14:635:320 Introduction to Nanomaterials Science and Engineering

Spring 2010

Tuesday/Friday 8:40-10:00AM, SEC 207

Registration Index #70122

Coordinator: Lisa C. Klein, Professor of Materials Science & Engineering, SOE A225, 732 445-2096, licklein@rci.rutgers.edu

Office Hours: Wednesday & Thursday 1-4PM

Prerequisite: Completion of 60 credits in Engineering, Chemistry or Physics Programs or permission of the Coordinator

Nanotechnology involves behavior and control of materials and processes at the atomic and molecular levels. This interdisciplinary course introduces the student to the theoretical basis, synthetic processes and experimental techniques for nanomaterials. This course is the introduction to 3 advanced courses in (1) Photonic, Electronic and Magnetic Applications, (2) Structural, Mechanical and Chemical Applications, and (3) Biological Applications of Nanomaterials. The advanced courses can be taken along with an accompanying laboratory. Students interested in nanomaterials science and engineering should take this Introduction first, and then choose 1 or more of the advanced courses.

Text: Nanostructures and Nanomaterials: Synthesis, Properties and Applications, G. Cao, ICP, London, 2004 (Cao-required)

Nanomaterials: Synthesis, Properties and Applications, ed. A. S. Edelstein and R. C. Cammarata, IoP (UK), 1996 (E&C-recommended).

OUTLINE 2010

Date	T/F	Topic	Assigned Reading	
January			**Cao**	***E&C***
19	T	Philosophy, History, Motivation	1-14	*3-10*
22	F	Survey of Materials and Scaling		*13-54*
26	T	Ultrafine Powders and Comminution	15-50	*89-110*
29	F	Nucleation and clustering (HOMEWORK #1: DUE)	51-81	*55-71*
February				
2	T	Sol-Gel Processing	81-105	*147-164*
5	F	No class		
9	T	Atomic Probe Microscopies	329-343	
12	F	Physical/Chemical Vapor Deposition	110-143	*113-144*
16	T	Gas Phase Synthesis (HOMEWORK #2: DUE)		*173-204*
19	F	Self Assembly	205-218	
23	T	Self Assembly		

Please turn over.

26	F	Surface area and porosity (HOMEWORK #3: DUE)	238-256	*305-321*
March				
2	T	Consolidation		
5	F	In-Class **Test**		
9	T	Nanoelectronics		
12	F	1- and 2-dimensional Systems		*347-373*
Spring Break				
23	T	Quantum Dots (ASSIGN CASE STUDIES)		*395-436*
26	F	Photolithography (HOMEWORK #4: DUE)	277-291	*497-539*
30	T	Imprint lithography	291-328	*477-494*
April				
2	F	Organic Electronics		
6	T	Mechanical Properties	352-362	*323-345*
9	F	Energy storage applications		
13	T	Energy conversion applications		
16	F	Electrochromics and photovoltaics (HOMEWORK #5: DUE)		
20	T	In-Class **Test**		
23	F	CASE STUDY PRESENTATIONS		
27	T	Nanocomposites		
30	F	Nanocomposites		
May				
11	T	**EXAM**, 8:00-11:00 AM		

Grading:
2 in-class tests 40%; 5 homeworks 25%; case study presentation 10%; final exam 25%. Without prior approval, late homework will not be counted after the end of class. However, all homeworks must be turned in. Problem sets can be solved as a group, but tests and the exam must be individual efforts. Regular attendance is expected. Class participation is encouraged. All tests are open notes/open book.