CHEN4440 Course Syllabus

Chemical Engineering Materials

Class Meetings:	Mon, Wed & Fri 1:55-2:45 PM	BIOT A108 & Zoom: https://cuboulder.zoom.us/j/91220228514
Office Hours:	Tue 3-5 PM Thu 4:30-6:00 PM Zoom: https://cuboulder.zoom.us/j/92199071714	BIOT B115 & Zoom BIOT B431 & Zoom
Instructor:	Hendrik Heinz Office: BIOT C126	Phone: 303-735-7517 Email: hendrik.heinz@colorado.edu
Adv. TA:	Xinpei (Cindy) Zhou	Email: xinpei.zhou@colorado.edu
TA :	Yu-Tang Lin	Email: yu-tang.lin@colorado.edu
CA:	Saud Abdollatif	Email: saud.alabdullatif@colorado.edu

Text:

Required:

William D. Callister, David G. Rethwisch*, Fundamentals of Materials Science and Engineering: An Integrated Approach,* 5th ed., Wiley & Sons: New York, 2016.

ISBN : 978-1-119-12548-3 (binder ready version)
ISBN : 978-1-119-12764-2 (e-text, same content)

Recommended Optional Texts:

Michael F. Ashby, David R. H. Jones, *Engineering Materials 1: An Introduction to Properties, Applications, and Design,* 4th ed., Butterworth-Heinemann/Elsevier: Oxford, 2014.

ISBN : 978-0-08-096665-6

Michael F. Ashby, David R. H. Jones, *Engineering Materials 2: An Introduction to Microstructures and Processing,* 4th ed., Butterworth-Heinemann/Elsevier: Oxford, 2014.

ISBN : 978-0-08-096668-7

Robert J. Young, Peter A. Lovell, *Introduction to Polymers*, 3rd ed., CRC Press: Boca Raton, 2011.

ISBN: 978-0-8493-3929-5

Instructional Videos: http://www.learncheme.com/screencasts/materials-science

Other Materials: Lecture notes, clickers, course website on Canvas, piazza for blogs & chats

Exams:		
	1st Midterm Exam	Thu, Feb 10, 6:30-8:30 PM in A108/Zoom (Reserved 6-9 PM) Accommodation exam C124: 5:30-8:30 PM
	2nd Midterm Exam	Tue, Mar 15, 6:30-8:30 PM in A115/Zoom (Reserved from 6-9 PM) Accommodation exam C124: 5:30-8:30 PM
	Final Project Written Report Talk/Poster Presentations No Final Exam	Thu, Apr 28, 5 PM Mon, May 2, 4:30-7:00 PM via Zoom

Prerequisites

- A grade of "C-" or better in Chemical Engineering Thermodynamics (CHEN 3320)
- Completion of at least one semester of Organic Chemistry

Course Learning Objectives

The course aims to introduce the structure and versatile function of the major materials classes: metals, ceramics, polymers, and hierarchically structured composite materials. Relationships between the atomic-scale structure and macroscopic properties will be explored and illustrated using examples from our everyday lives. We will learn concepts of materials chemistry, physics, and engineering that are useful to create lighter cars and aerospace vehicles, greener energy technologies, as well as advanced personal devices and computing power. We will apply the knowledge to case studies and a final research-type project. Discussions will explore crystalline materials, such as metals and alloys, lattices in diamond and highly temperature-resistant ceramics, as well as amorphous polymers with gradual transitions between solid-like and fluid-like behavior. The connection between structure and performance of materials will be exemplified by fascinating limits of mechanical properties, electrical conduction versus insulation, and energy conversion in batteries, fuel cells, and solar cells. We will also learn about production techniques and processing, defects and phase diagrams, as well as lessons from nature-inspired materials structures found in animals and marine life. The course also trains on timely delivery of assignments and teamwork, as well as clearly structured solutions to given problems.

Attendance and Course Communication

Attendance of all classes is mandatory. Up to 5% of the final grade may be deducted for each unexcused absence.

Canvas will be used to share lecture notes, homework assignments, and other items of interest. No hard copies of homework assignments will be handed out. Please contact the instructor and TAs anytime with questions, including office hours, before and after class, and email for individual appointments.

