635-321
Structural, Mechanical, and Chemical Applications of Nanostructures and Nanomaterials
Department of Ceramic and Materials Engineering

Course Instructors:
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Term:
Fall 2005 Wednesday: 5:00-8:00; ARC 110

Office Hours:
Cannon 4:30-6:00 Wednesday
Kear

Description:
Topics covered will be a nanoscale, fundamentals of grain boundaries and surfaces, application of nanomaterials to batteries, fuel cells and catalysts and mechanical applications such as hardness, yield strength, superplasticity, tribology and wear, microelectro-electro-mechanical systems (MEMS).

Objectives:
1) Develop an understanding and appreciation for nanomaterials technology
2) Learn to seek out the literature on current research topics.
3) Develop an understanding of new techniques used in studying nanomaterials.
4) Understand some of the theory describing differences between nanomaterials and micronmaterials.

Prerequisites:
Introduction to Nanomaterials

Attendance:
No attendance will be taken but material covered in class will often not be found in textbooks.

Projects:

Students will be required to write a paper covering a topic in structural, mechanical or chemical properties of nanomaterials. (The topic must differ from the topic papers submitted in Introduction to Nanomaterials).

Texts:
"Nanomaterials: Synthesis, Properties and Applications," A. S. Edelstein (editor), R. C. Cammearata (editor). Institute of Physics, Bristol and Philadelphia, 1996.

Supplimental reading:

Grade: 35% paper (topic approval Oct 26, paper due Dec. 9); 10% homework ; 20% Midterm; 35% Final.

Policy on Other Electronic Devices:
The use of cell phones, pagers, Walkman or any other electronic device that may disrupt the class is not permitted. They must be turned off or muted during class.

Academic Integrity:
Students will be expected to adhere to the Policy on Academic Integrity listed within the New Brunswick Undergraduate Catalogue. Students are encouraged to review this policy.

Contribution of Course to Meeting the Professional Component of ABET: Students gain basic science, engineering knowledge in lectures. Each topic requires fundamental understanding of the subject to understand the uniqueness of nanomaterials technology.

Schedule of Lectures

Date	Subject	Lecturer
Sept 7	Introduction to Nanomaterials Reading: Ch 1,9: Introduction, Nanostructures	Cannon
Sept 14	Introduction to nanoprocessing	Kear
Sept 21	Powder synthesis	Kear
Sept 28	Powder synthesis	Kear
Oct 5	Powder synthesis	Kear
Oct 12	Unique nanomaterials	Kear
Oct 19	Grain boundaries and Molecular Dynamics	Garofalini
Oct 26	Laboratory – molecular dynamic simulations	Garofalini
Nov 2	Midterm exam	Cannon
Nov 9	Dislocations and creep in polycrystalline materials Reading: (Ch. 7 in Callister): Dislocations and Strengthening Mechanisms.	Cannon

Nov 16	Nanomaterials and the Petch Relationship Nano-Indentation Reading: Ch 13: Mechanical Properties Weertman and Averback	Cannon
Nov 22	Superplastic forming of nanomaterials	Cannon
Nov 30	Fracture, resistance, thermal conductivity and coefficient of friction	Cannon
Dec 7	MEMS and NEMS	Cannon
Dec 21	Final Exam 6:10-9:00 PM	Cannon

Syllabus prepared by: W. Roger Cannon
Date: August, 2005