

Chemistry 395/435: Structure and Reactivity of Solid Surfaces

Department of Chemistry, Loyola University Chicago

Spring 2017

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Office Hours: M, 3–4 pm; Th, 10:30 – 11:15 am; and by appointment (FH 103)
Class: T Th, 8:30–9:45 am, FH-105
Text: ensemble of greatest hits
Course Prerequisites: Chemistry 302 or concurrent registration. If you have not completed the course prerequisites, you may be administratively dropped from the class.

Course Overview

Chemical reactions on solid surfaces are central to many technologies and catalytic methods. The structure-reactivity paradigm is central to the study of the chemistry and physics of solid surfaces. This course will cover fundamental surface properties. We will start with a bit of an overview, and then look at how solid-state physics and quantum mechanics is used to develop models for surfaces. We will also discuss surface analysis techniques and gas-surface dynamics.

We will start with a brief review of quantum mechanics and how it is important in developing models of the solid state. We will then move onto general properties of solid surfaces and develop models for their structure and how it relates to bulk structure. Next stop will be kinetics and mechanisms of reactions on surfaces. Interspersed with these topics will be methods and techniques for studying surfaces. We will likely do a more thorough review of the physics and chemistry of oxidized platinum surfaces, and use this system as a paradigm for understanding the dynamics of gas-surface interactions. Finally, we will review basic statistical mechanics to understand phase relationships on surfaces.

Exams, Homework, and Grading

There will be a two hour exams this semester. In addition, each student will select a current topic in surface chemistry by 3 March and write a short (10 double-spaced pages or so) review of a topic in the field. The paper will be due at the start of class on 6 April. Students will give a 25-30 minute presentation based on their paper. The presentation schedule will be determined in April. There may also be a couple homework assignments before the exam.

There will be no make up exams. Late papers lose a letter grade per calendar day. The presentation may not be rescheduled.

Final Exam: It is unlikely that there will be a final exam for this course.

Grading: The grade will be based on the exam, paper, and your presentation, roughly a third each.

Supplementary Texts

Concepts of Modern Catalysis and Kinetics, Chorkendorff and Niemantsverdriet
Introduction to Surface Chemistry and Catalysis, Somorjai and Li
Surface Science, Foundations of Catalysis and Nanoscience, Kolasinski
Elementary Statistical Physics, Kittel
Physical Chemistry, 2nd Ed., Rice, Ross, and Berry

Schedule

Note: The instructor reserves the right to make changes to the schedule, and to move things around. This is simply an outline

<i>Date</i>	<i>Class</i>	<i>Topics</i>	<i>Readings</i>	<i>other</i>
17 Jan	1	Meet & Greet		
19 Jan	2	Quantum review	McQuarrie/Levine	
24 Jan	3	Quantum review	McQuarrie/Levine	
26 Jan	4	Introduction	Som. & Kol.	
31 Jan	5	Introduction	Som. & Kol.	
2 Feb	6	Drude Theory	A&M, Ch. 1	
7 Feb	7	Somerfeld Theory	A&M, Ch. 2	
9 Feb	8	Intro To Solid State	Kittel, Ch. 1	
14 Feb	9	Intro To Solid State	Kittel, Ch. 2	
16 Feb	10	Crystal Lattices	A&M, Ch. 4	
21 Feb	11	The Reciprocal Lattice	A&M, Ch. 5	
23 Feb	12			
28 Feb	13			
2 Mar		Independent Reading Day		
7, 9 Mar	No Class: Spring Break			
14 Mar	14			
16 Mar		SEMINAR		
21 Mar	15			
23 Mar	16			
28 Mar	17			
30 Mar	18			
4 Apr	19			
6 Apr	20			
11 Apr	21			
13 Apr	22			
18 Apr	23			
20 Apr	24			
25 Apr	25	Presentations		
27 Apr	26	Presentations		

Academic Integrity

All students in this course are expected to have read and to abide by the demanding standard of personal honesty, drafted by the College of Arts & Sciences, that can be viewed at:

http://www.luc.edu/cas/pdfs/CAS_Academic_Integrity_Statement_December_07.pdf

Anything you submit that is incorporated as part of your grade in this course (e.g. quiz, examination, homework, lab report) must represent your own work. Any students caught cheating will, at the very minimum, receive a grade of "zero" for the item that was submitted and this grade cannot be dropped. If the cheating occurred during a course exam, the incident will be reported to the Chemistry Department Chair and the Office of the CAS Dean. Depending on the seriousness of the incident, additional sanctions may be imposed.

I have no tolerance whatsoever for cheating or plagiarism. *Any instance of dishonesty (including those detailed on the website provided above or in this syllabus) during a quiz, test, or exam will result in a failing grade for the course.* The Dean of Arts & Sciences and The Chair of The Department of Chemistry & Biochemistry will also be notified. I truly hope to never have to invoke these processes. Please be honest with your work.

Teamwork: I strongly encourage you (the class) to work together to solve assigned and unassigned problems. In order to learn and excel in Physical Chemistry, you should work through problems. The assigned problems are a minimum. Work together with your classmates, if you do not understand something, someone else may. You will also find that explaining a solution to your classmate will cement the information in your mind, and make you a better student.

When working as a group, if each member contributes to the discussion, and you each hand in very similar work, that is perfectly acceptable given the nature of the assignments. On the other hand, if someone simply copies an assignment from someone else, that is plagiarism, and will be treated as such.

Students with Disabilities

If you have any special needs, please let me know in the first week of classes. The university provides services for students with disabilities. Any student who would like to use any of these university services should contact the Services for Students with Disabilities (SSWD), Sullivan Center, (773) 508-3700. Further information is available at <http://www.luc.edu/sswd/>.

Tutoring

The Loyola Undergraduate ACS has open tutoring every week on W and R evenings in Flanner 129. In addition, Loyola maintains a Center for Academic Excellence & Tutoring (<http://www.luc.edu/tutoring/>). Again, this is a service included in your tuition, so I encourage you to utilize their assistance.

Your well-being

If there are events occurring in your life that cause school to diminish in its priority, please discuss this with me or contact the Wellness Center (<http://www.luc.edu/wellness/index.shtml>) or the dean of students (http://www.luc.edu/studentlife/dean_of_students_office.shtml) for assistance. These are services that **your** tuition pays for and can be invaluable for your personal health and maintaining progress towards your degree.