PHASE EQUILIBRIA IN MATERIALS (NATURE & PROPERTIES OF MATERIALS-II)

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PRE-REQUISITES : 12th standard, Science Background

INTENDED AUDIENCE : UG students of any branch of engineering and sciences, PG students engaged in materials related research

INDUSTRIES APPLICABLE TO : Materials related companies

COURSE OUTLINE :

The course is second part of the broader course on Nature and Properties of materials and would be suitable for undergraduate and postgraduate students of every branch of science and engineering. This course will focus on essentials of thermodynamics, thermodynamic basis of phase diagrams, free energy composition diagrams, phase equilibrium, phase diagrams in unary, binary and ternary systems and correlation of phase diagrams with microstructure evolution. The course will enable a beginner in Materials to understand the phase diagrams.

ABOUT INSTRUCTOR :

Ashish Garg is Professor of Materials Science and Engineering at IIT Kanpur. Details of his research and teaching can be accessed on http://home.iitk.ac.in/~ashishg

COURSE PLAN :

Week 1 : Introduction, Thermodynamic aspects of phase formation and phase equilibrium, Mixing of atoms

Week 2 : Thermodynamics of mixing in binary solutions: Ideal and Regular Solutions, Real Solutions

Week 3 : Systems with intermediate phases, Equilibrium in Heterogenous systems, Free energy composition diagrams and their use in determining phase diagrams

Week 4 : Types of Phase diagrams and reactions, Gibbs phase rule and its applications to phase diagrams, Invariant reactions, Tie-line and Lever rule

Week 5 : Binary Phase Diagrams: Applications of tie-line and lever rules to determine phase compositions and fractions, Microstructure evolution under equilibrium and non-equilibrium cooling conditions, Examples of Phase diagrams and their correlations with microstructures in common alloy systems.

Week 6 : Examples of Phase diagrams and their correlations with microstructures in common alloy systems: Fe-C, Cu-Zn systems

Week 7 : Experimental determination of phase diagrams, Ternary phase diagrams

Week 8 : Ternary Phase diagrams and Course summary