out in the near surface region of 4-point bend specimens, where the global stress can be approximated as uniaxial tension. Specific microstructural patches have been characterized prior to deformation using electron backscattered electron diffraction orientation imaging microscopy (OIM). Specimens have been deformed both in-situ in scanning electron microscopy (SEM) and *ex-situ*, facilitating a range of experimental characterization methods including optical microscopy, atomic force microscopy, SEM based backscattered electron imaging, OIM, and channeling contrast imaging, as well as 3-D X-ray diffraction. These studies have allowed a comprehensive experimental characterization of the nature of plastic deformation and damage nucleation in the microstructural patches. To complement these studies, quasi 3-D FEM meshes, developed based the experimentally characterized microstructural patches, have been computationally deformed. While the simulations accurately reproduce significant aspects of the experimental studies, including some crystal rotations and surface topography development, further work to include grain boundary behavior in the simulations is needed.

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