MASC 310 – Materials Behavior and Processing

Fall, 2017

Lecture
T/Th 11:00-12:20 am VHE 210

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, as well as material processing methods. The course employs an integrated approach that stresses concepts that are applicable to all materials. The structure of the course primarily follows the text by Callister, which provides a bottom up introduction to materials science incorporating fundamentals, microstructure development, properties, and manufacturing. Supplemental readings and electronic resources are utilized to highlight specific concepts.

Contact information
Dr. Lessa Grunenfelder
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Phone: 213-740-2072
Office hours: Tuesday 1:00-1:50 or by appointment
Office hours with TA every week (check Blackboard)

Course Objectives

Following completion of this course, students should be able to

- Explain the importance of materials science in everyday life, and in the context of engineering
- Work effectively in a multi-disciplinary team of peers
- 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

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

- Describe the organizational scheme of the periodic table, the electron structure of atoms, and the mechanisms of atomic bonding
- Define and differentiate between the various material families on the basis of atomic structure and bonding, properties, and processing routes
- Identify crystallographic planes and directions in cubic systems, and perform calculations based on crystal structure

- Classify defects in crystalline materials on the basis of their geometry, and describe the influence of various defects on material properties and performance
- Interpret and construct phase diagrams for binary systems, and utilize time-temperature-transformation and continuous-cooling-transformation diagrams to predict microstructure

Content

A Blackboard website for the course (http://blackboard.usc.edu) provides assignments and supplemental readings.

Text:

Fundamentals of Materials Science and Engineering: An Integrated Approach, 5th edition, William D. Callister, 2015 ISBN: 9781119175483
The course will utilize Wiley PLUS, which comes with an online-only electronic version of the textbook. Please visit Blackboard and click on the WileyPLUS Homepage icon in the content folder to be taken through the registration process. Options are available to purchase an ebook or hard copy of the text in addition to the required online access.

WileyPLUS Assignments: The online WileyPLUS system will be utilized for homework assignments and readings. WileyPLUS is integrated through Blackboard, and assignments and textbook readings will be accessible through the Blackboard interface. Homework assignments are due by the beginning of class on Thursday. HW's are considered late if received later than the start of class, and will be penalized 25%. HW's will not be accepted after 24 hours past the due date and time.

Video Lectures:

Video lectures covering main concepts will be posted prior to class. It is expected that students view these short videos and come to class prepared to work problems and perform in-class labs based on concepts covered in the video segments.

In-Class Labs:

Materials science is a discipline that benefits greatly from hands-on experience and practice. For this reason, several in-class labs and assignments will be completed throughout the semester to highlight concepts covered in lecture and readings. It is understood that occasionally students will need to miss class for personal reasons. The two lowest in-class lab scores, therefore, will be dropped when calculating the final course grade.

Exams: Exam scores will consist of 2 midterms and a final. Exams are closed book and closed notes. An equation sheet will be provided for each exam, and made available prior to the exam to facilitate studying.

Grading

Grading	
WileyPLUS assignments	10%
In-class labs & assignments	20%
Midterm 1	20%
Midterm 2	20%
Final exam	30%

Important Dates

Midterm 1: Tuesday, September 26th, in class
Midterm 2: Tuesday, October 31st, in class
Final exam: Tuesday, December 12th 8:00-10:00 am

Course Content

Topic	Reading
Intro to materials science and classification of materials	Ch 1
Atomic structure and bonding	Ch 2
Crystal structures of metals and ceramics	Ch 3
Structure of polymers	Ch 4
Defects	Ch 5
Diffusion	Ch 6
Mechanical properties	Ch 7
Strengthening mechanisms	Ch 8
Phase diagrams	Ch 10
Phase transformations	Ch 11
Failure Mechanisms	Ch 9
Manufacturing	Ch 14, Ch 15

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 the classroom, and the university as a whole, is a safe and inclusive environment that facilitates learning.

