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

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MAT SCI 103
Phase Transformations & Kinetics

Spring, 2018

LOGISTICS

Course Website
bCourses (MAT SCI 103 –LEC 001)

Lecture
MWF 11am-12pm HMMB 348
Makeup lectures on Wednesdays, 5-6pm HMMB 348

Discussion
W 6-7pm HMMB 348

GSI
Danny Broberg, dbroberg@berkeley.edu

Office Hours
Professor Asta: M&W 1-2:30pm, HMMB 319

Danny Broberg (GSI): Th & Fri, 10-11 am, HMMB 475

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 11:59 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 should not be an altered version of work from others. 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 six weeks, and the second midterm will cover material from the next six 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 8 from 7-10 pm.

COURSE CONTENT AND SCHEDULE

Date	Section	Topics	HW/Exams
Wed, 1/17	11am-12pm	*No Class*	
Wed, 1/17	6-7pm	*No Class*	
Fri, 1/19	11am-12pm	*Lecture 1*: Course Syllabus and Introduction Introduction to Thermodynamics	
Mon, 1/22	11am-12pm	*Lecture 2*: Single Component Free Energy Curves Pressure-Temperature Phase Diagrams	
Wed, 1/24	11am-12pm	*Lecture 3:* Clausius-Clapeyron Equation Gibbs Phase Rule	
Wed, 1/24	5-6pm	*Lecture 4 (makeup):* Phase Transformation Driving Forces Binary Mixtures	
Wed, 1/24	6-7pm	*Discussion*	
Fri, 1/26	11am-12pm	*Lecture 5*: Gibbs Free Energies for Binary Mixtures Method of Intercepts, Common Tangent	**HW01**
Mon, 1/29	11am-12pm	*Lecture 6*: Binary phase diagrams (I) Ideal-Solution "Lens" Diagram	
Wed, 1/31	11am-12pm	*Lecture 7*: Regular Solution Model Miscibility Gaps	
Wed, 1/31	6-7pm	*Discussion*	
Fri, 2/2	11am-12pm	*Lecture 8*: Bragg Williams Model Order-Disorder Transitions	**HW02**
Mon, 2/5	11am-12pm	*Lecture 9*: Binary phase diagrams (II) Eutectic Phase Diagrams	
Wed, 2/7	11am-12pm	*Lecture 10*: Binary phase diagrams (III) Invariant Equilibria and Gibbs Phase Rule	
Wed, 2/7	5-6pm	*Lecture 11 (makeup):* Binary phase diagrams (IV) More Examples of Invariant Equilibria	
Wed, 2/7	6-7pm	*Discussion*	
Fri, 2/9	11am-12pm	*Lecture 12*: Ternary phase diagrams (I)	**HW03**
Mon, 2/12	11am-12pm	*Lecture 13:* Ternary phase diagrams (II)	

Wed, 2/14	11am-12pm	*Lecture 14*: Ternary phase diagrams (III)	
Wed, 2/14	5-6pm	*Lecture 15 (makeup):* Introduction to Diffusion Fick's First Law	
Wed, 2/14	6-7pm	*Discussion*	
Fri, 2/16	11am-12pm	*Lecture 16*: Fick's Second Law	**HW04**
Mon, 2/19	11am-12pm	Campus Holiday	
Wed, 2/21	11am-12pm	*Lecture 17*: Solutions to Diffusion Equation	
Wed, 2/21	5-6pm	*Lecture 18 (makeup):* Diffusion Mechanisms (I)	
Wed, 2/21	6-7pm	*Discussion*	
Fri, 2/23	11am-12pm	*Lecture 19*: Diffusion Mechanisms (II)	**HW05**
Mon, 2/26	11am-12pm	*Lecture 20*: Interdiffusion and Kirkendall Effect	
Wed, 2/28	11am-12pm	*Lecture 21:* Interdiffusion, Tracer Diffusion and Intrinsic Diffusion Coefficients	
Wed, 2/28	6-7pm	*Midterm Review*	
Fri, 3/2	11am-12pm	*Midterm 1*	**EXAM**
Mon, 3/5	11am-12pm	*Lecture 22*: Mobilities and Thermodynamic Factors	
Wed, 3/7	11am-12pm	*Lecture 23*: Interfacial Energy and Crystalline Anisotropy	
Wed, 3/7	5-6pm	*Lecture 24 (makeup):* Equilibrium Crystal Shape Wulff Construction	
Wed, 3/7	6-7pm	*Discussion*	
Fri, 3/9	11am-12pm	*Lecture 25*: Grain Boundaries Grain Boundary Energy	**HW06**
Mon, 3/12	11am-12pm	*No Class*	
Wed, 3/14	11am-12pm	*No Class*	
Wed, 3/14	6-7pm	*Discussion*	
Fri, 3/16	11am-12pm	*Lecture 26*: Solid-Solid Heterophase Interfaces	**HW07**
Mon, 3/19	11am-12pm	*Lecture 27:* Homogenous Nucleation (I) Elemental Solid/Liquid Transitions	
Wed, 3/21	11am-12pm	*Lecture 28*: Homogeneous Nucleation (II) Solid State Transformations, Strain Energy	

Wed, 3/21	6-7pm	*Discussion*	
Fri, 3/23	11am-12pm	*No Class*	**HW08**
Mon, 3/26		**Spring Break**	
Wed, 3/28		**Spring Break**	
Fri, 3/30		**Spring Break**	
Mon, 4/2	11am-12pm	*Lecture 29*: Heterogeneous Nucleation (I) Binary Systems	
Wed, 4/4	11am-12pm	*Lecture 30*: Heterogeneous Nucleation (II)	
Wed, 4/4	6-7pm	*Discussion*	
Fri, 4/6	11am-12pm	*Lecture 31:* Heterogeneous Nucleation (III)	**HW09**
Mon, 4/9	11am-12pm	*Midterm Review*	
Wed, 4/11	11am-12pm	*Midterm 2*	**EXAM**
Wed, 4/11	6-7pm	*No Class*	
Fri, 4/13	11am-12pm	*Lecture 32*: Avrami Equation	
Mon, 4/16	11am-12pm	*Lecture 33*: TTT Diagrams	
Wed, 4/18	11am-12pm	*Lecture 34:* Interface Mobility	
Wed, 4/18	6-7pm	*Discussion*	
Fri, 4/20	11am-12pm	*Lecture 35:* Diffusion Limited Growth Ostwald Ripening	**HW10**
Mon, 4/23	11am-12pm	*Lecture 36*: Spinodal Decomposition (I)	
Wed, 4/25	11am-12pm	*Lecture 37*: Spinodal Decomposition (II)	
Wed, 4/25	6-7pm	*Discussion*	
Fri, 4/27	11am-12pm	*Lecture 38*: Spinodal Decomposition (III)	**HW11**
Mon, 4/30		RRR: Reviews TBA	
Wed, 5/2		RRR: Reviews TBA	
Fri, 5/4		RRR: Reviews TBA	
Tues, 5/8	7-10pm	Final Exam Tuesday May 8, 7-10pm	**EXAM**