

Spring 2020

CHE 375-002: Structure, Properties and Processing of Materials

Kathleen McEnnis

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ChE 375 – Structure, Properties and Processing of Materials Spring 2020

Instructor: Dr. Kathleen McEnnis

PhD, Assistant Professor in CME Department

She/Her/Hers pronouns

Office: 382 Tiernan Hall

Email: mcennis@njit.edu

Office Hours: **Monday:** 1:30 – 2:30 PM; **Thursday:** 1:30 PM – 2:30 PM.

Other hours by appointment only

Teaching Assistant: Seyed Mahmoud Arzideh (sa2463@njit.edu)

Required eTextbook (Online Subscription Required): WileyPLUS: Fundamentals of Materials Science and Engineering: An Integrated Approach, 5th Edition, W.D. Callister, Jr., and D.G. Rethwisch, John Wiley and Sons, Inc.

Class: Tuesday 11:30 AM-12:50 PM Room CKB 204

Thursday 11:30 AM-12:50 PM Room CKB 204

Course: Tailoring materials properties by engineering their microscopic/macroscopic structures via processing is central to product design and development in the chemical industry. This course introduces the principles of materials engineering from the perspective of structure-property-processing relationships. Instead of covering different types of materials separately, this course will use the principles common to engineering of all important materials as an underlying theme. These are atomic/molecular structure, nanoscale, morphology, principles of phase transformation, structure development during processing, and property dependence on structure. All these topics will be introduced through the paradigm of comparing metals, ceramics and polymers. Besides single component systems, advanced materials such as multiphase and/or multi component systems, (e.g. composites and gels) and nanomaterials will be discussed based on these principles. An integral part of this course will be the criteria for selection of materials for the chemical process industry.

Prerequisites: Chem 236 or Chem 235

Withdraw Deadline: April 6, 2020

Course Administration: Administration of this course will be done through Canvas where links to the WileyPLUS platform can be found.

Homework: Homework assignments will be given using WileyPLUS. Homework assignments are graded and will be 10% of the overall grade.

Quizzes: Quizzes will be given in class (closed book) and are 15% of the total grade. The lowest quiz grade will be dropped.

Exams: There will be two exams and one final. The exams are each worth 20% of the total grade and the final is worth 35% of the total grade. All exams and finals will be closed book.

GRADING

Assignments (WileyPLUS)	10%
Quizzes	15%
Exams	40%
Exam 1	20%
Exam 2	20%
Final	<u>35%</u>
	100%

Grades will be based on:

- A: 90 – 100%
- B+: 85 – 89%
- B: 80 – 84%
- C+: 70 – 79%
- C: 60 – 69%
- D: 50 – 59%
- F: 0 – 49%

Makeup Policy: No makeup exams, finals, or quizzes will be granted unless the Dean of Students contacts me about your reason for missing and the reason is deemed suitable.

Late Work Policy: Homework assignments that are received after the deadline will receive 50% credit. No homework will be accepted after the last class (April 20).

Electronic Device Policy: With the exception of calculators, the use of electronic devices during exams, finals, or quizzes is prohibited. The use of an electronic device during class time is allowed and you are encouraged to bring a personal electronic device to class to participate in PollEverywhere questions and access your WileyPLUS materials. Please be aware, however, that though these devices can aid in your learning experience, they can also be a source of distraction for both you and your peers. Use your electronic devices responsibly so as not to distract yourself or others from the class.

Academic Integrity Policy: Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at:

<http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. **Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.** If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

Course Objectives: Students will be able to:

- Identify the different properties and applications of metals, ceramics, polymers and composites.
- Describe the differences in atomic/molecular structure between crystalline and noncrystalline materials
- Describe the general types of polymer molecular structures and how they relate to properties.
- Identify and describe imperfections including defect structures and grain boundaries and dislocations of materials.
- Explain diffusion properties, thermal properties, mechanical properties, and failure mechanisms in different materials.
- Apply principles of phase diagrams and phase transformations to design and control engineering problems.
- Select materials for various applications.
- Explain the role of processing on materials properties.
- Explain the mechanism of corrosion of materials as well as methods for control and prevention of corrosion.

Topics:

- | | |
|---|---------------------|
| 1. Introduction | Chapter 1 |
| 2. Atomic Structure & Interatomic bonding | Chapter 2 |
| 3. Metallic/Ceramic Structures | From Chapter 3 |
| 4. Polymer Structures & Polymer Cryst., Melting, T _g | From Chapter 4 & 11 |
| 5. Imperfections in Solids | From Chapter 5 |
| 6. Mechanical Properties | Chapter 7 |

Exam 1 Tuesday, February 25

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| 7. Deformation/Strengthening Mechanism | Chapter 8 |
| 8. Phase Diagrams | Chapter 10 |
| 9. Phase Transformations | Chapter 11 |

Exam 2 Tuesday, March 31

10. Types and application of materials	Chapter 13
11. Introduction to fabrication of materials- Synthesis and fabrication of Polymers	Chapter 14
12. Property modification with composite materials	Chapter 15
13. Corrosion in metals and ceramics- Polymer Degradation	Chapter 16
14. Thermal Properties	Chapter 17
15. Magnetic and Optical Properties of Materials	From Chapter 18 & 19
16. Economic, Environmental and Social Issues	Chapter 20

Final Exam TBA (will take place during the May 8 - 14 Final Exam period)

Exam dates and topics may be subject to change.

If you need accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services, Fenster Hall Room 260 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.