Assignments

Assignments consist of

- Clickers and workshops in class (10% of overall grade)
  Dismiss lowest two grades for the calculation of final grade
- Weekly homework in groups of three (15% of overall grade, 14 x 20 points)
  Drop one homework with lowest score
- 4 Quizzes at the end of class (10% of overall grade, 4 x 20 points)
  The timing is shown in the schedule at the end, between midterms and final project.
  Count top 3 scores towards final grade
- Final project (25% of overall grade)
  Includes interim reports for feedback (clicker points), the final report (50%), peer review (25%), a lightning talk (10%) and a poster presentation (15%)

We will use **Clicker** questions in class and as part of the workshops that will count toward your final grade. All clicker days will be given the same weight, regardless of the number of points. Leaving your clicker at home or running out of batteries are not valid excuses for being unable to participate in clicker activities. The lowest two grades among the clicker sessions will be dismissed for calculation of the final grade.

The due date for the **Weekly Group Homework** is every Friday midnight. Weekly homework must be submitted electronically to Canvas, which helps transparency and faster turnaround for grading. Individual homework assignments are planned to be of equal scores of 20 points. Every completed group homework must include the statement (on the first page) "All of us worked on all of these problems together, and take full responsibility for the work done in the assignment" and everyone must sign it. The homework must follow formatting guidelines, which are part of grading. No names will be added to the group homework once the homework has been turned in. Anyone left off will receive a zero for that homework assignment. Anyone who has their name placed on a group assignment for which they did not contribute to every problem will be considered to have plagiarized. Please complete each problem on a separate page (with your names), otherwise they will not be graded.

Four **Quizzes** will be administered at the end of classes on Mondays in between midterm exams and the final project. The quizzes will last approximately 15 min and count 20 points.

The **Final Project Report** and interim progress reports need to be submitted through Canvas. The grade for the final project will be determined 50% by the final project report, 25% from peer review by the team members, and 25% by the lightning talk or poster presentation.

Turn in your assignments on time!!

- Assignments are due at the time/date shown on in the Course Schedule and in Canvas
- Assignments turned in late within 24 hours after the due date/time will be counted for 50% of possible points.
- ***No credit*** will be given for assignments turned in 24 hours or more past the due date/time.
- There is no penalty for turning in an assignment early!

Exams

Two midterm exams will be given, and a final project instead of a final exam (see above). **No make-up exams will be given.** If there is an emergency, please contact me before the exam date to be

excused if possible. We require documentation to be fully excused from an exam. If you are excused from a midterm exam, we may substitute with the grade of the other midterm exam. If you miss an exam due to any reason that is not excused, you will receive an F for the course.

Screencasts

Screencasts that supplement the materials from the lectures, book, and homework will be assigned each week. Please do not come to office hours with questions about course material or homework problems without watching them. They are a valuable addition to the course and you are responsible for watching the material.

Grading

If you feel a homework assignment, quiz, or exam has been graded incorrectly, please let the instructor or TA know within one week for a re-grade of the entire assignment/exam. A re-grade request may result in your grade being lowered or raised. Re-grading an assignment/exam will not be possible multiple times. The weight of individual grade items is summarized in Table 1.

Table 1. Grade items, their contribution to the total score, and the breakdown of each contribution.

Grade item	Contribution to the total score	Breakdown
Participation (iClicker/Polls), in-class workshop credit	**10%** 35 classes * 5 points = 175	~37 classes x 5 points Drop lowest 2 days
Weekly homework in groups of 3	**15%** 13 HWs * 20 points = 260	14 HWs x 20 points Drop lowest score
Quizzes in class	**10%** 3 quizzes * 20 points = 60	4 x 20 points Drop lowest score
1st Midterm exam	**20%** 80 points	
2nd Midterm exam	**20%** 80 points	
Final project in a project team	**25%** 100 points	40% written report (40 P) 25% peer evaluation (25 P) 25% pres. (T + P) (25 P) 10% interim reports (10 P)
Total	**100%** **(scaled by category and added)**	

The letter grade will be assigned based on the final distribution of percentage scores in the class. The final percentage of cumulative points for all grade items translates into letter grades as shown below:

A	93-100 %
A-	90-93 %
B+	87-90 %
B	83-87 %
B-	80-83 %
C	70-80 %
D	60-70 %

F	0-60 %

The final percentage *may* be curved in favor of the average grade of the class.

