ENGR 0022: Material Structure and Properties

Fall 2022

Instructor:	Shan Gong	**Time:**	Monday 8:15am – 11:00am
Email:	shan.gong@scupi.cn	**Place:**	Room 4-216
Office:	Room 4-221		

Course Pages

- https://pibb.scu.edu.cn
- We will post lecture notes, assignments, projects, announcements and your grades on it.

Office Hours

- Mondays & Wednesdays: 1:00PM – 4:00 PM
- By appointment via Email
- Online via QQ Group: 771062098

Teaching Assistant

- Keran Xu
- Contact: 2020141520151@stu.scu.edu.cn
- If you have any question regarding to homework grading, please contact TA **within one week** after the homework is returned to you.

Course Description

This course lays a fundamental knowledge and skill basis for engineers to understand materials structure, properties, and the relationship between the two. Topics covered include structure of solids, mechanical and physicochemical properties of materials, fabrication and processing of materials, materials performance, materials degradation, characteristics and application of materials. (3 credits)

Prerequisites

- Chem 0960 is required for a smooth study.

Course Objectives

A deep understanding of the relationship between structure and properties plays a key role in materials design, process, and application. To ensure such a good understanding, students should be able to perform tasks showing below upon completing this course:

1. Define material families based on chemical composition, atomic and micro structure, physico-chemical properties, and processing routes.

2. Describe relationships between materials structure at the atomic and/or micro level of materials and their properties.

3. Explain how processing alters materials structure and hence modify materials properties.

Textbook

- William D. Callister, JR, and David G. Rethwisch, "Materials Science and Engineering", 9th edition (2014)

Assessments

Homework:	30%
Midterm Examination:	30%
Final Examination:	40%
	100%

Grade

90.00 – 100.00	A	85.00 – 89.99	A-	80.00 – 84.99	B+	76.00 – 79.99	B	73.00 – 75.99	B-
70.00 – 72.99	C+	66.00 – 69.99	C	63.00 – 65.99	C-	60.00 – 62.99	D	0.00 – 59.99	F

Class Policy

- Regular attendance is essential and expected.
- Important dates and plans will be announced during class.

Homework and Other Assignments

Homework problems and other assignments will be assigned periodically and are due as stated in the assigned paper. All work will be submitted electronically through the Blackboard system. Late submission **WILL NOT** be accepted. It is **your duty** to make sure that submission through Blackboard has been properly processed. **Unless specifically requested, emailed homework will not be accepted.**

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 plagiarism is caught, zero score for all homeworks.** If you have a compelling emergency that prevents you from turning in the homework on time, email Dr. Shan Gong (shan.gong@scupi.cn).

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** from its return. Please adhere to these **homework guidelines:**

- Put your name, ID number (last four digits), and class section at the top of the first page.

- All work must be shown for each solution to receive full credit. Present your solution in a logical fashion, showing and explaining all steps in detail.
- Obtaining the correct answer includes getting the correct quantity, **number of significant digits**, sign, and **unit**.

Exams

There will be two exams (one Midterm and one Final), all are **CLOSED-BOOK**. Students can bring **one** A4 page note and it must be **hand-written** on **two sides** of the paper. It cannot be a photocopy. All midterm and final exams are mandatory. If you must miss an exam, you **MUST** make alternative arrangements with the instructor before the exam is given. If you missed an exam without prior notification, you will receive a score of **ZERO** for that exam except under extenuating circumstances. If you missed the midterm or final, a make-up exam may be given if the student has the approval from the instructor or emergencies and health issues **with a valid proof**. I will not accept the student deceleration for absence form for the final exam. Students who have not taken either the midterm or the final exams are **NOT** eligible to take th make-up exam if he/she failed the course. Students taking make-up exams can only attain at most a **D** grade if he/she failed the course.

Academic Integrity

At Sichuan University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do.

Unacknowledged direct copying from the work of another person, or the close paraphrasing of somebody else's work, is called **plagiarism** and is a serious offense, equated with cheating in examinations. This applies to copying both from other students' work and from published sources such as books, reports or journal articles.

Paraphrasing, when the original statement is still identifiable and has also no acknowledgement, is plagiarism. A close paraphrase of another person's work must have an acknowledgement to the source. It is not acceptable for you to put together Unacknowledged passages from the same or from different sources linking these together with a few words or sentences of your own and changing a few words from the original text: this is regarded as over-dependence on other sources, which is a form of plagiarism.

Everyone at SCUPI is expected to treat others with dignity and respect. The Code of Student Conduct allows Sichuan University to take disciplinary action if students don't follow this community expectation.

Course Content

A schedule in detail will not be available as the pace of the course will highly be determined by students' reception of the content.

1. Structure of solids
    - Materials classification and selection
    - Atomic structure and interatomic bonding
    - Fundamentals of crystallography
    - The structural of crystalline solids
    - Polymer structure
    - Ceramics structure
    - Imperfection of solids
2. Mechanical and physicochemical properties of materials
    - Diffusion
    - Mechanical properties of metals
    - Dislocations and strengthening mechanisms
3. Materials performance
    - Failure
    - Phase diagram
    - Phase transformation
4. Characteristics and application of materials
    - Properties and applications of metals
    - Properties and applications of ceramics
    - Characteristics and applications of polymers
    - Composite materials
5. Fabrication and processing of materials
    - Fabrication and processing of engineering materials
6. Materials degradation
    - Corrosion and degradation of materials