**Materials Seminar**

Department of Materials Science & Engineering

# Thursday March 8, 2018

3:30 – 4:30 ~ Min Kao 404

Faculty Candidate

"Processing-Structure-Property Relationships in Additively Manufactured Metals: Building Reliable & Reproducible Microstructures"

**Speaker:** **Dr. Eric Lass**



National Institute of Standards and Technology

Abstract:

Additive manufacturing (AM) has received significant attention in recent years because of its potential to transform the commercial production of components, particularly for high-value, low-volume applications, where part geometries and other requirements make them difficult or impossible to produce via conventional processing methods. One inherent drawback to current AM technology is the reproducibility of microstructures and properties of materials created via the additive process. This is because most of the alloys currently in use for AM applications were originally developed for dramatically different processing routes, namely conventional cast and/or wrought processes. Thus, the microstructures and properties of alloys built using AM processes can be dramatically different than nominally identical wrought counterparts. In many cases, properties also show significant variation from build to build using the same AM process, making component design using such materials impossible. In the present work, we investigate the processing-structure-relationships in additively manufactured materials, focusing on thermal processing in the solid state, i.e. post-built material. Specifically, Inconel 625 and 17-4 PH stainless steel are investigated. As expected, as-built microstructures are comparable to welded materials, and they respond in a similar manner to thermal processing as welded alloys. However, differences are also observed, resulting from the unique processing history of AM alloys compared to conventional materials. For example, composition differences arising from the gas atomization of powder feedstock. Using both computational modeling and experimental investigation the differences in microstructural evolution behavior of conventional and AM materials are highlighted; and post-build thermal processing regimens are identified to develop more uniform predictable AM-produced microstructures. Finally, the future of AM will also be discussed, where the dream is to employ alloys specifically designed to take advantage of AM processing instead of repurposing alloys designed for other applications. Some possible considerations for AM alloy design will be discussed.

Biography:

Eric Lass received his Ph.D. from the University of Virginia in 2008. He moved to NIST in 2009 as an NRC postdoc, and joined permanent the staff in 2011. He is currently the leader of the MSE Division project titled “Advanced Materials Design: Structural Applications”; and is also a sublead on the MSED project on additive manufacturing, where he is the coordinating of much of the experimental investigation. Eric’s research interests are in the broad field of phase transformations and microstructural evolution in metals and alloys. Current research topics include combining experiment and computational thermodynamics to understand phase transformations and microstructural evolution in metals and alloys. He is also active in TMS, serving on several technical committees and organizing symposia at the TMS annual meeting.