CHEM 267 – Solid State Chemistry
Spring 2021 Syllabus

Instructor: Prof. Michael T. Ruggiero, Ph.D.
Office: E342 Innovation
Email: Michael.Ruggiero@uvm.edu
Office Hours: By appointment.

Course Information
Class: TR 2:50-4:05pm
Location: Aiken Center 110
Prerequisites: CHEM 165

Recommended Text: *Solid State Chemistry and its Applications*, Anthony R. West. Wiley, UK. ISBN: 978-1-119-94294-8.

Course Description and Goals
This class will explore the rich field of solid-state chemistry, from the fundamentals to modern cutting-edge research. Solid-state materials represent some of the most promising advanced materials in development, with applications ranging from pharmaceuticals to flexible electronics. Understanding why such materials have such promising properties lies in a combination of the molecular identity, bulk packing structure, and molecular dynamics, all of which can be traced back to fundamental chemical phenomena. Due to the ubiquitous nature of solids in chemistry, the modern chemist or materials scientist should be well-versed on this topic. This class introduces students into the chemical physics surrounding solids. Topics include (but are not limited to) crystals and their properties, nanomaterials, semiconductors, and characterization methods.

Grading

Undergraduate	*Graduate*
50% - Midterm and Final (25% each) 25% - Weekly assignments, quizzes, and participation 25% - Topical Presentation	40% - Midterm and Final (20% each) 20% - Weekly assignments, quizzes, and participation 20% - Topical Presentation 20% - Literature Review Report

NB: Graduate students will have additional questions on exams/quizzes compared to their undergraduate colleagues. They will also be required to undertake the topical presentations on their own, where undergraduate students will work in pairs, and will also be required to perform a literature review (*vide infra*). The weekly assignments will be graded with more rigor for graduate students compared to the undergraduate students.

Topical Presentations
You will be expected to prepare a thirty-minute lecture about a solid-state material, characterization method, or novel application of your choice, pending instructor approval. The focus should be something 'state-of-the-art', and only the most current ant cutting edge topics will be given the go-ahead. For example, it would not be appropriate to give a presentation on infrared spectroscopy of solids, but instead the basics as well as some cutting-edge application or advances in instrument capabilities and what this implies for future work would be appropriate. Note: Graduate students will be required to work alone, while undergraduate students will work in pairs.

Literature Review Report
Graduate students taking this course are expected to be more aware of the current state of the art. Therefore, the graduate students in the course are required to choose an article/topic of their choice (published within the last 2 years), and to be effectively able to communicate their findings. Thus, a 5 page document will be due at the end of the semester.

Student Learning Accommodations
In keeping with University policy, any student with a documented disability interested in utilizing accommodations should contact SAS, the office of Disability Services on campus. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly encouraged to meet with their faculty to discuss the accommodations they plan to use in each course. A student's accommodation letter lists those accommodations that will not be implemented until the student meets with their faculty to create a plan.
Contact SAS:
A170 Living/Learning Center;
802-656-7753;
access@uvm.edu
www.uvm.edu/access

Religious Holidays
Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please submit the dates of your absence to me in writing by the end of the second full week of classes. You will be permitted to make up work within a mutually agreed-upon time. https://www.uvm.edu/registrar/religious-holidays

Academic Integrity
The policy addresses plagiarism, fabrication, collusion, and cheating. https://www.uvm.edu/policies/student/acadintegrity.pdf

Tentative Course Schedule (*subject to change*)

Week Number	Class Numbers	Topics
1	1-2	Introduction to solid-state properties, crystals, amorphous solids, unit cells, symmetry, crystallography.
2	3-4	Crystals and diffraction, single-crystal diffraction, powder diffraction.
3	5-6	Defects, solid-solutions, color centers, alloys, dislocations and mechanical properties.
4	7-8	Characterization techniques, X-ray diffraction, neutron diffraction, microscopy, spectroscopy.
5	9-10	Characterization techniques, X-ray diffraction, neutron diffraction, microscopy, spectroscopy.
6	11-12	Thermodynamics, phase diagrams, polymorphism.
7	**13**	**Midterm.**
8	15	Preparation methods, synthesis, solid-state catalysis.
9	16-17	Preparation methods, synthesis, solid-state catalysis.
10	18-19	Bonding in solids, electronics of solids, orbital theory of solids, extended bonding, semiconductors, quantum confinement in nanoparticles.
11	20-21	Bonding in solids, electronics of solids, orbital theory of solids, extended bonding, semiconductors, quantum confinement in nanoparticles.
12	22-23	Optical and electrical properties, lasers, magnetic and magneto-optical effects.
13	24-25	Properties of solid-state materials, solar cells, super conductivity, electron-phonon coupling.
14	26	Cutting edge methods, printing molecules, DNA-origami, boutique methods, special interest topics.
14	27-29	Topical Presentations