

# ME 306: Materials Science

Spring 2011

## Instructor and Class Information

**Instructor:** Dr. Peter A. Zink, Research Assistant Professor of Mechanical Engineering

**Office:** 730 Commonwealth, ENA209

**Email:** pzink@bu.edu

**Phone:** 617.353.1631

**Office Hours:** Tuesday 2-3 PM; email to set up other times

**Class Hours:** Tuesdays and Thursdays 12-2 PM

**Classroom:** Psychology(PSY) B53

**Lab Coordinator** Kara Mogensen (karam@bu.edu, 617.358.1565)

**Lab Hours:** Monday 10-12 and 2-4, Tuesday 10-12 and 2-4, Wednesday 10-12 and 2-4, Thursday 10-12, Friday 10-12

**Midterm Date:** Tentatively the week of March 7 (prob Chaps 1-7).

**Final Date:** Tentatively Friday, May 13 from 9-11 AM.

**Lab Location:** 730 Commonwealth, Room 307

**Course Website:** <http://blackboard.bu.edu>

## GTF Information

(1) Mr. Jason Keller

Office: 36 Cummington, Room 302

Email: jpkeller@bu.edu

Cell phone: (408) 431-3138

Labs: Monday 2-4, Tuesday 2-4, Wednesday 2-4, Friday 10-12

Office hours: Thursday 3-4 or by appointment (arrange via email)

(2) Mr. Jiapeng Xu

Office: 750 Commonwealth, Room B-08

Email: xu@bu.edu

Office phone: (617) 353-3641

Labs: Monday 10-12, Tuesday 10-12, Wednesday 10-12, Thursday 10-12

Office hours: Friday 12-2 or by appointment (arrange via email)

Jason and Jiapeng will be responsible for running and grading the laboratory sessions.

(3) Mr. Andre Botelho

Office: EMB 122

Email: abotelho@bu.edu

Office phone: (617) 353-8469

Office hours: Wednesday 1-3

Andre will be responsible for the Friday discussion sections and for grading the homeworks.

## Course Outcomes

As an outcome of completing this course, students will:

1. Gain an understanding of the fundamental principles of materials science.
2. Gain exposure to different classes of engineering materials.
3. Gain laboratory experience in the area of processing/structure/property correlations in materials.
4. Gain experience in working in a team environment.
5. Gain experience in communicating key engineering results in the form of class presentations and project reports.
6. Gain a clear understanding of laboratory safety issues.

## Textbook

*Materials Science and Engineering: An Introduction* by William D. Callister, Jr., eighth edition, John Wiley and Sons (2008)

## Reference Book

*Essentials of Materials Science and Engineering* by Donald R. Askelund and Pradeep P. Fulay, second edition, Cengage Learning (2009)

## Class Policies

- Homework not turned in by the end of class (i.e. 2 PM) on the due date, either to myself in class, in the dropbox outside my office, or in my mailbox at 15 St. Mary's Street will be considered to be late. Late homework will receive a maximum of 80% of the available score. Homeworks that are more than one class late will not be accepted. For example, assume that the homework is due Thursday at 2 PM. If it is not turned in by that time, it is late. If the homework is not received by 2 PM the following Tuesday, then it will receive a 0.
- Laboratory reports are due at the beginning of the next scheduled laboratory session. As with homeworks, late laboratory reports will receive a maximum of 80% of the available score, and laboratory reports that are more than one class late will not be accepted.
- It is your responsibility to check with the GTF (who will be in charge of the grade sheet on blackboard) to make sure that all homeworks and labs have been recorded correctly, and that you are not missing any points on the grade sheet. I will accept complaints about homework scores, test scores and lab scores up to 2 weeks after the assignment is returned. Beyond that, there will be no change in grades.
- One midterm and one final exam will be given.
- Making up of missed examinations will be permitted only when the exam is missed for a valid reason. Valid reasons include serious illness or observance of a religious holiday. Except in cases of extreme emergency, this must be approved by the professor BEFORE the regularly scheduled exam.

- All complaints related to grading of homework assignments, quizzes, and examinations must be reported to the instructor immediately after the grades are announced.
- **Cheating and collaboration:** Homework assignments should be done individually; it is OK to consult other students, but the work you turn in should reflect your own work. Lab projects will be collaborative, in that they will be group projects - each group should work together to complete the labs and the lab project. Consulting other groups is acceptable; however, the work that is turned in should be unique and reflective of the groups work.
- A group project (4-6 people in each group) will be assigned. A pre-proposal, outlining the design of your experimental work and the objective of your project, needs to be submitted to Kara Mogensen before you can begin project related experiments. An intermediate project report (Introduction, including a detailed literature review, and experimental design) is due prior to the final report submission as detailed in the laboratory schedule. The group project will require a final oral presentation and submission of a typed final report.

## Laboratory Schedule

- Lab safety/metallography demo, start Lab 1 (Week of January 24-28)
- Lab 1 - Microstructural characterization (Week of January 31 - February 4)
- Lab 1 due, Lab 2 Microstructural analysis by X-Ray and SEM (Week of February 7-11)
- Lab 2 due, Lab 3 Diffusion (Week of February 14-18)
- No Labs (Monday Holiday) Lab 3 Due (Week of February 21-25)
- No Labs and Project Pre-proposals due (Week of February 28 - March 4)
- Discuss pre-proposals with students in lab times (Week of March 7-11)
- Spring Break (March 14-18)
- Project Proposals Due, Lab 4 (Week of March 21-15)
- Lab 4 due, Project work (March 8 - April 1)
- Project work (April 4 - April 8)
- (Monday Holiday) Project work (April 11 - April 15)
- Project work (April 25 - April 29)
- Project presentations in class, reports due last day of class (May 2-6)

## Project Information

- Each project group needs to submit a project pre-proposal to Kara Mogensen (due about the 6th week of class). It should be 1 page or less, and contain the following information: (1) Project title, (2) Group members, (3) Major objective of the project, (4) A very brief description of the proposed experiments, preferably in a list format that includes details such as materials, temperatures, times, mechanical and microstructural characterizations planned, and number of samples
- The project proposal will be due about 2-3 weeks after the pre-proposal. It should be about 3 pages in length, and should be written only after Kara has approved the details in the pre-proposal. The proposal should include: (1) Title, (2) Group members, (3) Introduction that includes (a) Objectives, (b) Literature review, and (4) Experimental design in descriptive detail

## Approximate List of Topics to be Covered

- Chapter 1: Introduction to Materials.
- Chapter 2: Atomic Structure and Interatomic Bonding.
- Chapter 3: The Structure of Crystalline Solids
- Chapter 4: Imperfections in Solids
- Chapter 5: Diffusion
- Chapter 6: Mechanical Properties of Metals
- Chapter 7: Dislocations and Strengthening Mechanisms
- Chapter 8: Failure
- Chapter 9: Phase Diagrams
- Chapter 10: Phase Transformations in Metals
- Chapter 12: Structure and Properties of Ceramics
- Chapter 14: Polymer Structures
- Chapter 15: Characteristics, Applications, and Processing of Polymers
- Chapter 16: Composites

## Grading

- Homeworks: 5%
- Labs: 20%
- Midterm: 30%
- Final: 30%
- Lab project: 15%