Electrochemistry of Polymer Films - 4:220

Syllabus for Chemistry 4.220 - Spring 2010 - 1 Hour
January 21 through February 18 - 6:30 p.m. to 9:20 p.m., Thursday, C139 PC
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(Tentative) Office Hours 9:00 to 11:30 Thursdays and by appt.

General Comments on the Course:  This course is intended to introduce graduate students to the use of electrochemical methods in characterizing polymer films. This includes the transport properties of the films, their electroactive and ion exchange properties, as well as how properties change upon forming composite materials. The course may be of interest to students in pharmacy and chemical engineering who evaluate polymer, film, and membrane properties.

Text:  Information will be provided in lecture and hand outs. For more detailed information about voltammetry, see, for example, *Electrochemical Methods* by Allen J. Bard and Larry R. Faulkner.

ICON:  The class website is at http://icon.uiowa.edu/. All registered students should have access through their hawkid and password; if you are having trouble, please let me know. The website will contain information for the class, including updates and supplemental material.

Prerequisites:  Undergraduate analytical and physical chemistry.

Course Topics:
- Introduction to Electrochemistry and Electrochemical Methods
- Classes of Polymers and Film Formation
- Transport through Inert Films
  - Uniform Films
  - Films with Pinholes
  - Graded Density Films
  - Crusted Films
- Polymer Films
  - Redox Polymers
  - Ion Exchange Polymers
  - Electron Conducting Films
- Kinetic Models of Catalytic and Mediated Reactions in Films
- Composite Films

Class Requirements:  There is a single assignment for this class. This involves evaluating papers from the literature and characterizing literature data as described in class. Three papers, each of the student’s choosing, will be evaluated. The final assignment should be submitted as hardcopy in 451 VAN by 6:30 p.m. by 25 March 2010; earlier is fine, too. (If you are also taking Modeling, you can hand the assignments in at the start of class.) You may send relevant spreadsheets by email if you think this is important to your discussion. Please see appended assignment description. Because of the nature of the handouts and lecture as well as the emphasis on class participation, class attendance is highly encouraged.

Exams:  There are no exams or final.

Grading:  Grade will be determined by class participation (30%) and the final assignment (70%).
Final Assignment for 4:220

The first electrochemical characterization of polymer films were reported in the late 1970's. As covered in class, various classes of polymer films have been evaluated since that time.

1. Inert films
   1. uniform
   2. pinholed
   3. graded
   4. crusted films.

2. Redox polymers

3. Ion exchange polymers

4. Electron conducting polymers

5. Composite films

This represents five major types of films.

The assignment is to analyze data in each of three references using the methods described in class. Each reference must be for a different class of films. The objective is to practice and demonstrate the methods and films, as described in class. Several additional rules of engagement follow.

1. Each report will include a copy of the original paper analyzed, a description of the system reported, your analysis, and an assessment of your results as compared to those in the paper. The written text should cover two to three pages. There should be plots from spreadsheets that reflect the equations and models described your report. Spreadsheet sheets that summarize data are also highly appropriate. The plots and spreadsheets do not count toward the two to three pages of text.

2. Literature data may or may not report analysis of the data in the paper. References may be found in journals and in some of the review articles listed in course handouts. If there is no analysis, please analyze the data in the paper to the extent possible. If there is an analysis, please analyze the data in the paper and compare your analysis to that provided by the authors. References are to be identified in the literature for three classes. (Only one from the class of inert films is allowed.) An example of the student’s or a colleagues raw data may be substituted for one the references.

3. References cited in class or the notes may not be used. It is anticipated that each student will have a unique set of references. Please work independently.

4. Please include an example of methods of each rotating disk voltammetry, cyclic voltammetry, and either potential step (chronoamperometry), microelectrodes, or optically transparent electrodes within your three examples. Each example does not need to include all of these, but good cases will include a steady state and a transient method for maximum deconvolution of data. If you find other methods that you want to substitute, please email your proposed alternative method to me for verification.

5. The final assignment should be submitted as hard copies in 451 VAN by 6:30 p.m. by 25 March 2010. (If you are also taking Modeling, you can hand the assignments in at the start of class.) If you think the spreadsheets are relevant to your discussion, those may be forwarded by email. Please put hard copies of your plots in your report. (You can submit reports earlier than 25 March if you prefer.)

Please let me know if you have any questions.
Administrative Home: The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Student Academic Handbook.

Electronic Communication: University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences. (Operations Manual, III.15.2. Scroll down to k.11.)

Accommodations for Disabilities: A student seeking academic accommodations should first register with Student Disability Services and then meet privately with the course instructor to make particular arrangements. See www.uiowa.edu/~sds/ for more information.

Academic Fraud: Plagiarism and any other activities when students present work that is not their own are academic fraud. Academic fraud is a serious matter and is reported to the departmental DEO and to the Associate Dean for Undergraduate Programs and Curriculum. Instructors and DEOs decide on appropriate consequences at the departmental level while the Associate Dean enforces additional consequences at the collegiate level. See the CLAS Academic Fraud section of the Student Academic Handbook.

CLAS Final Examination Policies: Final exams may be offered only during finals week. No exams of any kind are allowed during the last week of classes. Students should not ask their instructor to reschedule a final exam since the College does not permit rescheduling of a final exam once the semester has begun. Questions should be addressed to the Associate Dean for Undergraduate Programs and Curriculum.

Making a Suggestion or a Complaint: Students with a suggestion or complaint should first visit the instructor, then the course supervisor, and then the departmental DEO. Complaints must be made within six months of the incident. See the CLAS Student Academic Handbook.

Understanding Sexual Harassment: Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather: In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Public Safety web site.

*These CLAS policy and procedural statements have been summarized from the web pages of the College of Liberal Arts and Sciences and The University of Iowa Operations Manual.