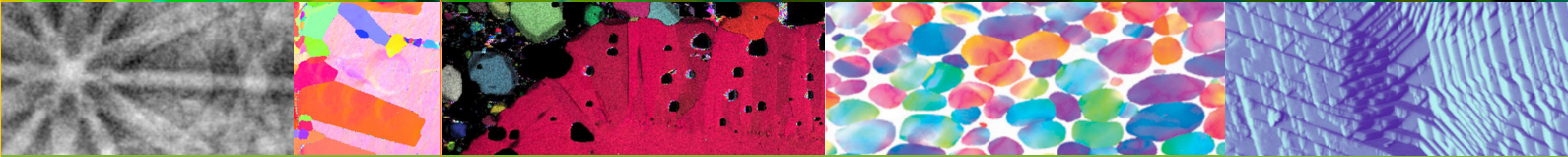


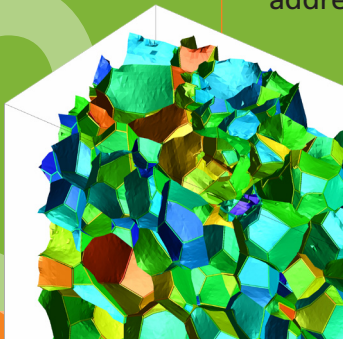
# Dedicated to the Understanding, Control, and Optimization of Interface Dominated Materials Properties



The Materials Research Science and Engineering Center (MRSEC) is an interdisciplinary research and educational enterprise within Carnegie Mellon University dedicated the understanding, control and optimization of grain boundary dominated materials properties.

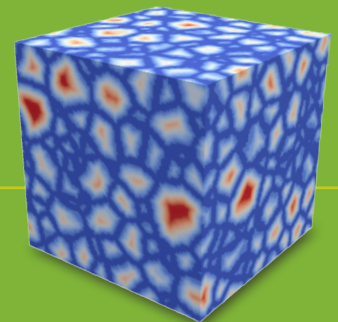
One of the long-range goals of materials research has been to understand, at a predictive level, the mechanisms that link the performance of polycrystalline materials to their processing and mesoscale structure. Although the physical and chemical mechanisms that govern different types of performance, such as electrical resistance and yield strength are completely different, a common requirement for establishing such links is an accurate and quantitative description of the structure. To address this issue, the mesoscale

interface mapping project (MIMP) of the Carnegie Mellon MRSEC has worked to quantify the mesoscale structure of polycrystals, to understand the mechanistic origins of the grain boundary distribution, and to understand its influence on macroscopic response. We have led the development of experimental data and theoretical simulations of polycrystals involving all three spatial dimensions and all five crystallographic dimensions.



## HIGHLIGHTS . . .

Three dimensional measurements of orientations and grain boundary properties with polycrystalline solids.

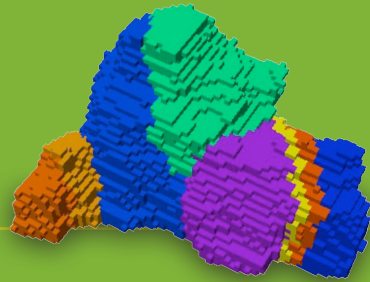
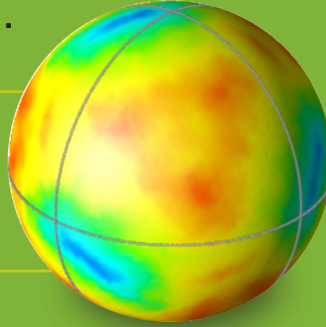


Modeling mechanical response of three dimensional granular structures from experimental and hypothetical structures.

DIRECTOR: Gregory S. Rohrer  
<http://mimp.materials.cmu.edu/>

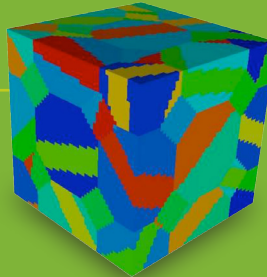
## RESEARCH FUNDAMENTALS . . .

The Carnegie Mellon MRSEC pioneered the study of grain boundaries as a function of all five observable crystallographic parameters.



The Carnegie Mellon MRSEC discovered the role of grain boundary energies in determining the relative populations of grain boundaries.

The Carnegie Mellon MRSEC developed tools to create hypothetical microstructures with specific statistical properties.



Grain boundaries are literally holding together the materials that make up the world around us – our goal is to be able to predict which grain boundaries occur and how they influence the properties of a material. //

Gregory S. Rohrer, Director MRSEC



## MRSEC OFFERS DIVERSE EDUCATION AND PARTNERSHIPS...

- **The CMU MRSEC** hosts an annual ten-week summer research program to expose science and engineering undergraduates to cutting edge materials research.
- **“Talk to the Professor”** allows high school students to engage in a discussion with a CMU professor on a topic in materials science. The purpose of this activity to enhance and enrich the secondary student’s education by enabling the interaction with a professor in the science community.
- **The CMU Summer Internship** for teachers allows high school educators to spend 4-6 weeks developing a curriculum unit for use in their class, usually involving a laboratory exercise, that illustrates some fundamental principle of Material Science.

# OUTREACH

More information about the workshops, internships, partnerships, and educational opportunities are available at: <http://mimip.mems.cmu.edu/education/index.html>

