

MEMS 1011: Structure and Properties of Materials Lab

Course Syllabus

Spring 2019

Catalog Description

The relationship between structure and properties is at the core of materials engineering and often defines it as a separate discipline. It is not possible to explore all the important structure-property relationships in a single laboratory class. Instead, the laboratory exercises will focus on important concepts for each material class and also emphasize experimental design and problem solving using some of the characterization methods introduced in MSE 1010. 3 credit hours.

Schedule

Thursday 9:10 - 11:55AM @ Zone 4 – 203

May exchange with afternoon or other sessions

Instructor

Prof. Charles Hua charleshua@scu.edu.cn or charleshua2017@outlook.com

17760422493, Room Zone 4 - 118

Prof. Yijing Yin yijing@scu.edu.cn

Office hours: after lab classes

Teaching Assistant

Huiqin Wang: 18428389194@163.com

When emailing the instructors or TA, include “**MEMS 1011**” in the subject field of your message. Use your university email account (student_ID_number@stu.scu.edu.cn); mail from other accounts might be stopped by the SCU spam filter.

Textbook

None at this moment

We will cover some basic metallographic methods and some advanced analytical techniques in materials science. Reading assignments will be posted to the class website. Read the assigned chapter BEFORE class.

- You *must* have taken:
 - Materials Structure and Properties (Or equivalent, or consent of instructor)
- You *should* have taken:
 - MEMS 040 – Materials and Manufacturing (But not strictly required)
 - MEMS 1010 - Experimental Methods in Materials Science
- It is assumed that the student has a basic working knowledge of:
 - **Phase diagrams:** reading and understanding the diagrams, identifying phases and eutectics, solubility and relative composition of phases
 - **Basic kinetics:** equilibrium cooling (i.e. through a phase boundary) and time-temperature-transformation diagrams
 - **Microstructure:** Phases, eutectics, lamellae, connection to phase diagrams and kinetics

If these terms are fuzzy to you, review your course notes. If they are totally unfamiliar, beware....

Web Site

This course uses the Blackboard system; the web site is

<https://learn.scupi.cn/>

There you will find the course syllabus, homework assignments, and other materials. Current announcements and assignments will be posted on the home page. All assignments will be uploaded through the Blackboard system. Please check the class page frequently.

Class Format

EXPERIMENTAL METHODS IN MATERIALS SCIENCE AND ENGINEERING is taught using a combined lecture, reading, review and discussion format. The lecture begins with two sessions to review material in the literature and introduce new concepts. In the third session, the lecturer may ask questions to as many students as possible and encouraging critical reading of published papers in related field.

For laboratory work and report, you will be divided into groups of 4 people. Each person in the group will take turn to be the leader for one of the 4 labs. That means everyone will have a chance to be the leader and be responsible for report writing.

It is imperative that you come to class prepared. This will generally involve reading all posted literature and viewing tutorial videos. This is a three credit hour class, which means you should expect to devote at least 8 hours of effort outside the scheduled class time every week.

Experiments (tentative, pending availability of lab facilities)

Ceramic Materials

1. Pressing of powders and the analysis of sintering
2. Chemical synthesis of ceramic materials (*)

Polymers

1. Effect of mixing ratio on the glass transition of a thermoset
2. Effect of temperature on the setting of a thermoset

Metals and Alloys

1. Cold work and annealing of metals
2. Heat treatment of an aluminum alloy (*)

Feedback

There will be a short voluntary and anonymous survey with two questions each week on Courseweb about positive aspects of the laboratory week and aspects that need improvement. This is an opportunity for the students, the teacher and TA to improve this and future laboratories. If you participate in 80% or more of the surveys, you receive 3% towards your extra credits (see below). The final grade cannot exceed 100%

Homework Assignments

Homework problems will be assigned every week or so and posted on Blackboard. These are to be completed and turned in by **Sunday 1:30 PM**. You may work with other people on homework, but all writeups must be individual efforts. Homework will be graded on a 0-100 point scale.

All work will be submitted electronically through the Blackboard system. Late homework will not be accepted.

Unless specifically requested, emailed homework will not be accepted.

Please adhere to these homework guidelines:

- Your assignment must be typeset using Word and submitted electronically through Blackboard. Handwritten assignments will not be accepted.
- Put your name, ID number (last four digits), and class section at the top of the first page.
- List the names of other people you've worked with on the assignment or report.

All of the homework scores will be used in your grade computation. Unless otherwise indicated, you can work with your fellow classmates in the class, but you must submit a distinct and independent write-up to receive credit.

