DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Department of Materials Science and Engineering
Winter Seminar Series

3:00 PM, Wednesday, March 2
PISB 104

"Fundamentals and Applications of Ambient and High-Temperature Shape Memory Alloys"

Dr. Peter Anderson
Materials Science and Engineering
Ohio State University

Abstract:

Shape memory alloys (SMAs) offer the potential for a vast array of applications, including actuators for reconfigurable blades on rotorcrafts, variable geometry chevrons on aircraft engines, and flap actuators on aircraft wings. However, there are considerable materials challenges that include functional and structural fatigue under repeated actuation. An understanding of these phenomena is critical to the design and application of new high temperature SMAs for automotive and turbine engine applications.

This talk focuses on the underlying deformation phenomena in SMAs at the micro- and nano-structural scale. Transmission electron microscopy studies show the development of plasticity when SMAs are heated and cooled, even in the absence of an external load! This is captured in recent phase-field simulations that predict plastic deformation at the transformation front that alters subsequent performance. This plasticity can be suppressed in new high-temperature Ni-Ti-Hf alloys. This is attributed to nanoscale precipitates that suppress plasticity yet allow the phase transformation to progress seamlessly. Corresponding simulations suggest why the precipitates are so effective.

Dr. Anderson:

Peter M Anderson is Professor and Chair in the Department of Materials Science and Engineering at The Ohio State University. He received his PhD in Engineering Sciences at Harvard University and was a Post-doc in the Engineering Department at University of Cambridge (UK). His work pursues the relationships between mechanical properties and underlying material structure. Applications include "quantized crystal plasticity" in nanograined metals, concepts of strengthening and work hardening in nanolayered composites, the development of nanoindentation techniques to extract size-dependent strength in nanostructured composites, novel finite element-phase field simulations, the development of wear-resistant materials that employ phase transformations, and the design of biological scaffolds that can aid in cell differentiation and growth. He is a coauthor of new (3rd) edition of the *Theory of Dislocations* that is currently in press (coauthored with John Hirth and Jens Lothe).

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