

# ENGR 0022: Material Structure and Properties

## Course Syllabus

**Fall 2020**

### Catalog Description

To introduce the basic principles underlying the behavior of materials. This course provides the scientific foundation for understanding of the relations among material properties, microstructure, and behavior of metals, polymers, ceramics and composites. Students will develop a vocabulary for the description of the empirical facts and theoretical ideas about the various levels of structure, from atoms, through defects in crystals, to larger scale morphology of practical engineering materials. 3 credit hours.

### Schedule

Monday/Tuesday/Wednesday: 8:15-11:05am, August 31, 2020 to Dec. /2020  
Room 4-203 and/or  
online: <https://learn.scupi.cn>  
AntiVirus Classroom using “5B” – Blackboard BigBlueButton

### Instructor

Dr. Charles Hua, 17760422493 (WeChat and Mobile), charleshua@scu.edu.cn  
Office hours: Monday/Tuesday/Wednesday: 2-5pm,  
Room 4-226 and/or online, WeChat group

When sending email to the instructor, include “ENGR0022” 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. Use your real name or ID in your WeChat message, too.

### Laboratory Engineer/Manager

Liu Liu, Dong Liang and Senbao Lin

### Teaching Assistant: TBD or

Monday -	Scarlett Ruan 阮文杰	2017141523030@stu.scu.edu.cn
Tuesday -	Aubrey Zhang 张泽龙	2018141522050@stu.scu.edu.cn
Wednesday-	Alisa Zhou 周楞	2019223020063@stu.scu.edu.cn

**Textbook:** William D. Callister Jr. and David G. Rethwisch, Materials Science and Engineering: An Introduction, 10<sup>th</sup> Edition, John Wiley, January 2018. ISBN: 978-1-119-40549-8. There is a student site by the publisher: <https://www.wiley.com/en-us/Materials+Science+and+Engineering%3A+An+Introduction%2C+10th+Edition-p-9781119405498>

**Reference Book:** William F. Smith and Javad Hashemi, Foundations of Materials Science and Engineering, 6<sup>th</sup> Edition, McGraw-Hill Education, January 26, 2018. ISBN-10: 1259696553, ISBN-13: 978-1259696558.

## Web Site

This course uses the Blackboard system; the web site is

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

(Note: the **https** is important, otherwise it may not load.) 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

**Material Structure and Properties** is taught using a combined lecture, reading, review and discussion.

**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 6 hours of effort outside the scheduled class time every week.

### Feedback

There will be a short voluntary and anonymous survey with two questions each week or so by TA 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 work. If you participate in 80% or more of the surveys, you receive 6% towards your extra credits. 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 the specified due time. You may work with other people on homework, but all writeups must be individual efforts.

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: To be discussed with TA and Class**

Homework 20-30%; one or two mid-term exams 30-40%; final exam 30%, class participation 10%.

**Homework:** Up to 11 problem sets will be assigned and will be due one week after post on class website. Late homework will not be accepted unless approved otherwise. You can have reasonable cooperation among peers, providing it aids in the learning process. Copying is not permitted.

### **Office Hours**

If you don't understand something and/or want to explore more, 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** Monday/Tuesday/Wednesday: 2-5pm,  
Room 4-226 and/or online, WeChat group.

### **Academic Integrity:**

Students in this course will be expected to comply with the SCUPI and/or [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 University of Pittsburgh **MEMS Department has recently established a coordinated and uniform approach** to dealing with violations of academic regulations against cheating and plagiarism.

### **Disabilities:**

If you have a disability or sickness that requires special testing accommodations or other classroom modifications, you need to notify the instructor, student counselor, and/or the [Disability Resources and Services](#) in a timely manner. You may be asked to provide documentation of your disability or sickness to determine the appropriateness of accommodations.

### **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 via Textbook**

1. Atomic Structure and Interatomic Bonding in Solids
2. The Structure of Crystalline Solids and Noncrystalline Materials
3. Imperfections in Solids
4. Diffusion
5. Mechanical Properties of Metals
6. Dislocations and Strengthening Mechanisms in Metals
7. Failure, (Fatigue, and Creep)
8. Phase Diagrams
9. Phase Transformations
10. Applications and Processing of Metal Alloys
11. Structures and Properties of Ceramics, Applications and Processing of Ceramics
12. Polymer Structures
13. Composites
14. Corrosion and Degradation of Materials
15. Electrical Properties
16. Thermal, Magnetic and Optical Properties
17. Environmental, and Societal Issues in Materials Science and Engineering