JHU DEPARTMENT OF MATERIALS SCIENCE & ENGINEERING PRESENTS

FALL 2020 SEMINAR SERIES

Ashley Bucsek
University of Michigan

Probing Phase Transformations and Twinning Across Length Scales Using 3D X-Ray Microscopy

Advanced materials are broadly defined as innovative materials that have atypical sizes, microstructures, and responses. These atypical characteristics enable major, previously impossible technological breakthroughs, yet many advanced materials owe their desirable properties to complex underlying micromechanics including twinning, detwinning, and martensitic phase transformations. Establishing the relationships between these local micromechanics and macroscopic material behavior is critical to accelerating the implementation of advanced materials. Toward these goals, we utilize modern 3D X-ray diffraction techniques that offer the capability to measure the deformation and microstructure evolution inside bulk materials, in situ, and across nine orders of magnitude in length scales (nm to mm). Quantities of measure include the 3D microstructure "map" and spatially-resolved crystallographic orientation, elastic strain tensor, and phase fraction. These techniques can be used to simultaneously measure local microstructure events and the consequent macroscopic response, resulting in a tool uniquely suited for linking local micromechanics to material behavior. These capabilities will be illustrated using a number of research examples involving twinning and phase-transforming materials, using nickel-titanium shape memory alloys as a model material system. Ongoing and future work will also be discussed, including the development of a first-of-its kind laboratory scale instrument to conduct 3D X-ray diffraction experiments in-house.

Wednesday Nov.11th 2:30-3:30pm

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