

### Chem 375: Solid State Chemistry

COVID-19 Protocols are outlined by the University are expected to be followed in class and in lab; these may change during the semester.

<b>Instructor</b>	Robin S. Tanke
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<b>Office:</b>	CBB447 (If COVID rates are "substantial" or greater in the area, please wear a face mask for in person meetings.)
<b>Office Hours:</b>	Monday 1-2 PM, Thursday and Friday 10-11AM, by appointment. ZOOM appointments are available also

**Prerequisite: Chem 325 or Chem 220 Concurrent**

**Class Sessions:**

Lecture: T, R, F 9:00 – 9:50 AM CBB 261  
Lab W 2:00 -5:00 PM CBB 420

**Purpose:** The purpose of this course is to introduce students to different materials including metals (alloys), ceramics (glasses), natural and synthetic polymers, semiconductors and composites and to discuss how the structure of a material relates to the chemical, mechanical, electrical, magnetic and optical properties of a material

**Learning Outcomes:** Upon completing this course, students will be able to:

- Describe crystalline materials in detail and the influence of defects on the properties of materials.
- Explain the different bonding types and which apply to the different types of materials (solids, metals, ceramic, polymers, etc.)
- Perform and describe various syntheses of solid state materials.
- Discuss and as possible use a variety of methods to characterize solid state materials such as X-ray diffraction, spectroscopy, microscopy and thermal analysis
- Describe properties of solids such as:
  - *mechanical* - tension, compression, and sheer strength, brittle vs malleable vs tough, elastic vs rigid;
  - *electrical* - conductor, semiconductor, insulator; piezoelectric, pyroelectric, and ferroelectric
  - *optical* – transparent, reflective, opaque; absorption, emission, refraction
  - *thermal* – conductor, insulator; melting and glass transition temperatures;
  - *chemical* - resistance to various types of reactions, heterogeneous catalysts;
  - *magnetic* - diamagnetic, paramagnetic, ferromagnetic, antiferrimaganetic

**Required Texts and materials:**

**Available from text rental:** West, A. Solid State Chemistry and its Applications, Second Edition, Student Edition. Wiley 2014 and its companion website including Crystal Viewer.

**To purchase:**

- A bound laboratory notebook.
- Safety Goggles and COVID-19 abatement items (Mask and Hand Sanitizer)
- A clean flash drive for data storage; for some instruments this is the only way to save data.

**Grading: There are 750 points for the class.** You will be issued the following letter grades A above 695 points; B above 620 points; C above 540 points; D above 485, below 485 F. Minus and plus grades will be issued to students close to the cutoff grades.

5 Homework Assignments	5 x 25 points each	125 points
4 Exams	4 x 70 points each	280 points
Labs	detailed in the Lab schedule	195 points
Final		150 points

**Exam Schedule:**

- 📅 Exam 1: Friday, September 24, 2021
- 📅 Exam 2: Friday, October 15, 2021
- 📅 Exam 3: Friday, November 5, 2021
- 📅 Exam 4: Friday, December 3, 2021

**POLICIES AND OTHER CONSIDERATIONS****UWSP Community Bill of Rights and Responsibilities**

UWSP values a safe, honest, respectful, and inviting learning environment. In order to ensure that each student has the opportunity to succeed, a set of expectations have been developed for all students and instructors. This set of expectations is known as the Rights and Responsibilities document, and it is intended to help establish a positive living and learning environment at UWSP. For more information go to:

[https://www.uwsp.edu/dos/Documents/2015\\_Aug\\_Community%20Rights%20and%20Responsibilities%20Web.pdf](https://www.uwsp.edu/dos/Documents/2015_Aug_Community%20Rights%20and%20Responsibilities%20Web.pdf)

The Rights and Responsibilities document also includes the policies regarding academic misconduct are found on page 11.

**Americans with Disabilities Act**

The Americans with Disabilities Act (ADA) is a federal law requiring educational institutions to provide reasonable accommodations for students with disabilities.

