

# Materials Characterization (MAT 312)

## Fall 2018

**Course Motivation:** The focus of this course will be the analysis and characterization of engineered materials, in order to develop an intuitive understanding of their structure-properties-processing-performance relationships. To this end, a broad selection of commonly used characterization tools will be the subject of discussions and demonstration. We will use heat, light, electrons, and x-rays to probe the material structure. For each technique, we will address the structural features of the material are being investigated, the interpretation of the results of analysis to deduce information about the structure-property relationship in the material, and how the instruments work.

Stories that we analyze, that we dissect, in this class will enable us to

- 1) understand material properties
- 2) develop new materials based on our understanding of structure-properties relationships
- 3) understand how to extract material information by choosing the best analysis method

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Lecture hours: Mondays, 14:40-15:30 in FENS G025  
Tuesdays, 09:40-11:30 in FENS L058

Lab Sections: In FENS L021 and FENS L022 for all sections, unless indicated otherwise  
Thursdays, 10:40-14:30  
Fridays, 09:40-13:30

Lab sections will be optional this year, but you may only participate if your cell phone stays out of sight for the entire duration of the lab exercise.

Office hours: by appointment; please email at least 24 hours in advance

1. Lecture notes: *Some* of the lecture notes will be posted to SUCourse to help you follow along in lecture. **Recopying** your lecture notes is strongly recommended to aid your digestion of the concepts covered.
2. Textbook: There will not be an official course textbook. **You will need your ENS 202, ENS 205, and MAT 204 course notes and textbooks.** Additional reference material will be recommended or provided for each topic, at the end of the lecture slides.

3. Attendance: learn if you want; above all, do NOT talk during lecture (it is extremely rude). There will not be make-up labs, so if you miss one, borrow notes from a friend.
4. Lab section attendance is optional this year. If you attend, you must pass the quiz at the beginning, demonstrating that you have prepared for the lab in advance. This step is necessary, because we were only allowed 2 TAs and to prepare the course at the last minute; 10 students merely observing the lab is not practical. If you truly interested in learning, do please join, but there is no obligation to attend. However, ***cell phones are banned from the lab.***
5. Pre-lab preparation: We will down-select a reasonable amount of reading material and on-line multimedia to help you get an overview of the technique and material to be analyzed. By “reasonable” this should take you no more than an hour before each lab, to prepare for the lab section. ***Do not show up without a clue about the lab, as you will need to pass the quiz at the beginning with a score of 75% to participate in the lab.***
6. You will receive non-graded feedback on your lab notebook, during each lab session. The details are to be discussed in lecture on 24/09/18. You are responsible for learning the details from your classmates if you missed the discussion.
7. Lab write-up: To receive feedback, a 2-page memo should be submitted via Turnitin within one week of each lab. ***Your memos will not count in the course grade***; the memo is merely to teach those who are interested in learning to write technical communication. Please address concisely the following:
  - a. Indicate what you would like to learn about the specimen and why the specific technique would help you learn that information
  - b. Relate the measured properties to the structure of the material
  - c. Extrapolate to how this information would be useful in a commercial product (this is your chance to be creative; whatever you come up with will be your ammunition when interviewing for a job!)

***Plagiarism will not be tolerated***, which is why you will need to submit via Turnitin. Your writing will only be evaluated, if the automatically generated originality report shows that < 7% is common with other sources. Instructions for using Turnitin will be provided during the introductory lecture.

8. Grading: 20% of your course grade will come from an oral presentation describing how you would apply the tools we discuss to solving a failure analysis problem. 80% will come from each of the three Mid-term Exams. Please have some dignity and do not negotiate your grade. If it's really critical for you to pass this course, you would take every aspect of the course seriously, which would be reflected in your actions and output.
9. Please note the following exam dates in your calendar: ***Mid-term Exam I in class on 23/10/18, Mid-term Exam II in class on 20/11/18, and Mid-term Exam III in class on 25/12/18.*** Make-up exams will be an oral exam in Cleva Hoca's office within one week of the exam date, regardless of excuse.
10. This document defines the expectations for the course, and these rules are applied equally to all students. Therefore, please do not try to negotiate for special privileges or special projects to boost your grade. The grade that you earn for the course only reflects your degree of mastery of the course material ***during*** the 14 weeks of the semester. ***Your attendance in this course beyond the Add/Drop date automatically implies that you have read and accepted these guidelines.***

In order to submit your assignments on Turnitin, you will need to first **register to the course and every lab section** and second **make sure that you submit your memo to the correct lab section**. Course/Lab name and enrollment password for each are the following:

Unless otherwise notified, the schedule for the semester (as of 14/09/18) is shown in the following table:

Calendar Week #	Semester Week #	Lectures (M 14:40-15:30 in FENS G025; T 09:40-11:30 in FENS L058)			Lab (R 10:40-14:30)	Lab (F 09:40-13:30)
		Date	Topic	Lecturer		
39	1	24-25/09	Introduction / thermal analysis (TG-DTA & DSC)	CO	TG-DTA	TG-DTA
40	2	01-02/10	thermal analysis (TG-DTA & DSC)	CO	Raman	Raman
41	3	08-09/10	Spectrophotometry (UV-Viz, FTIR)	CO	no lab	no lab
42	4	15-16/10	Spectrophotometry (FTIR & Raman)	CO	SEM-1	SEM-1
43	5	22-23/10	Raman; <b>Mid-term Exam I during lecture hours 23/10</b>	CO/SK/AC	no lab	no lab
44	6	30/10	Crystallography & X-ray diffraction (XRD)	CO	XRD-1	XRD-1
45	7	05-06/11	Crystallography & X-ray diffraction (XRD)	CO	SEM-2	SEM-2
46	8	12-13/11	Crystallography & X-ray diffraction (XRD)	CO	XRD-2	XRD-2
47	9	19-20/11	<b>Mid-term Exam II during the lecture hours on 20/11</b>	CO/AC/SK	no lab	no lab
48	10	26-27/11	Visible Light Microscopy (VLM)	CO	VLM	VLM
49	11	03-04/12	Scanning electron microscopy (SEM)	CO	FTIR	FTIR
50	12	10-11/12	Scanning electron microscopy (SEM)	CO	TBD	TBD
51	13	17-18/12	Energy-dispersive x-ray spectroscopy (SEM-EDX)	CO	<i>oral presentations</i>	
52	14	24-25/12	<b>Mid-term Exam III during the lecture hours on 25/12</b>	CO/SK/AC	no lab	no lab

Color legend for TAs:

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