MASC 310: Material Behavior and Processing

Units: 4
Term—Day—Time: Fall 2020, TTh 2:00-3:50
Location: Online
Instructor: Lessa Grunenfelder
Office: Online
Office Hours: W 11:00-12:00 or by appointment
Contact Info: grunenfe@usc.edu

Teaching Assistant: Emily Gurniak
Office: Online
Office Hours: F 1:00-2:00 or by appointment
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Course Description

Materials Behavior and Processing is intended for undergraduate engineering students from all engineering disciplines, as well as Iovine and Young Academy students with a technology emphasis. The subject of materials is broad, and encompasses metals, ceramics, polymers, composites, and other advanced materials. The 310 course covers fundamental concepts underlying the behavior of engineering materials. The course employs a design-based approach with a focus on the selection of materials and processes for engineering design.

Learning Objectives

Following completion of this course, students will be able to

- Explain the importance of materials science in everyday life, and in the context of engineering.
- Utilize digital information storage and manipulation to look up material property data and background information.
- Describe relationships between the atomic structure and microstructure of a material and its properties.
- Explain if and how microstructure can be altered (via deformation, heat treatment, etc.) to modify specific material properties. Describe structure-property-processing relationships.
- Given a materials design problem: evaluate the available options, apply constraints to narrow possible choices, utilize objectives to select a material and/or process, and justify the final selection.

In addition to these general themes, students will be able to perform specific tasks including

- List the material families and differentiate between them based on atomic structure and bonding, properties, and processing routes.
- Interpret a stress-strain curve. Describe a tensile test and calculate mechanical properties from tensile test data.

- Interpret and construct phase diagrams for binary systems, and utilize time-temperature-transformation and continuous-cooling-transformation diagrams to predict microstructure.
- Utilize GRANTA EduPack to produce material property charts, access detailed records, and perform material and process selection.
- Discuss the environmental impact of material selection and processing choices, describe the materials life cycle, and identify possible ways to reduce the environmental impact of a product.

Prerequisite(s): None
Co-Requisite(s): None

Recommended Preparation:
MASC 110L/CHEM 105a or equivalent

Course Notes
MASC 310 will utilize both asynchronous and synchronous online learning modes. Class will meet via Zoom twice per week. In addition, short video lectures will be posted on specific topics. It is expected that students come to synchronous sessions having watched all assigned videos. Synchronous class time will be used for questions and clarification, additional content delivery, and working exercises (both independently and in small groups). The course has a research and project focus, with both midterm and final reports.

Communication
Students can attend scheduled Zoom office hours or contact me any time via email (grunenfe@usc.edu). Email will be responded to within 24 hours.

Students are encouraged to ask questions on designated Blackboard discussion boards. Peers will be able to respond to discussion board posts, but I will also monitor and respond.

Technological Proficiency and Hardware/Software Required
All course content will be delivered via Blackboard and Zoom. For technical issues with Blackboard email blackboard@usc.edu and for Zoom issues contact the ITS Customer Support Center at consult@usc.edu

MASC 310 will utilize a software package, GRANTA EduPack, for background reading, homework assignments, and projects. The software is available to students free of charge through the Viterbi Virtual Desktop Infrastructure (VDI). Installation and access information can be found on Blackboard. For issues with the VDI contact Viterbi IT at engrhelp@usc.edu

USC technology rental program
Attending classes online and completing coursework remotely requires access to technology that not all students possess. If you need resources to successfully participate in your classes, such as a laptop or internet hotspot, you may be eligible for the university's equipment rental program. To apply, please submit an application. The Student Basic Needs team will contact all applicants in early August and distribute equipment to eligible applicants prior to the start of the fall semester.

USC Technology Support Links
Zoom information for students
Blackboard help for students
Software available to USC Campus

Required Materials

Course notes will be posted weekly to Blackboard. The GRANTA EduPack software will serve as an interactive textbook. For additional background reading, a useful materials text is available online in PDF format: https://www.academia.edu/29966966/Materials_Engineering_Science_Processing_and_Design.pdf

Description and Assessment of Assignments

Short instructional videos will be posted to Blackboard. Students are expected to watch these videos prior to class. Each video contains embedded quiz questions. Quizzes can be taken an unlimited number of times, but must be submitted prior to the class period in which video content will be discussed. Videos can be viewed after the quiz due date.

Synchronous sessions will incorporate class discussions, problem solving, and group work. Active participation is expected and will take the form of zoom poll responses, breakout room discussions, chat box comments, and full class discussions.

Homework will be assigned weekly and is due before the start of class the following week (Tuesday at 2 PM). The "test" tool in Blackboard will be used for homework. Homework assignments will consist of a combination of multiple choice, matching, numerical entry (calculations), and short answer questions. Two attempts will be permitted for each homework assignment.

Semester project: A material and process selection project will incorporate many of the key topics discussed throughout the semester. The project is divided into multiple deliverables. Detailed instructions for each project deliverable will be posted on Blackboard. Deliverables include:

- Topic selection
- Annotated bibliography of resources
- Introduction
- Plot formatting
- Translation
- Final written report
- One-slide summary (for presentation and discussion)

Examples will be provided for specific project deliverables. The course final exam period will be used for presentations and peer discussion of project outcomes.

Midterm report: In lieu of a midterm exam, students will select a simple object to disassemble and/or investigate. The material used to fabricate each component in the object will be identified and design-limiting properties will be discussed. The midterm report will consist of two submissions:

- Topic proposal (to be approved)
- Report

The midterm report can take the form of a traditional written document, a detailed infographic, or a video. Examples will be provided for each format.

