

MSE 811 Material Thermodynamics

CHs: 3

Pre-requisites: Nil

Course Objectives:

- Understand basic laws of thermodynamics along with clear understanding of kinetics of chemical reactions.
- Be able to read phase diagrams in terms of thermodynamic concepts such as free energy.

Course contents:

- Concepts of Helmholtz Free Energy and Gibbs Free Energy,
- Energy-Property relationships, Thermal Equilibria, Chemical Equilibria,
- Ellingham Diagrams, 1st order and 2nd order Transformations,
- Gibbs Helmholtz Relationships, Fugacity and Chemical activity,
- Equilibrium constant and its variation with temperature, Vant Hoff's equation,
- Effect of temperature and pressure on phase transformations,
- Clausius-Clapeyron equation, Thermodynamics of solutions, Gibbs-Duhem relationship,
- Thermodynamic properties and equilibrium phase diagrams, Mixing functions,
- Excess functions, Phase Rule, Gibbs free Energy and Entropy Calculations of Phase transformation,
- Typical Equilibrium Phase Diagrams, Statistical Methods in thermodynamics.

Course Outcomes:

- Should be able to apply different concepts of thermodynamics e.g. the concept of activity and coefficient of activity to understand different materials processes such as ladle treatment of steel etc.

Recommended Text / Reference Books:

- Thermodynamics of Materials (David V. Ragone)
- Introduction to Thermodynamics of Materials (D. R. Gaskell)
- Thermodynamics, an Advanced Text for Material Scientists (J. Hudson)