UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Materials Science & Engineering

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Mat Sci 103
Phase Transformations & Kinetics

Spring, 2016

LOGISTICS

Course Website bCourses (MAT SCI 103 –LEC 001)

Lecture MWF 11:00-12:00 HMMB 348

Discussion W 5:00-6:00 HMMB 348

GSI Yanwei Lum, ywlum@berkeley.edu

Office Hours Professor Asta: Mon & Wed, 1:00-3:00 pm, HMMB 216

Yanwei Lum (GSI): Th & Fri, 12:30 – 1:30 pm, HMMB 350

Textbook David A. Porter, Kenneth E. Easterling and Mohamed Y. Sherif, *Phase Transformations in Metals and Alloys*, 3rd Edition, CRC Press (2009).

The information in the textbook will be supplemented by material taken from several other textbooks and related resources. All such material will be uploaded to the course website.

Lectures Lectures will make use of boardwork, with some powerpoint figures used to augment the content. Although the powerpoint figures will be posted on the course website, the material presented on the board will not be. You are encouraged to attend the lectures, as they will augment what is presented in the textbook.

GRADING

"As a member of the UC Berkeley community, I act with honesty, integrity and respect for others" (http://www.asuc.org/honorcode/index.php)

Ethics

Please remember that this is your honor code. It is a simple pledge that will serve you well during your academic career, and provide a solid foundation for success in your career as a practicing professional, when you will be held to even higher standards.

Course Grade

There are no individual thresholds assigned to the different components of your grade. All components are scored, weighted, pooled, then mapped onto a curve for a course grade determination at the end of the semester, based on the following guidelines.

Homework 25%

Due dates: Homework assignments are to be submitted electronically on the course website by 5 pm on Fridays. Deadlines are firm, to allow for timely uploading of solutions as additional study guides. When computing the final homework grade, the lowest two scores on the assignments will be dropped. No late assignments will be accepted.

Regrade policy: Homeworks will be graded by the course reader. If you have a question about the grading of an assignment, you must submit a hardcopy of the homework, with a cover sheet explaining your rationale for requesting more points. This must be submitted to the GSI within one week after the homework has been returned. **After one week regrades will not be considered.**

Your homework submissions must be your own work. The objective of these assignments is to guide your self-learning. Homework is not meant to be a "group learning" exercise, and not an artistic alteration of answers from others to avoid a plagiarism charge. Homework sets containing similar solutions may be considered academic dishonesty, in which case zero points will be awarded for the assignment and a report to the Center for Student Conduct will be considered.

Midterms 40%

Two midterms will be given on the dates listed in the table below. The midterms will be held in class. The exams will be closed-book and you will be provided formula sheets with relevant equations. Midterms are not cumulative. The first exam will test material from the first five weeks, and the second midterm will cover material from the next five weeks.

Regrade policy: If you have a question about the grading of an exam, you must submit it, with a cover sheet explaining your rationale for requesting more points, to the GSI within one week after the exam has been returned. **After one week regrades will not be considered.**

Final Exam 35%

A cumulative three hour final exam will be held on Tuesday, May 10 from 7-10 pm.

