MS/ME 503 Kinetic Processes in Materials
Spring 2021

Prof. Soumendra Basu
Rm. 204, 730 Commonwealth Avenue
Office Phone: 617-353-6728
Email: basu@bu.edu (preferred mode of contact)

Lectures: **M, W: 10.10AM – 11.55AM (LfA model, in-class lectures also on Zoom*)**
Location: **EPC 205**
Office/discussion hours: 1-2 PM Friday (on Zoom*)

* All Zoom links are on Blackboard under the Zoom tab in Tools. Links to Zoom lecture recordings will be provided.

Required Textbook:
Materials Kinetics Fundamentals: Principles, Processes, and Applications, Ryan O'Hare, John Wiley and Sons Inc., 2015

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

Grading:
There will be 2 midterms and a final. The final is NOT cumulative. Dates for Exams 1 and 2 will be set during the semester. The date for the Final will be set by the university.

Grading will be as follows:

Midterm I	-	30%
Midterm II	-	30%
Final exam	-	30%
Homeworks	-	10%

Homeworks:
3 HW sets will be handed out, one for each exam. Solution sets will be handed out, and will be discussed in class before each exam.

Syllabus

I THERMODYNAMICS VERSUS KINETICS

Introduction to chemical thermodynamics	1 lecture
Phase diagrams, driving force, flux	1 lecture

II KINETICS OF MASS TRANSPORT

Fick's Laws and solutions to Fick's laws	3 lectures
Interdiffusion, types of diffusivities	1 lecture
Diffusion and chemical potential, multipath diffusion	1 lecture
Atomistic models of diffusion, tracer diffusion	1 lecture
Diffusion in ionic crystals	2 lectures

III KINETICS OF CHEMICAL REACTIONS

Order of reaction, kinetics of gas/solid reactions	1 lecture
Mixed rate control, CVD, vapor phase etching	1 lecture

IV KINETICS DRIVEN BY MICROSTRUCTURE

Surface curvature, Gibbs Thompson effect	1 lecture
Grain growth, particle coarsening, sintering	1 lecture
Surface energy anisotropy	1 lecture

V KINETICS OF PHASE TRANSFORMATIONS

Nucleation and growth	2 lectures
Solidification	1 lecture
Spinodal decomposition	1 lecture
Martensitic transformation	1 lecture