Syllabus

Fall 2003, Chemistry 664
9:55 M,W
Rm. B387, Chem. Bldg.

Instructor: Hyuk Yu
Room 4227, Chem.Bldg.
yu@chem.wisc.edu

PHYSICAL CHEMISTRY OF MACROMOLECULES

2-3 credits (3rd credit requires a term paper on a subject to be chosen)
Textbook: "Polymer Physics ", Michael Rubinstein & Ralph Colby,
Oxford University Press, July 2003, will be distributed as a handout

- Those registered for 3 credits must report to the instructor by September 26, concerning their preferences for the term paper topics.
- There will be 11 problem sets, to be graded and will count toward the final course grade by 15%.
- There will be a mid-term examination, counting toward the final course grade by 35% during the week of October 27 outside the scheduled class hours. The exact time will be found at the conveniences of all registered.
- The final examination will be held at the specified time as indicated in the Time Table, December 19 (Fri), 12:25 pm.
- The course grading is in the standards of graduate course, i.e., C and below is a failing grade.
- References given in lectures are to be consulted as the time allows, but specific ones to be read will be brought to the attention of the class.

Lecture Outline:

I. ***Introduction***

Introduction to the structural orders of macromolecules and polymers; conformational regularities and chain configurations; molecular weight distributions; determinations of molecular weights

II. ***Single chain conformation***

A. Ideal chains

- Models of freely-jointed chains, freely-rotating chains, worm-like chains, chains with hindered rotation, & rotational isomeric state
- Linear chain dimensions; radius of gyration and end-to-end vector
- Distribution of the end-to-end vector
- Free energy & pair correlation function of the ideal chain
- Determinations of the linear dimensions

B. Real chains

- Self-avoiding random walk & excluded volume effects
- Deformations under tension, compression and by adsorption on substrate
- Scaling model of real chains, temperature effects and virial coefficients
- Determinations of the linear dimensions

III. ***Thermodynamics of Blends & Solutions***

- Statistical thermodynamics of mixing
- Free energy of binary mixing
- Equilibrium & stability

- Phase diagrams

IV. ***Statistical thermodynamics of polymer solutions***
- Cell model and Flory-Huggins theory
- Solvent quality and chain dimensions
- Semi-dilute solutions
- Scaling models of brushes & mushrooms

V. ***Network & Gelation***
- Random branching & gelation
- Networks & Gels

VI. ***Chain Dynamics***
- Unentangled polymer dynamics
- Entangled polymer dynamics