



MT 202 August 3:0

Materials Thermodynamics and Kinetics

Instructor

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Teaching Assistant

Email:

Department: Department of Materials Engineering

Course Time: MWF 11:00

Lecture venue: Classroom, Department of Materials Engineering

Detailed Course Page:

Announcements

Brief description of the course

This is a graduate level introduction to concepts in thermodynamics and kinetics, and their applications to materials phenomena, such as phase diagrams, chemical reaction equilibria, point defects, surfaces and interfaces, phenomenological treatment of diffusion, diffusion mechanisms in crystalline solids.

Prerequisites

None

Syllabus

Energy, entropy

Irreversible and reversible processes

First and second laws of thermodynamics

Conditions for thermodynamic equilibrium

Helmholtz free energy and Gibbs free energy

Equilibrium in single component systems; phase transformations

Solution thermodynamics

Equilibrium in multi-component systems

Phase rule, phase diagrams

Reaction equilibria

Thermodynamics of point defects

Surfaces and interfaces, curvature effects

Diffusion: Phenomenology

Diffusion in solids: Mechanisms

Course outcomes

Knowledge of various thermodynamic quantities and their inter-relationships

Thermodynamic origins of phase diagrams, reaction equilibrium constant, equilibrium defects, curvature effects, etc.

Solution to the diffusion equation in simple systems; their implications

Understanding of diffusion mechanisms, and the origin of temperature dependence of diffusion coefficient

Grading policy

20% for Mid-term 1

30% for Mid-term 2

50% for the Final Examination

Assignments

Resources

C.H.P. Lupis: Chemical Thermodynamics of Materials, Elsevier Science, 1982.

Robert DeHoff: Thermodynamics in Materials Science (Second Edition), Taylor & Francis, 2006.

P. Shewmon: Diffusion in Solids (Second Edition), TMS, 1998.