MS/ME 503 Kinetic Processes in Materials

Fall 2008

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Lectures: T, R: 12noon – 2PM
Location: EMB 105
Office hrs: 3-4 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:

Homework (4 total, 1 in each section)	-	20%
Midterm exam – Tuesday, October 21 (Sections I and II)	-	40%
Final exam – Set by university (Sections III and IV)	-	40%

Syllabus

I KINETICS OF DIFFUSION IN SOLIDS

Introduction to chemical thermodynamics	1 lecture
Driving force, flux, and Fick's laws	1 lecture
Solutions to Fick's laws	2 lecture
Interdiffusion	1 lecture
Atomistic models of diffusion	1 lecture
Diffusion along imperfections	1 lecture
Diffusion in ionic crystals	1 lecture
Diffusion in non-crystalline solids	1 lecture

II KINETICS OF CHEMICAL REACTIONS

Chemical reaction kinetics	1 lecture
Adsorption isotherms	1 lecture
Rate controlling step; CVD and oxidation	1 lecture

III KINETICS DRIVEN BY CAPILLARITY FORCES

Capillarity forces on surfaces and interfaces	2 lectures
Grain growth	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	1 lecture
Martensitic transformation	1 lecture