

Fall 2020

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

Mengqiang Zhao

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**ChE 375 003– Structure, Properties and Processing of Materials**  
**Fall 2020**  
**Syllabus**

**Instructor:** Dr. Mengqiang (Mark) Zhao

PhD, Assistant Professor in CME Department

He/Him/His pronouns

Email: mz24@njit.edu

Office Hours via WebEx: Mondays 1:30-2:30pm & Wednesdays 1:30-2:30pm.

Schedule an appointment through Canvas Office Hours tool. Please email me for other times

**Teaching Assistant:** Guangliang Liu (gl242@njit.edu)

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

**Class:** Monday 9:00 AM-10:20 AM via WebEx

Wednesday 9:00 AM-10:20 AM via WebEx

**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:** November 9, 2020

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

**Assignments:** Homework assignments will be given using WileyPLUS or otherwise posted on Canvas. In class practice problems will also be occasionally 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 during class time online through the Canvas Quiz Tool and proctored through Respondus Lockdown & Monitor and Webex on a mobile device. Quizzes are closed book & notes, though an equation sheet will be provided. Quizzes are 20% of the total grade and 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 30% of the total grade. All exams and finals will be closed book & notes, though an equation sheet will be provided. Exams will be given online through the Canvas Quiz Tool and proctored through Respondus Lockdown & Monitor and Webex on a mobile device.

### **GRADING**

Assignments		10%
Quizzes		20%
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:** The quizzes, exams, and final for this class will be administered online through Respondus Lockdown & Monitor, so a computer with a webcam is required. In addition, a second electronic device with a camera (such as a cell phone or tablet) will be used to proctor using Webex and for uploading your work at the conclusion of the quiz/exam/final. If you are lacking any of these devices please reach out to either me or the Dean of Students

office. During quizzes, exams, and the final calculators are permitted, but use of cell phones or other devices are not allowed except for using Webex for proctoring purposes or for uploading work at the end of the examination time.

**Webex Meeting Etiquette** – This class meets synchronously online through Webex and attendance is expected and will be collected. During class, please remain muted unless speaking. You may ask questions by unmuting and speaking, typing in the chat box, or using the ‘raise your hand’ feature. Please note that I may miss a question in the chat or a raised hand, so unmute and speak up if I have missed the question. Though use of your webcam is not required during lecture, it is strongly recommended to make class more interactive. Please have your webcam on during lecture if you are able to. Note that Webex has virtual backgrounds to afford you more privacy during class time (though these are not allowed during proctoring of quizzes/exams/final).

**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](mailto: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:

- 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.

**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 23**

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|---|---------------------|
| 4. Polymer Structures & Polymer Cryst., Melting, T <sub>g</sub> | From Chapter 4 & 11 |
|---|---------------------|

**Exam 1 Wednesday, October 7**

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

**Quiz 2 Wednesday, October 21**

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|--|-----------|
| 7. Deformation/Strengthening Mechanism | Chapter 8 |
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**Exam 2 Wednesday, November 4**

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|--------------------------|------------|
| 8. Phase Diagrams        | Chapter 10 |
| 9. Phase Transformations | Chapter 11 |

**Quiz 3 Wednesday, November 18**

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|--|------------|
| 10. Introduction to fabrication of materials-<br>Synthesis and fabrication of Polymers | Chapter 14 |
|--|------------|

**Quiz 4 Wednesday, December 2**

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|--|------------|
| 11. Property modification with composite materials | Chapter 15 |
| 12. Economic, Environmental and Social Issues      | Chapter 20 |

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

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.