Carnegie Mellon

Materials Science and Engineering Seminar Series

Materials Research at Carnegie Mellon

Herbert Miller

Graduate Research Assistant
Department of Materials Science and Engineering
Carnegie Mellon University

"Evolution of the Grain Boundary Character Distribution with Processing"

Friday, February 1, 2008
11:30 A.M. Seminar in Baker Hall A51
Refreshments precede seminar at 10:30 A.M. in 2325 Wean Hall

The grain boundary character distribution (GBCD) is the relative areas of grain boundaries, distinguished by their lattice misorientation and grain boundary plane orientation. It is hypothesized that for a given polycrystalline material, grain boundary energy anisotropy and geometric constraints lead to a deterministic, anisotropic GBCD. After a transitory initial state, the GBCD will be a scale-invariant characteristic of the microstructure during grain growth. Manipulation of grain boundary energy anisotropy or geometric constraints should allow for predictable manipulation of the GBCD and perhaps GBCD-dependent properties. To test the hypothesis of scale-invariant behavior of the GBCD with grain growth, we have used orientation mapping in the SEM coupled with a stereological analysis to measure the GBCD in polycrystalline strontium titanate at several time steps during grain growth at constant temperature. Quantitative comparisons of the distributions show self-similar behavior of the misorientation-averaged grain boundary plane distribution with grain growth while the five parameter GBCD evolves in such a way that the higher energy boundaries are preferentially eliminated. A comparative study of the GBCD in commercially available "reference" and "grain boundary-engineered" Ni will also be discussed, as an example of a case where the stored strain energy drives the changes in the microstructure.

Herb received his Bachelor's and Master's degrees in Materials Science and Engineering from Carnegie Mellon University in 2002 and 2004, respectively. He is currently a Ph.D. candidate under the guidance of Prof. Rohrer.