

Seminar Series

School of Materials Science and Engineering

Thursday, April 30, 2009

5:00 PM – Room 200 Olin Hall

Electrodeposition of nanocrystalline Ni-based alloys

HanSeung Park

Abstract:

Nanocrystalline materials can possess superior properties. For example, mechanical properties can be improved due to the Hall-Petch effect. However, nanocrystalline materials are generally unstable against grain growth when the grain size is less than 10 nm. Addition of a second element can reduce the excess grain boundary energy (as the driving force for grain growth) as well as grain boundary mobility, thus stabilizing nanocrystalline alloys. In present work, eight Ni-based alloys (pure Ni, Ni-W, Ni-P, Ni-Mo, Ni-Cu, Ni-B...) were made using an electrodeposition method. Different dopants result in different film morphology; among the eight binary alloys, Ni-W and Ni-P films are dense and uniform. Grain size was measured by SEM and XRD. A correlation between doping level and grain size is confirmed. Doped and undoped specimens are annealed at various temperatures in flowing Ar-H₂ to probe grain growth.

Advisor: Dr. Jian Luo

Optimization of beaming light from a subwavelength metal slit with surface gratings

Pengyu Chen

Abstract:

The transmission of light from a subwavelength aperture will be very weak and has a characteristic to diverge. This limitation can be overcome by creating periodic gratings on the exit side of a single slit in a metal film. We use COMSOL to simulate beaming light from a subwavelength metal slit with three different kinds of surface gratings. Simulation results show that by adjusting the grating periods and separation distance of the first two grooves of the gratings, transmitted light from the slit as a beam with a small angular divergence (approximately $\pm 3^\circ$) can be achieved. These results suggest that a wide range of photonic applications is possible, such as improving the functionality of optical devices through the subwavelength manipulation of light.

Advisor: Dr. Zhu Lin

Lab-Scale Experimental Design to Study the Cut Resistance of Aramid Fibers

Jeff Moreland

Abstract:

The results of a four-factor response surface experimental design used to study the effect of processing conditions on the cut resistance of wet-spun aramid fibers will be presented. The design utilized a split-plot arrangement to reduce the cost of the design and allow for implementation on small-scale wet spinning line. A para-oriented aramid copolymer was used as the fiber-forming polymer in the design, and the effects of coagulation additives and drawing on the cut resistance of the resulting fibers were studied using a novel cut testing device. Future microscopy and single-fiber studies will be used to further characterize the fiber morphology and structural relationships in an attempt to develop a more fundamental understanding of cut resistance.

Advisor: Dr. Phil Brown