



Mechanical Engineering Seminar Series

In Situ Characterization of Polycrystalline Materials at the Mesoscale.

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Tuesday, April 12, 2022

4:00 p.m. - 1303 EECS

[ME Seminar Zoom link](#) (QR Code below)

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Abstract

Polycrystalline materials comprise the vast majority of engineering materials. Understanding the complex interplay between their grain structure and critical bulk material properties, such as strength and resistance to damage, continues to be a primary thrust of materials research. I present High-Energy Diffraction Microscopy as a technique for characterizing both the microstructure and micromechanical state of bulk samples at the intergranular mesoscale – a unique ensemble view of these materials that were previously inaccessible. I present several example applications from in situ deformation studies, including the determination of single-crystal slip system strengths, examination of deformation intermittency and its relation to dwell fatigue and alloying in Titanium, statistical analysis of a Ni-superalloy at elevated temperature, and determining the active mechanism for the pressure-driven $\alpha \rightarrow \omega$ phase transition in Zirconium. My objective is to generate interest in new applications of the technique, as well as to sound a “call to arms” to address the pressing need for applying novel statistical analyses to these very rich data.

Bio

Joel's early interest in all things mechanical – bicycles in particular – manifested as enrollment in a dual degree program in Mechanical Engineering and Physics at Clarkson University. After receiving his Bachelor degrees in 1999, he enrolled at Cornell University to pursue a PhD under Matthew Miller. It was there that he was introduced to X-ray diffraction – Cornell having its own synchrotron – and his dissertation studies played an important role in establishing the materials research program that exists there today. In 2005, Joel took a post-doctoral appointment at the Advanced Photon Source where he began working on the grain-resolved diffraction techniques presented in this talk. Joel subsequently joined the staff at Lawrence Livermore National Laboratory in 2007, where 15 years later he continues to refine the acquisition and analysis of X-ray diffraction data against the backdrop of sun-drenched vineyards.

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