MTEN 395 Materials Engineering Laboratory

Credits and contact hours 1-6-0 (1 lecture hr/wk-6 lab hr/wk-4 course credit)

Monday: 1:00 pm – 3:50 pm Friday: 1:00 pm – 5:20 pm

Instructor: Irina Molodetsky <u>https://njit-edu.zoom.us/my/irina.molodetsky</u> email: <u>Irina.Molodetsky@njit.edu</u>

Textbook

- 1. No textbook
- 2. Required reading materials for each project are provided by an instructor. Additional recommended reading is available through NJIT library

Specific course information

a. Description:

MTEN 395. Materials Engineering Laboratory. 4 credits, 7 contact hours (1;6;0).

This course provides hands-on experience with materials characterization equipment, techniques and methods for qualitative and quantitative analysis of materials properties, methods of presenting collected data. The course emphasizes structure-properties relationships via the measuring properties of different classes of materials. This course includes physical, mechanical, thermal, electrical and optical properties measurements. Techniques for direct micro- and macrostructural analysis include X-Ray diffraction, optical and electron imaging.

Prerequisites: <u>FED 101</u>, <u>MTEN 205</u>, <u>MTEN 301</u>, <u>MTEN 305</u>, <u>MTEN 309</u>, <u>MATH 333</u>.

Specific goals for the course

The student will be able to:

- Apply methodology of Design of Experiment (DoE) for each project
- Apply materials characterization methods learned in previous courses
- Learn new experimental methods for structure-properties material analysis
- Write a report in the specified format
- Present a project to different types of the audience

Specifically, in Spring 2025::

- Design experiment to observe growth of Polyethylene Oxide (PEO) crystals
- Model nucleation and crystal growth in PEO with various molecular weights
- Conduct thermal analysis of PEO polymers with different molecular weights
- Evaluate rheological behavior of PEO polymer solutions
- Calculate strain in BaTiO₃ ceramic using powder X-Ray diffraction
- Determine D₃₃ coefficient for BaTiO₃-Ba₂TiO₄ samples (solid state synthesis)
- Measure energy gap of BaTiO₃-Ba₂TiO₄ samples

- Synthesize CaCO₃ in Continuous Stirred Tank Reactor by precipitation
- Synthesize CaCO₃ in the batch reactor at different temperatures
- Characterize CaCO₃ morphology and structure using electron microscopy and X-Ray diffraction
- Perform materials design assessment of the spark plug considering compatibility of materials in various joining processes

Course Structure

- 1. Weekly laboratory classes
- 2. There are 4 projects developed for this course (90%)
- 3. Projects emphasize difference in the structure-properties relationship in the following classes of materials: metals, ceramics, and polymers
- 4. Each project requires both: written report and presentation
- 5. Final exam is presentation to a wide audience of one of the projects (10 %)

Communication

- 1. This course will use the NJIT Canvas site accessed by <u>http://canvas.njit.edu</u> for all communications regarding changes in the schedule, status of the experiments, score rubrics, files and documents.
- 2. All online communications are done using Zoom
- 3. Additional individual or team discussions will be scheduled on Canvas and require you to sign up to a specific slot.
- 4. If circumstances require online communication with the entire class, it will be done through **Zoom** hosted by the instructor

Grading

Above 90 A Above 85 B+ Above 80 B Above 75 C+ Above 70 C Above 60 D Below 60 F

Professional Behavior

- Follow Safe laboratory practices and laboratory ethics
- Support inclusive learning environment
- 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 <u>dos@njit.edu</u>"

www.njit.edu/academics/pdf/academic-integrity-code.pdf

Accommodations due to a disability

If you need accommodations due to a disability please contact Marsha Williams-Nicholasto, Associate Director of Disability Support Services, Kupfrian 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

Use of Artificial Intelligence

If you have any questions or concerns about AI technology use in this class, please discuss it during the DoE stage. If permitted, AI must be cited as is shown within the <u>NJIT Library AI</u> <u>citation page</u> for AI.