

# Chemistry 425 – Self-Assembly and Materials Information Sheet

- **Topics:** Characterization techniques for nanomaterials, inorganic nanoparticles, devices and photonics, block copolymer assembly and application.
- **Time/Location:** Mondays 8:30, Tuesdays 10:30, Thursdays 9:30/online until pandemic abates
- **Instructor:** Dr. Guojun Liu, CHE411, [Guojun.Liu@chem.queensu.ca](mailto:Guojun.Liu@chem.queensu.ca); 533-6996
- **Grading Scheme for the Whole Course:**

Problem Sets (3):	60%
Final Problem Set	40%
Total:	100%
- You may discuss with each other on your assignment questions. However, you have to write up your assignments on your own. All those who hand in the same identical finished assignments will be punished for plagiarism.
- **Reference Books:** R.J. Young and P.A. Lovell *Introduction to Polymers* 2<sup>nd</sup> ed., Chapman & Hall, London, 1991 (Call No.: QD381. Y68 1991) and G.A. Ozin and A.C. Arsenault *Nanochemistry: A Chemical Approach to Nanomaterials*, RSC Publishing, 2005.

# Lecture Outline (1)

Lecture #	Content
1	Course Introduction
2	Materials Chemistry – An Example Project
<u>Techniques of Nanoscience</u>	
3	Operating principles of optical microscopes
4	Microscope Resolution and Depth of Field
5	From Light Microscopy to Electron Microscopy
6	TEM Sample Preparation and Observation
7	Scanning Electron Microscopy (Assignment 1 out)
8	SEM Sample Preparation and comparison between SEM and TEM
9	Scanning Probe Microscopy
10	Dynamic Light Scattering

# Lecture Outline (2)

<u>Inorganic Nanoparticles</u>	
11	Introduction to Inorganic Nanoparticles (Assignment 1 due)
12	Theory on Crystal Nucleation and Growth
13	Nanocrystal Preparation by Controlled Nucleation and Growth
14	Properties and Display Applications of Quantum Dots (Assignment 2 out)
15	Sensory and Diagnostic Applications of Quantum Dots
16	Synthesis, Properties, and Applications of Gold Nanoparticles
17	Co Nanoparticles
18	Reserved for unanticipated needs (Assignment 2 due)
<u>Devices and Photonics</u>	
19	Operating Principles of Common Devices
20	Photonic Crystals
21	Silica and Polymer Microspheres (Assignment 3 out)

# Lecture Outline (3)

<u>Block Copolymer Self-Assembly and Applications</u>	
22	Anionic Polymerization (1)
23	Anionic Polymerization (2)
24	Entropy for Mixing Polymers
25	Energy for Stretching Polymer Chains ( <b>Assignment 3 due</b> )
26	Energy and Equilibrium Thickness of the Lamellar Morphology
27	Chemical Processing of Self-Assembled Block Copolymer Solids
28	Block Copolymer Self-assembly in Block-selective Solvents (1)
29	Block Copolymer Self-assembly in Block-selective Solvents (2)
30	Block Copolymer Nanolithography ( <b>Assignment 4 out</b> )
31	Friction Reduction of Block Copolymer Micelles
32	Block Copolymers in Superamphiphobic Coatings

- Time after period 32 is reserved for unanticipated events and for covering unplanned topics.