PRISM Seminar Series – Spring 2014

PRISM
NNSA Center for Prediction of Reliability, Integrity and Survivability of Microsystems

PURDUE UNIVERSITY Discovery Park

Dr. Dennis M. Dimiduk
Air Force Research Laboratory,
Materials and Manufacturing Directorate
Wright-Patterson Air Force Base

Monday, March 31st
12:00 pm, ME 1051

"INTEGRATING MATERIALS AND STRUCTURES PERFORMANCE PREDICTION VIA THE MATERIALS GENOME INITIATIVE "

***Abstract*:**

Materials and structures design can now access a remarkable set of new materials modeling and simulation tools. The capabilities of such tools are expanding rapidly for representing mechanisms important to both 'design with' and 'design of' materials at disparate scales. The present talk examines advances in the multiscale aspects of mechanical behavior simulation for the purposes of predicting materials performance for an engineering design system. Selected tools and techniques are discussed from a viewpoint motivated by two questions: i) what multiscale tools and methods are able to provide predictive capabilities and, ii) how might the methods be incorporated into an integrated computational materials engineering framework to reduce the need for empirical data? The initial conclusion is that microstructure-level tools are significantly underdeveloped and are likely to remain so for some time; thus, a more structured approach to integrated computational and empirical methods is necessary that considers appropriate selections of both 'top down' and 'bottom-up' approaches.

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Speaker Bio:

Dennis M. Dimiduk is a Laboratory Fellow and past Technical Director of the Structural Materials Division at the Air Force Research Laboratory, Materials and Manufacturing Directorate. Through the early 1980's he performed metallurgical research on alloy development, phase transformations and strengthening mechanisms in high-temperature superalloys. At that time, Dr. Dimiduk led the intermetallics research area for the Air Force, conducting in-house research and motivating research at other laboratories and universities. Throughout the 1990's, work by he and his colleagues on titanium aluminides and refractory intermetallics opened an approach toward raising the use temperatures and realizing weight reductions in advanced engines. Their early research foundation led to current introductions of titanium aluminides into commercial turbine engines. In 1989, Dr. Dimiduk contributed to and led research seeking to understand the influence of chemistry on microstructural evolution and deformation in alloys through computer simulation. The group's early involvement in computational materials science and materials simulations led directly to the community's current and growing activities in Integrated Computational Materials Science & Engineering (ICMSE) and the MGI. That research also led to advancements in the 3d characterization of materials, new techniques for mechanical property characterization at the micrometer scale and, to the discovery of a new regime of size-affected metal deformation behavior. Dimiduk continues to pursue and explore those advancements today.

Dr. Dimiduk received his B.S. degree in Materials Science and Engineering in 1980 from Wright State University. While employed with the Air Force, Dimiduk completed his M.S. and Ph.D. degrees in Metallurgical Engineering and Materials Science at Carnegie Mellon University in 1984 and 1989, respectively. He has authored or co-authored more than 180 technical papers, 13 patents, 2 book chapters and co-edited 4 books. He is a member of the editorial board for *Intermetallics* and, is an adjunct professor at The Ohio State University. In 1993-94 he was a Visiting Scholar at the University of Oxford, UK conducting collaborative research and lecturing on structural intermetallics. Dr. Dimiduk received the 1991 AFSC Waterman Award for science, the 2004 Charles J. Cleary Award for scientific achievement and, five "Star-Team" awards from the Air Force Office of Scientific Research. He was elected Fellow of ASM International in 1997 and Fellow of the Air Force Research Laboratory in 1998. He was selected for a Carnegie-Mellon University Alumni Achievement Award in 2008.

Dimiduk has been a member of TMS, ASM and MRS throughout his career. Presently he is the Past Chairman of the Structural Materials Division of TMS and has served on their Board of Directors.