If you have a disability and require classroom and/or exam accommodations, please register with the Disability and Assistive Technologies Center and then contact me at the beginning of the course. I am happy to help in any way I can. For more information, please visit the DATC, located on the 6<sup>th</sup> floor of

the Learning Resource Center (the Library). You can also find more information here:

<https://www.uwsp.edu/datc/Pages/contact.aspx>

### Attendance

If you are able, please attend class. If you are ill, need to quarantine or are uncomfortable, class lectures will be recorded and posted on CANVAS. Should I become ill, need to quarantine, or feel uncomfortable, lectures will be held via ZOOM; please check your e-mail regularly. If the need to miss lab arises, please contact me as soon as possible. We will work together on how to proceed depending on how long you will have to be out and your individual circumstances.

All handouts will be posted on CANVAS. Homework assignments and typed lab reports will be uploaded to CANVAS. All exams and your lab notebook (completed with data) will be handed in at designated dates.

### Tentative Schedule

Week	Topic	Evaluation
1 (9/2- first class day)	Chapter 1: Symmetry elements, Crystal systems, Bravais Lattices and Miller Indices.	<b>Due 9AM Friday 9/3</b> <b>Information about you!</b>
2 (9/6)	Chapter 1: Unit cell densities and bond lengths, common crystal forms for metals and ionic cds.	<b>X-ray Safety Training due by 9/8 at 1PM</b>
3 (9/13)	Chapter 2: Crystal Defects, Non stoichiometry and Solid Solutions	<b>Homework 1 due 9AM Friday 9/17</b>
4 (9/20)	Chapter 3: Bonding in Solids	<b>Exam 1 Friday 9/24</b> <b>Chapters 1-2</b>
5 (9/27)	Chapter 4: Synthesis and processing of inorganic solids.	
6 (10/4)	Chapter 4: Synthesis and processing of inorganic solids.	<b>Homework 2 due Friday, 10/8</b>
7 (10/11)	Chapter 5: X-ray Diffraction	<b>Exam 2 Chapters 3-4 10/15</b>
8 (10/18)	Chapter 6: Microscopy and Spectroscopy Techniques	
9 (10/25)	Chapter 6: Thermal Techniques; Supplement: Organic Polymers	<b>Homework 3 due Friday, 10/29</b>
10 (11/1)	Organic Polymers and Chapter 7: Phase Diagrams	<b>Exam 3 Chapters 5, 6 and Polymers 11/5</b>
11 (11/8)	Chapter 8: Electrical properties	
12 (11/15)	Chapter 8: Electrical properties	<b>Homework 4 due 11/19</b>
13 (11/22)	Chapter 9: Magnetic Properties (Thanksgiving – no class R or F)	
14 (11/29)	Chapter 10: Optical Properties	<b>Exam 4 Chapters 7-9 12/3</b>
15 (12/6)	Chapter 10: Optical Properties	<b>Homework 5 due Friday 12/10</b>
16 (12/14)	Final Tuesday Dec 14, 2021 10:15-12:15	<b>Cumulative Final Exam</b>

Robin Tanke Fall Semester 2021

	Monday	Tuesday	Wednesday	Thursday	Friday
08:00					
09:00	Research	375 Lec 01 261		375 Lec 01 261	375 Lec 01 261
10:00	Research		WC	Office hour	Office Hour
11:00	Research	325 Lab 02L1 420			
12:00	325 Lec 02 261	325 Lab 02L1 420	325 Lec 02 261		325 Lec 02 261
13:00	Office Hour	325 Lab 02L1 420			
14:00			375 Lab 01L1 420	325 Lab 02L2 420	Meeting or Seminar
15:00		Curriculum Committee	375 Lab 01L1 420	325 Lab 02L1 420	Meeting or Seminar
16:00		Curriculum	375 Lab 01L1 420	325 Lab 02L1 420	

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