

Fall 2021

CHE 375-003: Structure, Properties and Processing of Materials

Menqiang Zhao

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**ChE 375-003 Structure, Properties and Processing of Materials
Fall 2021 Syllabus**

Instructor: Dr. Mengqiang (Mark) Zhao

PhD, Assistant Professor in CME Department

He/Him/His pronouns

Email: mz24@njit.edu

Office: 253 Fenster Hall

Webex Room: <https://njit.webex.com/meet/mz24>

Office Hours: Monday 1-2pm (in person or virtual) & Wednesdays 1-2pm (in person or virtual). Schedule an appointment through email. Please email me for other times

Teaching Assistant: TBD

Required eTextbook (Online Subscription Required): WileyPLUS: Fundamentals of Materials Science and Engineering: An Integrated Approach, 6th Edition, W.D. Callister, Jr., and D.G. Rethwisch, John Wiley and Sons, Inc.

Class: Monday 10:00 AM-11:20 AM Room CKB 320 (Face-to-Face)
Wednesday 10:00 AM-11:20 AM Room CKB 320 (Face-to-Face)

Course: Tailoring materials properties by engineering their microscopic/macrosopic 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: November 10, 2021

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

Assignments: Homework assignments will be given using WileyPLUS or otherwise posted on Canvas. In class practice problems will also occasionally be assigned and will contribute to the assignment grade. Homework assignments (and practice problems) are graded and will be 10% of the overall grade. While the in-class practice problems can be worked on with other students, the WileyPlus assignments must be completed independently.

Quizzes: Quizzes will be given in class. Quizzes are closed book & notes, though an equation sheet will be provided. Quizzes are 10% of the total grade and the lowest quiz grade will be dropped.

Presentation: Students will be required to do a presentation on a topic given by the instructor. A detailed rubric will be provided for grading criteria. Presentation will be 10% of the total grade.

Exams: There will be two exams and one final. The exams are each worth 20% of the total grade and the final is worth 30% of the total grade. All exams and finals will be closed book & notes, though an equation sheet will be provided.

GRADING

Assignments	10%
Quizzes	10%
Presentation	10%
Exams	40%
Exam 1	20%
Exam 2	20%
Final	<u>30%</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: Assignments will not be accepted late unless there is an extenuating circumstance documented through the Dean of Student's office.

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.

Use of “homework help” sites such as Chegg.com to complete class work is prohibited. Any student found to have used one of these sites on an assignment will be reported to the Dean of Students Office for a potential academic integrity violation.

Course Objectives: Students will be able to:

1. name types of bonding in materials and identify which materials exhibit each of these bonding types
2. identify the structures of metals and ceramics
3. identify the chemical and structural characteristics of polymers
4. define types of imperfections and the roles they play in affecting the behavior of materials
5. design structures/components using predetermined mechanical properties and mechanical constraints and/or safety constraints
6. identify deformation and strengthening mechanism for materials
7. interpret phase diagrams for determination of phases present and computation of phase compositions and amounts
8. apply phase diagrams for development of microstructures in alloys
9. apply phase transformations concepts to determine microstructure
10. draw relationship between microstructure and mechanical properties
11. identify economic, environmental and societal issues in materials design and selection
12. identify key material design principles considering function, property and processing requirements for a commonly used or an advanced (recently developed) device or a tool (for daily life or industrial use) using online resources (including internet and NJIT library resources), and present findings effectively considering a lay audience.

Topics & Dates (may be subject to change):

- | | |
|---|----------------|
| 1. Introduction | Chapter 1 |
| 2. Atomic Structure & Interatomic bonding | Chapter 2 |
| 3. Metallic/Ceramic Structures | From Chapter 3 |

Quiz 1 Wednesday, September 22

- | | |
|---|---------------------|
| 4. Polymer Structures & Polymer Cryst., Melting, T _g | From Chapter 4 & 11 |
|---|---------------------|

Exam 1 Wednesday, October 6

- | | |
|----------------------------|----------------|
| 5. Imperfections in Solids | From Chapter 5 |
| 6. Mechanical Properties | Chapter 7 |

Quiz 2 Wednesday, October 20

7. Deformation/Strengthening Mechanism Chapter 8

Exam 2 Wednesday, November 3

8. Phase Diagrams Chapter 10

Quiz 3 Wednesday, November 17

9. Phase Transformations Chapter 11

Student Presentations Due Wednesday, Dec 1

10. Economic, Environmental and Social Issues Chapter 20

Final Exam TBA (will take place during the Dec 15 - 21 Final Exam period)

Disability Support Services

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.

Virtual Contingency Plan

This course will be meeting Face-to-Face this semester, however, if circumstances change and we are required to change to a virtual format, then classes will be delivered over Webex while exams and quizzes will be given online through the Canvas Quiz Tool and proctored through Respondus Lockdown & Monitor on a computer and Webex on a mobile device.