Northeastern University

Distinguished Lecture in Nanotechnologies through Materials Innovation

Co-hosted by Mechanical and Industrial Engineering, Chemical Engineering, and Physics Departments

Presents

Professor J.J. Hoyt

Chair, Department of Materials Science and Engineering,
MCMaster University, Hamilton, ON

Topic: Particle Growth, Melting and Nucleation at the Nanoscale

Date: Monday, January 27, 2014
Time: 10:30am to 12:00pm (Refreshments from 10:00am to 10:30am)
Location: 50 Dodge Hall

Abstract: In this seminar various aspects of first order phase transitions at the nanoscale will be discussed. First, the growth velocity of plate-like precipitates in alloys is investigated, where the close analogy with dendritic solidification is emphasized. The concentration field in the matrix phase during growth is formulated by a boundary integral technique, which correctly accounts for the nanoscale step-terrace structure of the advancing precipitate, and, by examining the conditions at the plate tip and by using a stability argument for the plate thickness, a modified Ivantsov relationship is established between the growth velocity, the radius of curvature of the plate tip and the supersaturation. Results of the boundary integral formulation will be compared with experiment. Second, the concept of premelting at surfaces and internal interfaces will be reviewed and a molecular dynamics simulation method for extracting the so-called disjoining potential will be described. Preliminary results on the premelting of Au nanoparticles will be presented with particular emphasis on the suppression of the melting point in these nanoscale systems. Finally, molecular dynamics simulations of nucleation of the body centered cubic phase from the face centered cubic phase in a model of pure Fe will be presented and comparison of the simulation results with the classical theory of solid-solid nucleation will be described.

Bio-Sketch: Professor J.J. Hoyt received his BS degree in Materials Science and Engineering from Cornell University and his MS (1982) and PhD (1986) in Physical Metallurgy from the University of California, Berkeley. From 1988 to 1996 Dr. Hoyt was a faculty member in the Department of Mechanical and Materials Engineering at Washington State University, achieving the rank of associate professor. From 1997-2007 Prof. Hoyt was a senior member of the technical staff at the Sandia National Laboratories at both the Livermore, CA and Albuquerque, NM sites. Prof. Hoyt joined the Department of Materials Science and Engineering at McMaster University in 2007 and in 2012 was named chair of the department.

Prof. Hoyt is the author or co-author of over 100 papers in refereed scientific journals and has presented over 50 invited presentations at national and international scientific conferences. His research expertise is the study of phase transformations in materials using advanced computational tools such as molecular dynamics and Monte Carlo simulations.