MS/ME 503 Kinetic Processes in Materials
Spring 2011

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Lectures: M,W: 10AM – 12Noon
Location: PSY B43
Office hrs: 2-3 PM Friday, other times by appt.

Required Text:
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:

Midterm I – Monday, February 28	-	30%
Midterm II – Wednesday, April 6	-	30%
Final exam – Thursday, May 12 (3-5 PM)	-	40%

Homeworks:
4 HW sets will be handed out but not graded. Solution sets will be handed out.

Syllabus

I KINETICS OF DIFFUSION IN SOLIDS

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	2 lecture
Atomistic models of diffusion	1 lecture
Diffusion in ionic crystals	1 lecture
Diffusion along imperfections	1 lecture

II KINETICS OF CHEMICAL REACTIONS

Chemical reaction kinetics, adsorption isotherms	1 lecture
Rate controlling step; CVD	1 lecture
Kinetics of oxidation reactions	1 lecture

III KINETICS DRIVEN BY CAPILLARITY FORCES

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

IV KINETICS OF PHASE TRANSFORMATIONS

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