COURSE CONTENT AND SCHEDULE

Date	Section	Topics	HW/Exams
Wed, 1/20	11am-12pm	*Lecture 1*: Introduction, Review of Thermodynamics	
Wed, 1/20	5-6pm	*Lecture 2*: Phase Equilibria and Gibbs Phase Rule	
Fri, 1/22	11am-12pm	*Lecture 3*: One-Component Phase Diagrams	
Mon, 1/25	11am-12pm	*Lecture 4*: Free Energies of Binary Solutions	
Wed, 1/27	5-6pm	*Lecture 5:* Binary phase diagrams (I)	
Wed, 1/27	11am-12pm	*Lecture 6:* Binary phase diagrams (II)	
Fri, 1/29	11am-12pm	Discussion	**HW01**
Mon, 2/1	11am-12pm	*Lecture 7*: Binary phase diagrams (III)	
Wed, 2/3	11am-12pm	*Lecture 8*: Ternary phase diagrams (I)	
Wed, 2/3	5-6pm	Discussion	
Fri, 2/5	11am-12pm	*Lecture 9*: Ternary phase diagrams (II)	**HW02**
Mon, 2/8	11am-12pm	*Lecture 10*: Ternary phase diagrams (III)	
Wed, 2/10	11am-12pm	*Lecture 11*: Fick's laws of diffusion (I)	
Wed, 2/10	5-6pm	Discussion	
Fri, 2/12	11am-12pm	*Lecture 12*: Fick's laws of diffusion (II)	**HW03**
Mon, 2/15		Campus Holiday	
Wed, 2/17	11am-12pm	*Lecture 13*: Diffusion equation solutions (I)	
Wed, 2/17	5-6pm	*Lecture 14*: Diffusion equation solutions (II)	
Fri, 2/19	11am-12pm	Discussion	**HW04**
Mon, 2/22	11am-12pm	*Lecture 15*: Diffusion equation solutions (III)	
Wed, 2/24	11am-12pm	*Lecture 16*: Atomic Theory of Diffusion	
Wed, 2/24	5-6pm	Discussion	
Fri, 2/26	11am-12pm	Midterm 1	**EXAM**

Mon, 2/29	11am-12pm	*Lecture 17:* Diffusion mechanisms in crystals (I)	
Wed, 3/2	11am-12pm	Discussion	
Wed, 3/2	5-6pm	*Lecture 18*: Diffusion mechanisms in crystals (II)	
Fri, 3/4	11am-12pm	Lecture 19: Surface and interface energies	**HW05**
Mon, 3/7	11am-12pm	Lecture 20: Grain boundary energies	
Wed, 3/9	11am-12pm	*Lecture 21*: Wulff construction	
Wed, 3/9	5-6pm	Discussion	
Fri, 3/11	11am-12pm	*Lecture 22*: Classical nucleation theory	**HW06**
Mon, 3/14	11am-12pm	*Lecture 23*: *The critical nucleus*	
Wed, 3/16	11am-12pm	*Lecture 24*: *Nucleation rate*	
Wed, 3/16	5-6pm	Discussion	
Fri, 3/18	11am-12pm	*Lecture 25*: Heterogeneous nucleation (I)	**HW07**
Mon, 3/21		**Spring Break**	
Wed, 3/23		**Spring Break**	
Wed, 3/23		**Spring Break**	
Fri, 3/25		**Spring Break**	
Mon, 3/28		**No Lecture (MRS)**	
Wed, 3/30	11am-12pm	*Lecture 26*: Heterogeneous nucleation (II)	
Wed, 3/30	5-6pm	Discussion	
Fri, 4/1	11am-12pm	*Lecture 27*: TTT diagrams and JMA kinetics	**HW08**
Mon, 4/4	11am-12pm	*Lecture 28*: Stability of solutions	
Wed, 4/6	11am-12pm	*Lecture 29*: Spinodal decomposition	
Wed, 4/6	5-6pm	Discussion	
Fri, 4/8	11am-12pm	Midterm 2	**EXAM**
4/11	11am-12pm	*Lecture 30*: Gibbs-Thomson Effect	
4/13	11am-12pm	*Lecture 31*: Particle coarsening (I)	
4/13	5-6pm	Discussion	

4/15	11am-12pm	*Lecture 32*: Particle coarsening (II)	**HW09**
4/18	11am-12pm	*Lecture 33*: Grain growth	
4/20	11am-12pm	*Lecture 34*: Order-disorder transformations (I)	
4/20	5-6pm	Discussion	
4/22	11am-12pm	*Lecture 35*: Order-disorder transformations (II)	**HW10**
4/25	11am-12pm	*Lecture 36*: Martensitic transformations	
4/27	11am-12pm	*Lecture 37*: Martensitic transformations	
4/27	5-6pm	Discussion	
4/29	11am-12pm	*Lecture 38*: Martensitic transformations	**HW11**
5/2		RRR: Reviews TBA	
5/4		RRR: Reviews TBA	
5/6		RRR: Reviews TBA	
5/10		Final Exam Tuesday May 10, 7-10pm	**EXAM**