MS/ME 503 Kinetic Processes in Materials
Spring 2013

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Lectures: **M,W: 10AM – 12Noon**
Location: **EMB 105**
Office hrs: 2-3 PM Friday, other times by appt.

Textbook: A textbook is not required for the class. Taking good notes during class lectures is highly recommended. The following textbook has many (but not all) the topics to be covered in the course:
Kinetics of Materials, R.W. Bulluffi, S.M. Allen, W.C. Carter, John Wiley and Sons Inc., 2005

Other Suggested Readings:
Essentials of Materials Science and Engineering, D. R. Askeland, and P. Phule
Diffusion in Solids, P. G. Shewmon
Chemical Kinetics, K. J. Laidler
Phase Transformations in Metals and Alloys, D. A. Porter and K. E. Easterling
Silicon VLSI Technology; Fundamentals, Practice and Modeling, J. D. Plummer, M. D. Deal and P. B. Griffin

Grading:
There will be 2 midterms and a final. The final is NOT cumulative. The grading will be as follows:

Midterm I	– (3/4/13)	-	40%
Midterm II	– (4/1/13)	-	30%
Final exam	– (Date TBD)	-	30%

Homeworks:
3 HW sets will be handed out, one for each exam. They will not be collected or graded. Solution sets will be handed out, and will be discussed in class before each exam.

Syllabus

I KINETICS OF DIFFUSION IN SOLIDS (Exam 1)

Introduction to chemical thermodynamics	1 lecture
Phase diagrams, Driving force, flux	1 lecture
Fick's Laws and solutions to Fick's laws	3 lecture
Interdiffusion	1 lecture
Self, tracer, intrinsic and interdiffusion coefficients	1 lecture
Atomistic models of diffusion	1 lecture
Diffusion in ionic crystals	1 lecture
Multipath imperfections	1 lecture

II KINETICS OF CHEMICAL REACTIONS (Exam 2)

Chemical reaction kinetics, adsorption isotherms	1 lecture
Rate controlling steps; CVD	1 lecture

III KINETICS DRIVEN BY CAPILLARITY FORCES (Exam 2)

Capillarity forces on surfaces, grain growth	1 lecture
Surface energy anisotropy	1 lecture
Particle coarsening, sintering	1 lecture

IV KINETICS OF PHASE TRANSFORMATIONS (Final)

Nucleation and growth	2 lectures
Solidification	2 lectures
Order-disorder Reactions	1 lecture
Spinodal decomposition	1 lecture
Martensitic transformation	1 lecture