

Structure/Properties of Solids MatE 115

Guna Selvaduray
Fall 2006

Course & Instructor Information

- Structure/Properties of Solids
- 4 semester units
- Tuesdays/
Thursdays
3:00 ~ 4:50 p.m.
- Room: Engr 303
- Guna Selvaduray
- Office: E 179
- Phone: (408) 924-3874
- Email:
gunas@email.sjsu.edu
- Office Hours:
Mon/Tues/Wed
5:30 ~ 6:30 p.m., or,
by arrangement
- Homepage:
[www.sjsu.edu/faculty/
selvaduray](http://www.sjsu.edu/faculty/selvaduray)

Objectives

- To fully understand how the physical and chemical properties of solids are determined by their structure.
- To understand how the properties of solids can be "engineered" by varying structure and processing conditions.
- To learn how to apply the basics of materials science and engineering to understanding and engineering the properties of structural solids, both elemental and compound.
- To learn the essential physical and chemical concepts which explain the properties of solids.
- To learn selection of appropriate materials for specific applications.
- To become capable of specifying processing conditions for materials.

LEARNING OBJECTIVES

- Listed separately
- Attainment of Learning Objectives will be assessed via homeworks, in-class quizzes, mid-term and final examinations, and term project.

Course Description

- Properties of structural solids are heavily dependent on the structure and processing conditions, resulting in the possibility of “engineering” the properties of these solids.
- Primary focus of this course will be the manner in which the structure of solids affects the properties and behavior of structural materials. The manner in which processing (fabrication) can affect the properties and behavior will also be covered.
- Fundamental aspects of materials science and engineering, such as bonding theory, crystal structure, defect structures, solid state diffusion, solution thermodynamics and the basics of mechanical behavior of solids will be emphasized.
- Coverage will include elemental and compound (ionic) solids.

Tentative Lecture Topics

- Atomic structure
- Potential well theory; interatomic bonding; intermolecular bonding
- Crystal structures & crystallography; lattices
- Crystallography of compound structures
- Defects in solids
- Point defects; intrinsic & extrinsic defects
- Dislocations
- Surfaces, interfaces & grain boundaries
- Phases; solid solutions; The Gibbs Phase Rule
- Binary phase diagrams
- Fe-C system; hardening of steels
- Non-ferrous alloy systems; precipitation hardening
- Diffusion
- Reaction rate theory
- Solidification & nucleation
- Phase transformations
- Plastic deformation

Prerequisites

- Undergraduates: MatE 025, or its equivalent at another institution, with a grade of C or better.
- Graduate students: Have a B.S. in Chemistry, Physics or Engineering and should have been admitted to the department's graduate program.

Required Text

- Donald R. Askeland and Pradeep P. Phulé, The Science and Engineering of Materials, Fifth Edition, Thompson. (2006)
- Supplemental reading and instructional materials will be handed out in class periodically.

Useful reference books

- W. F. Smith, Principles of Materials Science and Engineering, McGraw-Hill. (1990)
- W. D. Callister, Jr., Materials Science & Engineering - An Introduction, John Wiley & Sons. (2000)
- Ashby and Jones, Engineering Materials, Volumes 1 and 2, Pergamon Press. (1980)
- Flinn & Trojan, Engineering Materials and Their Applications, Houghton Mifflin. (1993)
- Kingery, Introduction to Ceramics, Wiley Interscience. (1976)
- M. A. Myers & K. K. Chawla, Mechanical Metallurgy Principles and Applications, Prentice Hall. (1984)
- N. E. Dowling, Mechanical Behavior of Materials, Prentice Hall. (1993)
- Porter & Easterling, Phase Transformations in Metals & Alloys, Van Nostrand Reinhold (1981)
- C. Barrett, W. Nix and A. Tetelman, The Principles of Engineering Materials, Prentice-Hall.