If you're sick, or have a compelling emergency that prevents you from turning in the homework on time, email Prof. Charles Hua.

If you believe an error has been made in the grading of an assignment, bring it to the attention of your TA within ONE WEEK of its return.

Grading

There will be no exam for this course.

Your grade will be based on the homework (40%), and lab reports (10% \times 5 =60%). If your homework is submitted late, you lose 10% of the credits per day past due, and have zero credit one week past due. You should participate actively in the class and practical in order to grasp the important concepts.

Office Hours

If you don't understand something, and talking to your classmates doesn't help, then you should be seeking help from the instructor or teaching assistant.

Office hours are times we have specifically set aside to be available to students. During office hours, you can come to our office; you don't need an appointment. We are also available at other times; please email to schedule a time.

Current office hours will be Wednesday and Thursday morning 9-11:30am.

Requirements & Grading

Reports:

Each student has to complete a report for each experiment listed above (eight). For the experiments marked with the (*), teams of 3-4 students will also give additionally to the individual lab report a team presentation about a subject detailed in the description of the experiment and a group report. In addition to the extra credits (see below), the grade of the worst report (if all are submitted) will be dropped.

Lab notebook:

Each student is required to have a **bound** lab notebook that will be graded after each section (Ceramics, Polymers, Metals).

Extra Credits:

There will be two opportunities for extra credits that will account for (if all done and all points are received) 1 lab report. The accumulated grade of the extra credits can be used to replace the lowest grade of one group report, presentation or one lab report.

Presence during laboratory classes and experiments:

In a laboratory, presence is of most importance due to hands-on (or eyes-on) experiences, note taking, data recording and so on. Furthermore, delays of individual students will delay the entire class, since we are most of the time not in the class room. Therefore, students must be present during an experiment if they didn't get excused by the instructor (for example by having a doctor's note) prior to the experiment. If a student is not present during an experiment or part of it, he or she

cannot include this part of or the entire experiment in his or her laboratory report and laboratory notebook, which will result in automatic deductions. To not delay the entire experiments, students have to be in class on time. If students are 5 min or more delayed without prior by the instructor approved notice, an automatic deduction of at least 10% of the individual lab report will be applied.

Academic Integrity:

Students in this course will be expected to comply with the [University of Pittsburgh's Policy on Academic Integrity](#). Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators. To foster a high level of academic integrity, the **MEMS Department has recently established a coordinated and uniform approach** to dealing with violations of academic regulations against cheating and plagiarism. This approach involves disciplinary actions that increase in severity with number of instances a student has been found in violation of academic integrity (1st: 0 on assignment, 2nd: 0 on assignment and loss of one letter grade on final grade, 3rd and more: referral to SSOE or university).

Disabilities:

If you have a disability that requires special testing accommodations or other classroom modifications, you need to notify both the instructor and the [Disability Resources and Services](#) no later than the 2nd week of the term. You may be asked to provide documentation of your disability to determine the appropriateness of accommodations. To notify Disability Resources and Services, call 648-7890 (Voice or TTD) to schedule an appointment. The Office is located in 216 William Pitt Union.

Copyright Notice

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Statement on Classroom Recording

To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

Statement on Distractions during lecture and laboratory

To ensure a foremost safe but also productive and distraction free learning environment, cellphones, smartwatches, laptops, tablets and other electronic devices are in general not allowed. There will be exceptions from that rule after explicit permission, for example if calculations are needed.

Approximate Schedule

Week	Content	Assignment And Material Lab Request
1	Introduction and Chemical Safety Extra Credits 2 lab: mechanical testing	Extra Credit 1: lab safety
2	Ceramics 1: density, lecture & experiment 1	Alcoa Premalox 10 and A16-SG A furnace with a programmable controller, 1400C, Weight Scale
3	Ceramics 1: density, experiment 2	Individual lab report: Ceramics 1
4	Ceramics 2*: chemical synthesis, lecture Experiment part 1	
5	Ceramics 2*: chemical synthesis group presentations	Group project: Ceramics 2
6	Ceramics 2*: chemical synthesis Experiment part 2	Individual lab report: Ceramics 2
7	Polymer 1 : mixing ratio vs. glass transition	
8	Polymer 2 : temperature vs. setting	Individual lab report: Polymer 1
9	Metals 1 : Cold work and Anneal: 304L, HV	Individual lab report: Polymer 2
10	Metals 2*: Heat treatment of Al 2024	Individual lab report: Metals 1
11	Metals 2* : group work to prepare experiments	
12	Metals 2* : group presentation, experiments	Group project: Metals 2
13	Metals 2* : group experiments	Individual lab report: Metals 3