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:

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