Important Dates

Mon, Jan 10	First day of class
Mon, Jan 17	Martin Luther King Day, no class
Thu, Feb 10	1st Midterm Exam, 6:30-8:30 PM, A108
	Accommodations Exam, 5:30 PM to 8:30 PM, C124
Fri, Feb 11	No class after midterm exam
Tue, Mar 15	2nd Midterm Exam, 6:30-8:30 PM, A115
	Accommodations Exam, 5:30 PM to 8:30 PM, C124
Wed, Mar 16	No class after midterm exam
Mon-Fri, Mar 21-25	Spring break, no class
Wed, Apr 27	Last day of class
Thu, Apr 28	Submission of Final Project Report Due
TBA (Mon, May 2?)	Oral or poster presentations of Final Project

HH may have several absences due to research and university service activities. These include deadlines related to fundraising for research projects, conferences to report on research results and seminars at other universities. Absences or travel will be scheduled so that impacts on the class schedule are minimal.

Requirements for COVID-19

As a matter of public health and safety due to the pandemic, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements, and public health orders in place to reduce the risk of spreading infectious disease. Required safety measures at CU Boulder relevant to the classroom setting include:

- maintain 6-foot distancing when possible,
- wear a face covering in public indoor spaces and outdoors while on campus consistent with state and county health orders,
- clean local work area,
- practice hand hygiene,
- follow public health orders, and
- if sick and you live off campus, do not come onto campus (unless instructed by a CU Healthcare professional), or if you live on-campus, please alert CU Boulder Medical Services.

Students who fail to adhere to these requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution. For more information, see the policies on COVID-19 Health and Safety and classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please see the "Accommodation for Disabilities" statement on this syllabus.

All students who are new to campus must complete the COVID-19 Student Health and Expectations Course. Before coming to campus each day, all students are required to complete the Buff Pass.

Students who have tested positive for COVID-19, have symptoms of COVID-19, or have had close contact with someone who has tested positive for or had symptoms of COVID-19 must stay home. In this class, if you are sick or quarantined, please let the instructor know as soon as possible.

Ethical Standards – Honor Code

This course follows the University Honor Code.

Absolutely no RESUBMISSION is allowed. This means a student cannot resubmit one of his or her own papers – or part of it – whether it was from a different college course or high school.

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu); 303-492-5550). Students found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the Honor Code Office website.

The following actions will not be tolerated and will be grounds for academic penalty as deemed appropriate by the instructor and in compliance with University Honor Code.

1. Papers submitted by any student, written in part or in whole by someone other than that student; in addition, submitted papers that have already been submitted for a different class ("resubmission").
2. Vandalism, destruction of property, stealing.
3. Violation of CU guidelines and standards.

These actions shall be considered to constitute fraud under the University Honor Code or unacceptable or criminal behavior. The penalties can include, but are not limited to, a reduction in assigned grade, receiving an F on the assignment or for the course, or personal responsibility to correct the violation.

Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website and discuss your needs with your professor.

Religious Holidays

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please let me know of any upcoming observances and holidays at least two weeks in advance.

See the campus policy regarding religious observances for full details.

Classroom Behavior

Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the policies on classroom behavior and the Student Code of Conduct.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (including sexual assault, exploitation, harassment, dating or domestic violence, and stalking), discrimination, and harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, anonymous reporting, and the campus resources can be found on the OIEC website.

Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

Preferred Student Names and Pronouns:

CU Boulder recognizes that students' legal information does not always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

Wellness Resources:

We are here to help you grow as a student and as a person. Feel free to get in touch about academic topics as well as beyond the classroom. From our CEAS Values Statement:
"*We here at the College of Engineering and Applied Science (CEAS) value one another as human beings first and embrace practices to support the health, wellness, and success of all CEAS community members. We prioritize the well-being of all members of our community -- students, faculty, and staff. Community wellness begins with respect, empathy and inclusion, and we strive to develop well-balanced healthy individuals. We support conversations around mental health and health-seeking practices.*"

- Need to talk something through? Free, informal, and confidential consultation with a counselor
  "E-Let's Talk"
  colorado.edu/counseling/lets-talk

- Counseling & Psychiatric Services
  (303) 492-2277 (24/7 support)
  colorado.edu/counseling