Carnegie Mellon
Materials Science and Engineering Seminar Series
Materials Research at Carnegie Mellon

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

"Grain Growth and Stagnation in a Nickel Alloy: A Computational and Experimental Perspective"

Friday, September 15, 2006
11:00 A.M. Seminar in Doherty Hall 1212
Refreshments precede seminar at 10:30 A.M. in 2325 Wean Hall

A number of models have been developed to predict microstructure evolution during isothermal annealing in single and multi-phase materials. From a computational approach, a series of models in materials research and development have been implemented to simulate important physical phenomena such as recrystallization, precipitation, and grain growth. Their primary objective is to illuminate the mechanisms that control a process or property. In both cases, limited evidence exists for grain growth phenomena in multiphase materials. In this study, recrystallized Waspaloy was annealed at a γ' super-solvus temperature, 1100°C, to investigate the role of carbides during grain growth from a topological and texture perspective. The carbide size and volume fraction were evaluated and found to be stable; however, by comparing the overall misorientation distribution function with the types of boundaries on which the carbides are located, the correlation between particles and boundaries varied markedly as grain growth proceeded. The overall crystallographic texture sharpened slightly through a period of 1 hour at 1100°C. An attempt will be made to validate a Monte Carlo Potts-based model with experimental results. This research is focusing on the application of a Monte Carlo code to the problem of particle pinning of grain growth in an ideal two phase material. In order to obtain reasonable statistics of particles and grains at the 0.2-2% volume fraction of carbide found in typical alloys, it is necessary to use parallel codes in order to have sufficiently large simulation domains. Preliminary results appear to agree with the Zener-Smith estimate of a critical grain size as grain growth stagnates. Furthermore, novel methods must be implemented to probe the extreme regimes ($< 0.2\%V_v$) of grain – particle interactions.

Chris received his Master and Bachelor degree 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. Rollett and Dr. Semiatin