Three Dimensional Characterization of Materials

The linkage between processing, microstructure and properties is well known in the field of materials science. However, in most materials systems, especially in metallic and ceramic systems, the full microstructure is obscured and is only observable through to two-dimensional cross sections. While much information can be gained through 2D analysis, critical relationships and the true distributions of morphology are unclear, and can lead to false interpretations of the microstructure. Advances in computational power, as well as automation and imaging techniques, have now made it possible to examine materials in 3D, providing for the first time unambiguous measurements of the materials morphologies and distributions, and allowing for critical insight to how the microstructures evolved from processing and control the resultant properties. In this talk I will discuss how 3D characterization through automated serial sectioning is being used to validate and inform models of microstructural evolution, especially during grain growth. The data provides unique insight into the process of evolution and how nearest neighbor relationships play a key role in the evolution of the grain structures, an how crystallographic symmetries can drive unusual formations within polycrystalline grain networks.

Bio:

Dr. Rowenhorst received his Ph.D. from Northwestern University in 2004 in Materials Science and Engineering. Dr. Rowenhorst's doctoral work concentrated on the three-dimensional analysis of microstructures, specifically using 3D reconstruction to analyze particle coarsening (or Ostwald ripening) in Pb-Sn systems in microgravity environments. After graduation in 2004, Dr. Rowenhorst joined NRL as a NRC Postdoctoral Associateship and in 2006, continued on a staff scientist in the Phase Transformations and Joining Section. His work continues to concentrate on the 3D characterization of materials, specifically analyzing grain growth in polycrystalline materials and phase transformations in high strength steels. Additionally he has interests in high speed data collection through electron microscopy, and creating open frameworks for the storing and sharing of large materials datasets.