Fall 2018

CHE 375 - Structure, Properties and Processing of Materials

Murat Guvendiren

Course Syllabi:

ChE 375 – Structure, Properties and Processing of Materials
Fall 2018

Instructor

Murat Guvendiren, PhD, Assistant Professor of CBPE at NJIT.

Office: York Center – Rm: 204, 138 Warren Street

Office Tel: (973) 596-2932

Email: muratg@njit.edu

Office Hours: Monday-Wednesday 1-2 PM (Other hours by appointment only)

Course Description

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.

Teaching Assistant(s): NA

Prerequisites

Chem 236 and Chem 235

Text Book

- Fundamentals of Materials Science and Engineering: An Integrated Approach, 5th Edition, W.D. Callister, Jr., and D.G. Rethwisch, John Wiley and Sons, Inc. (2016). (ISBN 978-1-119-175483)

Course Objectives

1. Identify the different properties and applications of metals, ceramics, polymers and composites.

2. Describe the differences in atomic/molecular structure between crystalline and noncrystalline materials
3. Describe the general types of polymer molecular structures and how they relate to properties.
4. Identify and describe imperfections including defect structures and grain boundaries and dislocations of materials.
5. Explain diffusion properties, thermal properties, mechanical properties, and failure mechanisms in different materials.
6. Apply principles of phase diagrams and phase transformations to design and control engineering problems.
7. Select materials for various applications.
8. Explain the role of processing on materials properties.
9. Explain the mechanism of corrosion of materials as well as methods for control and prevention of corrosion.
10. Develop presentation skills and foster team work
11. Develop ability to search literature and learn critical reading
12. Identify economic, environmental and societal Issues in Materials Sci. and Eng

Target Enrollment

35 students

Grading Criteria

- Assignments and Quizzes 10%
- 3 Exams 57%
  - Exam 1 19%
  - Exam 2 19%
  - Exam 3 19%
- Group Presentation 3%
- Final Exam 30%

Grading 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%

- Students are expected to come to class having read the assigned material, completed the assignment, and well prepared to engage in dialogue regarding the assigned material. All reading and other preparatory assignments must be completed by their due date(s).

- The **total number** of Quizzes and the **format and scheduling of each QUIZ** will be determined by the Instructor, and **could vary** (e.g., **announced and/or unannounced**).

- There will be **NO MAKE-UP,** if you miss a Quiz or Assignment, an Exam or the Group Presentation. You will receive a **ZERO**.

- **The Final Exam** will take place during the **NJIT Final Exam Period (**December 15 - December 21). Students are expected to be present during this period and should make their travel plans accordingly. There will be **NO MAKE-UP** for the Final Exam

Disability Support Services

NJIT provides disability support services in the campus. 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.

Course Format

The course will be lecture with extensive participation between students and the instructor. The following is the tentative Course Schedule.

Note that the actual course content for each week will be subject to alterations to accommodate scheduling needs.

Course Schedule (SUBJECT TO CHANGE)

Month	Day	Chapters	Topics	Quiz
Sept	3	Labor Day	**No Class**	
Sept	5	Chp 1 & 2	Introduction + Atomic Structure and Interatomic Bonding	
Sept	10	Chp 3	Structures of Metals and Ceramics	Quiz 1 (Chp 1&2)
Sept	12	Chp 3	Structures of Metals and Ceramics	
Sept	17	Chp 4	Polymer Structures	Quiz 2 (Chp 3)
Sept	19	Chp 4 & 11	Polym. Struc. + Cryst, Melting and Tg	
Sept	24	Chp 5	Imps in Solids	Quiz 3 (Chp 4+11)
Sept	27	Chp 5	Imps in Solids + Sample Questions	
Oct	1	**EXAM I**	From Chp 1 - 5	
Oct	3	Chp 7	Mechanical Properties	
Oct	8	Chp 7	Mechanical Properties	
Oct	10	Chp 9 (9.2-8)	Failure: Fracture	Quiz 4 (Chp 7)
Oct	15	Chp 8	Deformation and Strengthening Mech.	
Oct	17	Chp 8	Deformation and Strengthening Mech.	Quiz 5 (Chp 9)
Oct	22	Chp 10	Phase Diagrams	
Oct	24	Chp 10	Phase Diagrams	Quiz 6 (Chp 8)
Oct	29		video lecture + Sample Questions	
Oct	31	**EXAM 2**	From Chp 7 - 10	
Nov	5	Chp 11	Phase Transformations	
Nov	7	Chp 11	Phase Transformations	
Nov	12	Chp 13	**Student Group Presentations**	
Nov	14	Chp 14 & 15	Synth, Fab and Proc of Mat +Comp.	Quiz 7 (Chp 11)
Nov	19	Chp 15	Composites	
Nov	21		**Friday Classes Meet - No Class**	
Nov	26	Chp 16	Corrosion and Degradation of Materials	Quiz 8 (Chp 14&15)
Nov	28	Chp 17	Thermal Properties	
Dec	3	**EXAM 3**		
Dec	5	Chp 18 & 19	Mag. and Opt. Properties of Materials	
Dec	10	Chp 18 & 19	Mag. and Opt. Properties of Materials	Quiz 9 (Chp 17, 18, 19)
Dec	12	Chp 20	Economic, Environmental and Societal Issues in Materials Science and Engineering	Quiz 9 (Chp 17, 18, 19)