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Advanced Materials via Science at the Mesoscale

Presented by:

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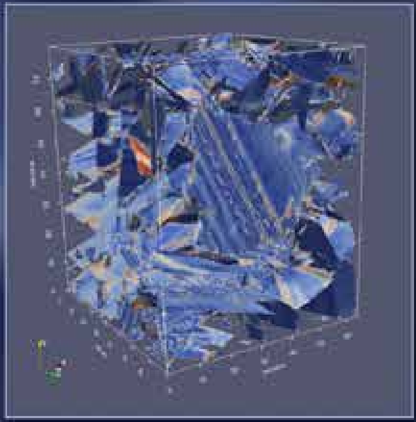

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Advanced Materials via Science at the Mesoscale

The discovery of new materials with unique properties and functionalities has revolutionized entire industries (communications, aerospace, automotive) and fundamentally transformed society over the past few centuries. However, the pace by which new materials can impact technological systems has long been limited by the immense scope of the problem. Most materials are multicomponent - often containing 8 to 10 elements from the periodic table.

The properties of materials and their behavior in service environments are strongly influenced by processes across many scales, from atomic scale (nanometers) to the mesoscale (millimeters and above). Recent advances in theory and computation have greatly expanded our ability to predict atomic-scale phenomena. However, tools for the mesoscale that permit prediction of properties such as stiffness, permeability or fatigue life are still strongly lacking.

Emerging capabilities for 3D and 4D materials science that address these mesoscale challenges will be discussed. Examples of unique mesoscale materials information that can be acquired via a new "Tri-Beam" tomography platform are reviewed. The challenges with regard to materials data will be discussed and the future outlook for discovery, design and implementation of new materials will be addressed.

ABOUT

Professor Tresa Pollock

Tresa Pollock is the Alcoa Professor of Materials at the University of California, Santa Barbara. Professor Pollock is a world-renowned expert in the science and technology of advanced structural alloys with applications in aerospace, energy and automotive industries. She holds degrees from Purdue University (B.Sc. 1984) and MIT (Ph.D. 1989). Her professional career started at GE Aircraft Engines, where she worked in the development of advanced superalloys for gas turbine engines. In 1991 she joined the MSE faculty at Carnegie Mellon University, where she was Alcoa Professor until 1999. In 2000 she moved to the University of Michigan, where she held the L.H. and F.E. Van Vlack Professorship of Materials Science and Engineering. In 2010, she joined the Materials Department at UCSB where she is now serving as Chair of the Department.

Professor Pollock is the recipient of numerous honors and awards, most notably her election to the National Academy of Engineering in 2005 and election as TMS Fellow in 2009 "for seminal contributions in the understanding of high temperature alloys, for distinguished leadership in materials education and the materials profession," and the German Academy of Sciences Leopoldina in 2016. She has been honored both for her contributions to the literature (2008 AIME Raymond Award, 2005 Magnesium Technology Award) as well as for excellence in teaching (1995 ASM Stoughton Award) and overall professional accomplishment (1999 ASM Silver Medal, 205 IMR Lee Hsun Award, 2007 ASM Jeffries Lecture). Professor Pollock is a Fellow of TMS, serving as President in 2005, and ASM International, Editor in Chief of Metallurgical and Materials Transactions and was the 2005-2006 President of The Minerals, Metals and Materials Society.

Professor Pollock's current interests include the mechanical and environmental performance of materials in extreme environments, unique high temperature materials processing paths, ultrafast laser-material interactions, alloy design and 3-D materials characterization. Her recent research has focused on thermal barrier coatings systems and platinum group metal-containing bond coats, new intermetallic-containing cobalt-base materials, vapor phase processing of sheet materials for hypersonic flight systems, growth of nickel-base alloy single crystals with a new liquid tin-assisted Bridgman technique, development of new femtosecond laser-aided 3-D tomography techniques and development of models for Integrated Computational Materials Engineering efforts.