

Surface Analytical Techniques

CH 622

Fall 2002

Lectures: MWF 9:00 - 9:50 AM

Room 331 Lloyd Hall

Instructor: Shane Street

Office: 325 Lloyd Office phone: 8-5957 email: ssstreet@bama.ua.edu

Office hours: MWF 10 am, or by appointment

Course description: This course is designed to introduce the student to the instrumentation and techniques used to study surfaces and interfaces. The techniques include: electron spectroscopy (AES, XPS), vibrational spectroscopy (RAIRS, HREELS, SERS), desorption techniques (TPD, SIMS), optical techniques (ellipsometry, SPR), and scanning probe microscopy (AFM, STM). Emphasis will be placed on metal and semiconductor surfaces since they are most widely encountered in catalysis, microelectronics, and magnetic materials.

Required text: Surfaces, G. Attard and C. Barnes, Oxford Press, 1998.

Optional texts: Practical Guide to Surface Science and Spectroscopy, Y-W Chung, Academic Press, 2001. Modern Techniques of Surface Science, D.P. Woodruff and T.A. Delchar, Cambridge University Press, 1990.

Additional material: There is a fair amount of good surface-related instructional material available on the Internet, although no claim is made here for their correctness. Examples include:

An Introduction to Surface Chemistry <http://www.chem.qmw.ac.uk/surfaces/scc/>

This is probably the best surface chemistry site on the web!

Simon Garrett's topical course <http://www.cem.msu.edu/~cem924sg/>

There are some very nice practice problems at this site.

UK Surface Analysis forum <http://www.uksaf.org/tech/list.html>

The webpage for our class is: <http://www.bama.ua.edu/~sstreet/surface.htm>

Grading: Your final grade will be determined by the results of 6 quizzes, a final, and a short paper (~ 5 pages, 1400-1600 words). No make-up quizzes will be given. If you miss a quiz the average of your graded quizzes will be substituted.

6 quizzes 300 points (50 each)

Paper 100

Final 100 points

Total = 500 points

Tentative Lecture Sequence

Introduction: Why surfaces?

The structure of metallic (crystalline) surfaces, single crystals, relaxation and reconstruction

Adsorption and desorption, isotherms, kinetics, bonding

Why UHV? Ultrahigh vacuum requirements, techniques

Electron spectroscopies: AES, XPS, LEED, RHEED

Surface vibrational spectroscopies: HREELS, RAIRS

Desorption techniques: TPD, SIMS

Scanning probe microscopy: AFM, STM

Optical techniques: spectroscopic ellipsometry and SPR

FINAL Friday 13 Dec 02, 8 - 10:30 AM

Academic Misconduct: All acts of dishonesty in any work constitute academic misconduct.

The Academic Misconduct Disciplinary Policy will be followed in the event of academic misconduct.

Disability access statement: To request disability accommodations, please contact the Office of Disability Services at 348-4285. After initial arrangements are made with that office, contact the professor.

Acronyms

AES	Auger electron spectroscopy
AFM	atomic force microscopy
HREELS	high-resolution electron energy-loss spectroscopy
LEED	low energy electron diffraction
RHEED	Reflection high energy electron diffraction
RAIRS	reflection-absorption infrared spectroscopy
SERS	surface-enhanced Raman spectroscopy
SIMS	secondary ion mass spectrometry
SPM	scanning probe microscopy
SPR	surface plasmon resonance spectroscopy
STM	scanning tunneling microscopy
TPD	temperature programmed desorption
XPS	x-ray photoelectron spectroscopy