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Spring 2019

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

Irina Molodetsky

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ChE 375 – Structure, Properties and Processing of Materials Spring 2019

Instructor: Dr. Irina Molodetsky **Office:** 350 Tiernan Hall
Email: Irina.Molodetsky@njit.edu

Office Hours: **Wednesday:** 3:00 PM-5:00 PM; **Thursday:** 3:00 PM – 5:00 PM
Please, contact me by email to schedule additional office hours.

Required eTextBook: WileyPLUS: Callister & Rethwisch, Fundamentals of Materials Science and Engineering: An Integrated Approach, 5e

In addition to the textbook, you will have an access to online learning resources, self-assessment exercises, tutorial videos, concept check questions, interactive simulations and animations that would help you with the “muddiest points” of this course.

Class section URL: www.wileyplus.com/class/675076

Class: Monday, 11:30 AM – 12:50 PM; Room: CKB 303
 Wednesday, 1:00 PM – 2:20 PM; Room: CKB 303

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 the most 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. 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 is an introduction to principles of the materials characterization and selection of techniques for creative problem solving (failure analysis and troubleshooting). We will discuss examples of materials selection and design for industrial applications.

Course Administration: administration of this course is done on the WileyPLUS platform and Moodle

Pre-Requisites: Chem 236, (or Chem 235), Mech 320 (can be taken as co-requisite).

Homework: Weekly homework assignments are given using WileyPLUS platform. Homework assignments are graded (15 %)

Quizzes: Quizzes are given weekly (15 %). There will be **no make-up** for quizzes.

Exams: There are two midterm exams (20% each) and one final exam (30 %). There is **no make-up** for the exams

Grading

A:	>90
B+:	>85
B:	>80
C+:	>70
C:	>60
D:	>50
F:	50 and below

Note: NJIT Honor Code will be upheld and any violations will be brought to the attention of the Dean of Students.

Students will be informed regarding modifications or deviations from the syllabus.

Course Objectives:

- Identify the structure-properties relationship in metals, ceramics and polymers
- Identify imperfections in materials and their effects on the materials properties
- Read binary phase diagrams and apply them to materials engineering problems
- Explain the role of processing in materials engineering
- Identify a set of analytical methods to characterize the materials macro- and microstructure
- Apply critical thinking and acquired knowledge to identify materials failure mechanisms
- Select materials for various application
- Be aware of the new technologies in materials engineering and processing
- Develop ability to search literature

Course Schedule (Subject to change)

Month	Day	Chapters	Topics
Jan	23	Introduction	Ch.1, 2
Jan	28	Ch.2,3	Interatomic Bonding. Structures of Metals and Ceramics
Jan	30	Ch. 3	Structures of Metals and Ceramics. Fundamentals
Feb	4	Ch. 3	Structures of Metals and Ceramics. Examples. X-Ray Diffraction
Feb	6	Ch. 4	Polymer Structures
Feb	11	Ch. 5	Imperfections in Solids. Fundamentals
Feb	13	Ch. 5	Imperfections in Solids. Examples. Characterization techniques
Feb	20	Ch. 5, 6	Imperfections in Solids. Diffusion
Feb	25	EXAM I	From Ch 1 - 6

Feb	27	Ch. 10	Phase Diagrams. Fundamentals
March	4	Ch. 10	Phase Diagrams. Binary metal and ceramic systems
March	6	Ch. 11	Phase transformations. Fundamentals
March	11	Ch. 11	Phase transformations. Polymers. Thermal Analysis
March	13	Ch. 7	Mechanical Properties
March	25	Ch. 7,8	Deformation and Strengthening
March	27	Ch. 9	Failure
April	1	Ch. 16	Corrosion and Degradation of Materials
April	3		*Team Exercises (Failure Analysis cases)
April	8	EXAM II	From Ch 1-6, 7-11, 16
Apr	10		*Team Exercises (Failure Analysis cases)
Apr	15	Ch. 14	Synthesis and Fabrication. Metals.
Apr	17	Ch. 14	Synthesis and Fabrication. Ceramics. Nanotechnology
Apr	22	Ch. 14	Synthesis and Fabrication. Polymers.
Apr	24	Ch. 15	Composites
Apr	29		*Team Exercises (Materials Engineering cases)
May	1		*Team Exercises (Materials Engineering cases)
May	6		*Team Exercises (Materials Engineering cases)
May	TBD	FINAL EXAM	

*Additional reading to enable active participation in the team exercises will be assigned

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.