

Syllabus of CENG 1500L1
A First Course on Materials Science and Applications

2021/22 Spring
09:00– 10:20 am (Tuesday and Thursday), Room LTD

Instructor: Professor Minhua Shao, Tel.: 3469-2269, Room: CYT2006, email: kemshao@ust.hk

Scope

This course is designed for students with basic science and engineering background. The scope of this course is to introduce different categories of materials and to elucidate their applications. We will study basic concepts of different kinds of materials and the basic structures at different scales. The focus of the course is the structure/property relationship. Design and applications will be explored. After the course, the students are able to understand basic techniques for measuring the common properties of materials, and for fabricating and processing of novel materials, and evaluate the social, economical, and environmental impact of materials.

Course intended learning outcomes (ILOs)

CILO 1 Describe the basic structures and properties of materials used in our daily life, and discuss the novel applications of selected advanced materials

CILO 2 Understand basic techniques for measuring the common properties of materials, and for fabricating and processing of novel materials

CILO 3 Evaluate the social, economical, and environmental impact of materials

Methodology

Textbook and group projects (**optional**). For the part of the textbook, lecture-based learning will be conducted (CILO 1-3). Homework will be assigned once a week (CILO 1-2). Mid-term exam will be conducted on-line in April and Final exam in May (CILO 1-2). Both exams will be **open books and notes**. All lecture notes will be posted on Canvas at least one day before the lecture. The students are responsible for downloading them from the website. Lectures will be video recorded and shared with students.

For the **optional** group projects, each group will consist of **1-2** students (CILO 2-3). The group will select one topic about materials and their applications and give a 15 min presentation in the last week of the class.

It is expected that the lecture will be delivered in the classroom via ftf. However, during the add/drop period, ftf with zoom lite will be adopted for this course.

<https://hkust.zoom.us/j/93521416391?pwd=TW81SIR2SjFXTG9RU1hCRG9hd1BCQT09>

Meeting ID: 935 2141 6391

Passcode: 339176

Lectures

Lecture 1 introduction

Lecture 2 Atomic structure and bonding

Lecture 3 Crystal structure

Lecture 4 Lattice position and plane

Lecture 5 X-ray diffraction

Lecture 6 Crystal defects

Lecture 7 Diffusion
Lecture 8 Mechanical properties I
Lecture 9 Mechanical properties II
Lecture 10 Thermal behaviour
Lecture 11 Phase diagram I
Lecture 12 Phase diagram II
Lecture 13 Phase diagram III
Lecture 14 Heat treatment I
Lecture 15 Heat treatment II
Lecture 16 Structure materials-metals and polymers
Lecture 17 Structure materials-ceramics and composites
Lecture 18 Electronic materials-conductors and superconductors
Lecture 19 Electronic materials-insulators and semiconductors

Skills Trained

Problem solving, Critical thinking, Team, Presentation, Writing and Communication

Grading Methodology

No group project

Homework: 10% (CILO 1-2)
Mid-term exam: 40% (CILO 1-2)
Final exam: 50% (CILO 1-2)

With group project

Homework: 10% (CILO 1-2)
Mid-term exam: 30% (CILO 1-2)
Final exam: 40% (CILO 1-2)
Project presentation: 20% (CILO 2-3)

Assignments/homework:

Weekly homework assignment. The answers will be posted on the Canvas course web. There will be 10 homework assignments through the semester. Each assignment counts 1 point toward the final score.

Other Information:

Tutorial Room LTC, 12:00 – 15:50 pm (Friday)
Zoom meeting link will be provided by the TAs later.

Office hours: Room CYT2006 and online, Tuesday: 2-3 pm or appointment

<https://hkust.zoom.us/j/93810500719?pwd=NGRIZitOc2tvSmx3SnRhVTJKWVdudz09>
Meeting ID: 938 1050 0719
Passcode: 779323

PG TAs: HW grading, tutoring
LIU Fangzheng (FLIUAI@connect.ust.hk)
WANG, Jin (JWANGER@connect.ust.hk)
WANG, Yian (YWANGLA@connect.ust.hk)
KIM, Hyeongwoo (HKIMAI@connect.ust.hk)

Textbook

James F. Shackelford, *Introduction to Materials Science for Engineers*, 7th Edition, Person Education, 2009; or 8th Edition, 2016. E-version is available.

Reference

Brian S. Mitchell, *An Introduction to Materials Engineering and Science*, John Wiley, 2004.