Spring 2009 – EML4930/5930: Experimental Methods in Nanoscale Science & Engineering
Course Syllabus
CEB A223 - MW 9:15-10:30

Instructor: Dr. Ongi Englander
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Office hours: Monday 10:30am-12:30pm or by appointment
Class info, reading materials, etc are available on course Blackboard site

Course Description

Nanomaterials with desired and well controlled properties that can be reliably reproduced are a requirement for the successful integration of nanoscale components in next generation materials and devices. We have a wide range of options in terms of tools and techniques when fabricating nanoscale materials. In broad categories, we must consider both top-down and bottom-up methods. Interfacing with and studying nanomaterials is facilitated by our characterization tools, without which, the nanoscale would be inaccessible to us. We utilize tools that allow us not only to visualize our nanoscale creations but also evaluate their properties (electrical, thermal, mechanical, structural etc). As experimentalists, we utilize a combination of fabrication and characterization techniques (often in an iterative fashion) to realize and understand novel materials. This course will explore experimental methods in nanostructure fabrication and characterization.

Prerequisite: *Introduction to Micro and Nano Scale Science and Engineering* or permission of instructor.

Course Objectives

Throughout this course students will:

- Survey the literature, identify and collect journal articles pertaining to specific topics
- Identify and describe various nanostructures, nanomaterials and nanoscale phenomena
- Describe techniques for nanostructure fabrication and synthesis
- Propose synthesis parameters for nanostructure fabrication
- Compare and contrast various electron and probe-based imaging techniques
- Identify images from various microscopy tools
- Critically evaluate tools and techniques available in nanomaterial fabrication
- Understand the opportunities and challenges offered by nanotechnology
- Participate in team based projects & learning

Topics

Nanoparticles
1-D nanostructures
Thin films and thin film deposition systems
Reducing feature size via advanced litho and other methods
Bio-nano materials
Carbon based nanomaterials
Electron microscopy
Probe based microscopy

There is no textbook for the course; lecture material will be drawn from a variety of sources. Readings and references will be available through Blackboard.

Grading Policy

Undergraduate Students

Class participation/attendance	10%
Quizzes	20%
Semester project (group)	25%
Group projects (group)	25%
Lab activities	5%
Individual proposal with literature survey	15%

Graduate Students

Class participation/attendance	10%
Quizzes	15%
Semester project (group)	25%
Group projects (group)	25%
Lab activities	5%
Individual proposal with literature survey	10%
Paper presentation	10%

Participation & attendance policy

This course will be discussion-based and interactive. Consequently, attendance is required and participation in class activities will be factored into final grades.

Quizzes

Quizzes will be administered in class and may or may not be announced.

Lab activities

Hands-on experience will complement the lecture portion of the course. Both, short labs and the semester-long project will contribute to *lab activities.* Pre lab/post lab assignments and required lab training are also considered *lab activities*.

Group activities

This course has *three group assignments* as well as a *semester-long project* which will be carried out in parts through the semester.

Paper presentations

Graduate students are required to select a journal article (or journal articles), prepare a presentation and lead a class discussion regarding the content of the chosen work(s). No review articles may be selected and the topic area must be relevant to the course content. You must email the instructor the paper(s) to be presented at least 24 hours prior to your presentation date. Papers will be posted on Blackboard in advance of your presentation.

This course relies on the availability of a wide range of equipment, materials and general infrastructure. Should any of the required components become unavailable or inoperable, suitable arrangements and substitutions will be made.