GENERAL PRINCIPLE OF PHASE TRANSFORMATION IN ALLOYS

- The phase is a physically and chemically homogeneous portion of the matter.
- They may be solid, liquid and gases phases.
- But solid phase is more important in material science.
- A phase changes requires to change in properties.
- All pure materials are single phases materials, while alloys are both single phases and multi phases materials depending upon the solid solubility of the metals melted together to form a alloys.
- Steel and cast iron are the typical example of multi-phase alloys.
- The phase is defined by any homogeneous physically distinct part of a system which is mechanically separable and bounded by a definite surface.

- To fully understand phase diagrams. We must first define several terms commonly used to interpret and discuss these plots.

a. System :- A series of possible metal mixture (called alloys) consisting of the same components, but without regard to alloy composition.

for example:- Fe-C system

b. Phases :- A phase in a material in terms of its microstructure is a region that differs in structure and/or composition from another region.

As a atoms/molecules in a gases are mixed at atomic/molecular level therefore the gaseous state is a single phases.

C. Components :- components refer to the independent chemical species that comprises the system. The components of a system may be elements, ions and components.

for example :- in ice-water system, the component = h20.

D. Degree of freedom :- The degree of freedom (F) are those externally controllable conditions of temperature, pressure and composition which independently variable and which must be specific in order to define completely the state of the system at equilibrium.

E. Equilibrium phase :- A phase which minimize a system free energy for a specified combination of temperature, pressure and compositions.

F. Metastable (or non- Equilibrium) phase :- A phase that can be produced by a very rapid change in system conditions(i.e temperature of pressure) in some cases, the metastable state may persist indefinitely, as the movement towards equilibrium is virtually imperceptible over long period of time. This is very important for the processing of the materials.

G. Solid solution :- A mixture of two (or more) types of atoms in which the solute atoms occupy either substitution or interstitial positions within the solvent lattice and the crystal structure of the solvent is maintained.

H. Solubility limit :- The maximum concentration of solute atoms that can dissolved in a solvent to form a single phase i.e is the limit or exceeded, another solid solution or component of different composition will form.

I. Microstructure :- The microscopic structure of an alloy (i.e spatial arrangement of phases) as viewed using an optical or electron microscope of note, the term microstructure refers to features on the scale of micrometers.

- Phase diagram are classified on the basis of the number of components in the system.
- Single component system have unary diagram.
- Two component system have a binary diagram.
- Three component system have a ternary diagram.

J. Pure substances :- a pure substance (solid, liquid,gases) made of one chemical species only has one phase.

example :- oxygen (O2), ice (H20)

K. Mixture of gases :- a mixture of gases say H2, N2 and O2 contribute one phase only as all gases mix freely to form a homogeneous mixture.

L. Aqueous solutions :- A aqueous solution of a solid substance such as Nacl is uniform through out. So, there is only one liquid phase.