Assignments & Examinations

- Assignments will be due in one week
- First Midterm Examination: Sept 28, 2006
- Second Midterm Examination: Nov 09, 2006
- Final Examination: Dec 14, 2006
12:15 ~ 14:30

Term Paper

- The topic should focus on a practical issue where structure and processing of solids affects the performance.
- Conduct computerized literature search, using the electronic data bases that are accessible via SJSU's Martin Luther King, Jr. Library, an equivalent computerized technical literature search system.
- Length: Approximately 10 to 12 pages; absolute maximum of 15 pages, including references, figures and tables, but excluding the Title Page.
- Formatting:
http://www.engr.sjsu.edu/cme/Student_Resources/Advising/CMETHesisGuidelines.doc
- Students are expected to use references to obtain the necessary information for their term paper. They are expected to synthesize this information so that they can write a cohesive term paper. "Word for word" transfer of material from references to the term paper could easily fall within the category of plagiarism. Please exercise caution. Students are strongly encouraged to read and understand SJSU's Academic Integrity Policy which is available on the university's website.
- Term papers must be original work. Reports written for other classes, including reports written by other individuals, cannot be resubmitted, with or without revisions.
- Two hard (paper) copies and one electronic copy, in **MS Word format**, of the paper must be submitted by the due date which is Tuesday, November 28, 2006.
- Submit term paper to turnitin.com before submission in class.

Term Paper Deadlines

- Sept 12: One-page description of the term paper and proposed table of
- Sept 19: Finalize decisions on term paper topic
- Oct 3: Submit completed literature search, including complete citations and abstracts only, printed on an off-line laser printer or ink jet printer.
- Nov 28: Submission of completed term paper

Term Paper Contents

- **Introduction.** This section will contain an explanation of what the topic/product is and its societal significance, including commercial value if appropriate.
- **Principle/Mechanism.** The materials science/engineering principle upon which the topic or product is based upon must be described in detail here.
- **Application.** The manner in which the principle/mechanism that was described in Section (b) above is used to construct the particular product, or is used in the particular application must be described here.
- **Summary/Conclusion.** A brief summary or conclusion, of approximately 100 words.
- **References.** A minimum of five peer reviewed references is required. The most important information in the term paper must be based on the information contained in these papers.
- Students are expected to have hard copies of the materials used as references, and be able to submit them with the term paper, if required.

Term Paper Evaluation

- Introduction to topic 10
- Explanation of Mechanism/
Principle involved 40
- Applications 20
- Typewritten, formatting, tables,
figures 10
- English 5
- References 5
- Overall impression (subjective) 10

Grading

- First Mid-term 20%
- Second Mid-term 20%
- Final Examination 35%
- Homeworks 10%
- Term Paper 15%

Grading - 2

- Letter Grades:
 - A: approx. 90% ~ 100%
 - B: approx. 80% ~ 90%
 - C: approx. 70% ~ 80%
 - D: approx. 60% ~ 70%
 - F: < 60%

Materials Engineering Student Honor Code:

- Take an examination in place of someone else, or have someone else take an examination in his/her place.
- Give information or receive information from another person during an examination.
- Use more reference material during an examination than is allowed by the instructor.
- Obtain a copy of an examination prior to the time it is given.
- Alter an examination after it has been graded and return it to the instructor for re-grading.
- Receive or offer any aid to other students in the class, other than what has been authorized by the instructor.
- Violation of any one of the above honor code items can result in a grade of F for the entire course.

Instructor Commitments

- Return all homeworks and examinations within 10 days of submission.
- Have available solutions for all homeworks and examinations.
- Make available to the students a record of the work submitted and the grades assigned to each submission.

Notes - 1

- No late assignments will be accepted
 - Late assignments may be graded if the student wishes to have it graded, but no credit will be given
- Absence during examinations and quizzes, without prior approval, will result in a zero
- Prior approval will be given only under exceptional circumstances
- Seating arrangements may be handed out for mid-term and final examinations
- There will be no make-up examinations
- Be prompt in getting to class and in returning from breaks.

Notes - 2

- Please be punctual for class
- Please **turn off** your cell phones and pagers when you enter the classroom
- Remain OPEN MINDED; ASK questions

Homework and Examination Solutions

- Solutions to all homework assignments and examinations will be posted electronically through the course instructor's website - www.sjsu.edu/faculty/selvaduray
- No photocopies of solutions will be provided, nor will they be posted on bulletin boards.

Academic Integrity - 1

"Your own commitment to learning, as evidenced by your enrollment at San Jose State University, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Student Conduct and Ethical Development. The policy on academic integrity can be found at http://sa.sjsu.edu/student_conduct

Academic Integrity - 2

- No authorized assistance may be given or received
- Papers submitted for other classes or assignments may not be submitted to meet the requirements of this class
- **Plagiarism**

Compliance with ADA

If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during my office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with DRC to establish a record of their disability.

Emergency Procedures

- Evacuation Route
- Earthquakes

Self Introductions

- Name
- Major
- Graduate student/Undergraduate?
- Work experience?
 - Where?
 - How long?
- Interest in this class?