Statement for Students with Disabilities

Any candidate requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. to 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776. The email address is ability@usc.edu. The website for DSP has additional information regarding accommodations and requests (www.usc.edu/disability).

Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others and to avoid using another's work as one's own. All students are expected to understand and abide by these principles.

Section 11.00 of *SCampus,* the USC Student Guidebook, which outlines behaviors that violate the USC Student Conduct Code, can be found here:

https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/

A list of recommended sanctions for a range of academic integrity violations are located in Appendix A of *SCampus,* which can be found here:

https://scampus.usc.edu/files/2009/08/appendix_a.pdf

Should there be any suspicion of academic dishonesty, students are referred to the Office of Student Judicial Affairs and Community Standards (SJACS) for further review. The SJACS review process can be found here:

http://www.usc.edu/student-affairs/SJACS/pages/students/academic_integrity.html

The SJACS website provides additional resources that you will find helpful in understanding what is meant by academic integrity, such as the following:

Academic Integrity: A Guide for Graduate Students

http://www.usc.edu/student-affairs/SJACS/forms/GradIntegrity.pdf

Academic Integrity Overview

http://www.usc.edu/student-affairs/SJACS/forms/AcademicIntegrityOverview.pdf

Incompletes

An incomplete (IN) is given when work is not completed because of documented illness or some other emergency occurring after 80% of the course has been completed. Arrangements for the IN and its removal should be initiated by the student and agreed to by the instructor prior to the final exam. The University policy on IN is as follows (from the USC Catalogue):

Conditions for Removing a Grade of Incomplete: If an IN is assigned as the student's grade, the instructor will fill out the IN Completion form which will specify to the student and to the department the work remaining to be done, the procedures for its completion, the grade in the course to date, and the weight to be assigned to work remaining to be done when computing the final grade. A student may remove the IN by completing only the work not finished as a result of illness or emergency. Previously graded work may not be repeated for credit. It is not possible to remove an IN by re-registering for the course, even within the designated time.

Time Limit for Removal of an Incomplete: One calendar year is allowed to remove an IN. Individual academic units may have more stringent policies regarding these time limits. If the IN is not removed within the designated time limit, the course is considered "lapsed" and the grade is changed to an IX and it will be calculated into the grade point average as 0 points. Courses offered on a Credit/No Credit basis or taken on a Pass/No Pass basis for which a mark of IN is assigned will be lapsed with a mark of NC or NP and will not be calculated into the grade point average.

Standards of Appropriate Online Behavior

This course involves both in-person and online segments. The protocols defined by the USC Student Conduct Code will be upheld in online classes. Students are not allowed to post inappropriate material, spam to the class, use offensive language, or engage in online flaming. For more information, please visit http://www.usc.edu/student-affairs/SJACS

Emergencies and Course Continuity

In case of emergency, and if travel to campus is difficult, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of 2SC, teleconferencing, and other technologies. Although this course uses the 2SC LMS for online support, an emergency site for the course is also available through 2SC (2SC.usc.edu). For

additional information about maintaining classes in an emergency, please access: http://cst.usc.edu/emergency-preparedness/

In the Event of Technical Breakdowns: Students may submit assignments to the instructor via email by the posted due date. Remember to frequently back up your work, post assignments once completed, load files onto a power drive, and keep a hard copy of papers/projects.

Academic Accommodations

The University of Southern California is committed to full compliance with the Rehabilitation Act (Section 504) and the Americans with Disabilities Act (ADA). As part of the implementation of this law, the University will continue to provide reasonable accommodation for academically qualified candidates with disabilities so that they can participate fully in the University's educational programs and activities. Although USC is not required by law to change the "fundamental nature or essential curricular components of its programs in order to accommodate the needs of disabled candidates," the University will provide reasonable academic accommodation. It is the specific responsibility of the University administration and all faculty serving in a teaching capacity to ensure the University's compliance with this policy.