In-Class Activities

Synchronous Zoom sessions will involve individual and group work. Students are expected to participate in breakout room and full class discussions. Participation will take several forms including responses to Zoom polls, comments in the chat box, and speaking over microphone. If a student is unable to attend a synchronous Zoom session, they can receive credit for in-class activities by watching the posted recording and completing the weekly course worksheet, saving as a pdf, and submitting to me via email.

Grading Breakdown

Assignment	% of Grade
Video quizzes	5
In-class activities (or worksheet submission)	10
Homework	25
Midterm report	20
Redesign project	40
Total	100

Grading Scale

Course final grades will be determined using the following scale.

Numerical Score	Letter Grade
90-100	A
87-90	A-
84-87	B+
82-84	B
80-82	B-
78-80	C+
74-78	C
70-74	C-
65-70	D+
60-65	D
55-60	D-
0-55	F

Assignment Submission

All course assignments will be distributed and submitted via Blackboard. Assignment feedback will also be accessible via Blackboard.

Grading Timeline

Assignments will be graded within a week of submission. Students can access feedback on homework and project submissions via Blackboard.

Late work

Deadlines for the midterm and final project reports are firm. Throughout the semester, however, students will be granted up to 3 one-week extensions on any homework, video quiz, or intermediate project deliverable (not final reports), no questions asked.

Academic integrity

Students are welcome to discuss homework or project deliverables with peers. All submitted work, however, must be the student's own.

Attendance

Attendance at synchronous Zoom sessions is encouraged, but not required. When it is necessary for a student to miss a synchronous session credit for in-class activities can be earned by watching the posted recording and completing and submitting the weekly course worksheet.

Netiquette

"Netiquette" or "internet etiquette," describes recommended behaviors for online communication.

- Students can log in to synchronous sessions using a computer, tablet, or phone
- Students should update their display name in Zoom to reflect how they would like to be addressed by the instructor and peers
- Students should mute themselves when not speaking
- Students are encouraged, though not required, to turn on their webcams while in breakout rooms and while participating in discussions. If a camera is not available, or cannot be turned on, students should upload a profile photo to their Zoom account.
- Students are encouraged to unmute to ask questions at any time during synchronous sessions, and/or use the raise hand and chat features in Zoom.
- Students can eat, drink, and leave for bathroom breaks at any time during synchronous sessions
- Chat acronyms, emoticons, etc. are permitted in chat and on discussion boards

Please contact me with any questions about class policies or any issues with conduct in Zoom sessions or other online interactions.

Synchronous session recording notice

Synchronous sessions will be recorded and made available to students via Blackboard. Transcripts of the chat will also be archived and made available to students. Breakout room discussions will not be recorded.

Sharing of course materials outside of the learning environment

Per university policy, recordings of synchronous sessions as well as all asynchronous course materials (notes, assignments, etc.) cannot be shared outside of the MASC 310 learning environment.

SCampus Section 11.12(B)

Distribution or use of notes or recordings based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study is a violation of the USC Student Conduct Code. This includes, but is not limited to, providing materials for distribution by services publishing class notes. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the Internet or via any other media. (SeeSection C.1 Class Notes Policy).

Course evaluation

Course evaluation occurs at the end of the semester university-wide. The learning experience evaluation is a critical tool for instructors and the university to improve teaching. Students are asked to provide honest and constructive feedback and focus on specific aspects of instruction as opposed to personal characteristics of the instructor. In addition to the end of course evaluations, students will be provided with weekly opportunities for feedback and course reflection as part of each homework assignment.

Course Schedule: A Weekly Breakdown

	Topics	Assigned	Due	Reading
Week 1	Intro to materials and properties	HW 1 Project: Deliverable 1 – topic selection		Ch 1
Week 2	Material and process selection for design	HW 2	HW 1 Project: Deliverable 1	Ch 2, Ch 3
Week 3	Atomic bonding and packing	HW 3 Project: Deliverable 2 – annotated bibliography	HW 2	Ch 4
Week 4 *No class 9/10*	Stress and strain	HW 4 Project: Deliverable 3 – Introduction	HW 3 Project: Deliverable 2	Ch 4
Week 5	Atomic level properties (density and modulus)	HW 5 Midterm project	HW 4 Project: Deliverable 3	Ch 4
Week 6	Properties for selection: performance indices	HW 6	HW 5 Midterm project: Topic proposal	Ch 5
Week 7	Plastic deformation	HW 7	HW 6	Ch 6, Ch 7
Week 8	Manipulating strength	HW 8 Project: Deliverable 4 – plot formatting	HW 7 Midterm project: Report	Ch 6
Week 9	Fracture and fatigue	HW 9 Project: Deliverable 5 -Translation	HW 8 Project: Deliverable 4	Ch 8, Ch 9
Week 10	Process selection	HW 10 Project: Final report and one-slide	HW 9	Ch 18
Week 11	Phase diagrams and phase transformations	HW 11	HW 10 Project: Deliverable 5	Ch 19
Week 12	Processing for properties	HW 12	HW 11	Ch 19
Week 13	Materials and the environment		HW 12 Project: Final report and one-slide	Ch 20
FINAL Tu 11/17 2:00-4:00	Final report one-slide presentations and class discussion			

Diversity Statement

I am committed to creating an inclusive environment in which all students are respected and valued. I will not tolerate disrespectful language or behavior on the basis of age, ability, color/ethnicity/race, gender identity/expression, marital/parental status, military/veteran's status, national origin, political affiliation, religious/spiritual beliefs, sex, sexual orientation, socioeconomic status or other visible or non-visible differences. I expect the same from you.

You are here to learn the course content, and I am here to teach it, but we are all here to grow as people and learn from one another. It is each of our responsibility to ensure that our online classroom space, and the university as a whole, is a safe and inclusive environment that facilitates learning.

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710
campussupport.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.