Carnegie Mellon

Materials Science and Engineering Seminar Series

Materials Research at Carnegie Mellon

Jason Gruber

Department of Materials Science and Engineering
Carnegie Mellon University

"Grain growth, interfacial anisotropy, and texture development"

Friday, March 24, 2005
11:00 A.M. Seminar in Baker Hall 136A
Refreshments precede seminar at 10:30 A.M. in 2325 Wean Hall

The study of microstructure is fundamental to the field of materials science, as the expected properties and utility of engineering materials are routinely inferred from structural features. This has traditionally involved optical imaging of structural features and gathering statistics on grain size or inclusion content, phase identification, or a range of other geometric parameters. Modern quantitative microstructural analysis includes methods known collectively as "texture analysis," all of which provide some kind of information about crystal orientations. For these methods and the research based on them to have a significant impact on engineering practice, it must be shown that the control of texture can bring about improved materials performance. This involves first determining what textures lead to desired properties, and then demonstrating that process control can produce real changes in observed texture.

The focus of the present work is to observe what grain boundary character distributions (interface textures) develop during grain growth in polycrystals and to explain the physical mechanisms responsible for these observations. This is a crucial step towards the more general goal of controlling interface character by thermal processing. This talk will include results from three-dimensional moving finite element and Monte Carlo grain growth simulations with anisotropic grain boundary properties. We will show that interface texture develop during grain growth, and also consider the relative effects of energy and mobility anisotropy. Evidence that suggests what physical mechanism controls texture development during grain growth will be presented. We will show that we can predict reasonably well what grain boundary character distribution will result from grain growth with knowledge of the grain boundary energy alone.

Jason Gruber is currently a PhD candidate in the Department of Materials Science and Engineering. He received his BS in Materials Science and Engineering at Lehigh University in 2002.