

Chem 4F03 Course Outline - Winter 2008

Surface Chemistry

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This course is intended as an introduction to Surface Science, with emphasis on surface analysis.

Classes are held Mon, 18:00 - 21:00 in ABB-AB404, starting 07 Jan 2008, ending 31 Mar 2008.

Week

1. Surface structure
2. Surface reactions
3. Diffraction techniques (LEED, RHEED, Neutron Scattering, X-ray diffraction, ...)
4. Electron spectroscopies (XPS, UPS, AES, NEXAFS, HREELS, ...)
5. Optical spectroscopies (SERS, RAIRS, ATR-FTIR, SPR, Ellipsometry, ...)
6. Scattering/Sputtering/Desorption/Particle Beams (SIMS, RBS, NRA, TPD, ESDIAD, ...)
7. Introduction to SPM; Experimental Considerations
8. Fundamentals of Tunneling Microscopy; Spectroscopic Methods with the STM
9. Fundamentals of Force Microscopy; Force Spectroscopy
10. Surface Manipulation and Lithography with the STM and AFM
11. Derivative Techniques
12. Student Presentations

Suggested Reading:

- D. J. **O'Connor**, B. A. **Sexton**, R. St. C. **Smart** (Editors), Surface Analysis Methods in Materials Science, 2nd Edition, Springer Verlag, 2003, ISBN 3-540-41330-8
- D. P. **Woodruff**, T. A. **Delchar**, Modern Techniques of Surface Science, 2nd Edition, Cambridge University Press, ISBN 0-521-42498-4 (paperback)
- Ernst **Meyer**, Hans Josef **Hug**, Roland **Bennewitz**, Scanning Probe Microscopy. The Lab on a Tip, Springer Verlag, 2004, ISBN 3-540-43180-2 (*Nice introductory textbook - affordable*)
- Dawn **Bonnell** (Editor), Scanning Probe Microscopy and Spectroscopy. Theory, Techniques and Applications, 2nd Ed., Wiley, 2001, ISBN 0-471-24824-X (*More comprehensive but more expensive*)
- Roland **Wiesendanger** (Editor), Scanning Probe Microscopy. Analytical Methods, Springer Verlag, 1998, ISBN 3-540-63815-6 (*Focusses on tunneling techniques*)
- Additional references for recommended and supplementary reading will be given throughout class.

Grading

Each student taking the course will give four short talks (1 each during Weeks 3, 4, 5 and 6) and answer all related questions, each worth 15% of the final grade. Furthermore, you are expected to ask at least one qualified question to each of the other student presenters. During the first day of class, each student chooses the topics in consultation with the instructor. For your presentation, you are responsible for distributing copies of your overheads to everybody participating in the class. 30% of the final grade is based on a project that each student is required to conduct on scanning probe microscopy. The projects will be chosen in consultation with the instructor. Students may conduct practical projects with samples of their own interest or prepare a literature review. In either case, a critical and exhaustive analysis of a set of actual SPM data is expected. Students will submit a written report about the project by the end of the course and give a presentation to the class during week 12. The remaining 10% of the final grade will come from 5 short (10min) quizzes about the material from the previous week, written at the beginning of the 8th through 12th week.

4 x 15%	Short presentations during weeks 3, 4, 5 & 6
30%	Project on scanning probe microscopy, incl. presentation in week 12.
5x2%	Quizzes during weeks 8, 9, 10, 11, 12
100%	Total

Disclaimer: Changes to the course schedule and marking scheme may be made at the discretion of the instructor and announced to the students at any time during the course. An effort will be made to keep inconveniences from changes to a minimum.

Academic dishonesty: Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e. g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at http://www.mcmaster.ca/senate/academic/ac_integrity.htm

In particular reference to the expected student work in this course, properly reference your sources for the written report and the talks you are giving and acknowledge any help and support you may have gotten. (A researcher never operates in a vacuum. All research is also influenced by interaction with the environment. The key is honest acknowledgment of outside sources.)