Expt. No. .... Date 1

Page No. ....

Application of two Component System.

Hons (II), Paper III, chapter Phase rule, Lecture: 04

Dr. Shailesh Kumar Jha.
Asst Prof. (Guest)
Dept of Chemistry
Marwari College Darbhanga.

To start the Study of two Component System, first of all we should discuss about Condensed | Reduced phase rule.

Condensed or Reduced phase rule:→

As we have seen previously we calculate the no. of degree of freedom by using no. of phase & no. of Component, that we get an equation which is also Called Gibb's phase rule equation i.e

$$F = C - P + 2$$

Where F = no. of ~~freedom~~ degree of freedom
C = No. of Component
P = No of phase

This equation already we have used the above equation to Calculate degree of freedom in One Component System, but for two Component System it becomes

$$F = 2 - P + 2$$

$$F = 4 - P$$

Now in above equation we have used the no. of component 2 if the no. of phase is one, then $F = 4 - 1 = 3$

If the no. of degree of freedom is 3 it means three variables are required to explain the systems which is not possible to plot three variable at a time in a system, so we keep one variable constant, so the no. of degree of freedom is reduced by one, and the formula becomes $F = 3 - P$

This equation has received the name condensed or reduced phase rule equation in the system

If $P = 1$, $F = 2$ Bivariant

$P = 2$ $F = 1$ Monovariant

$P = 3$ $F = 0$ Non variant.

Two Component System Pb-Ag : →

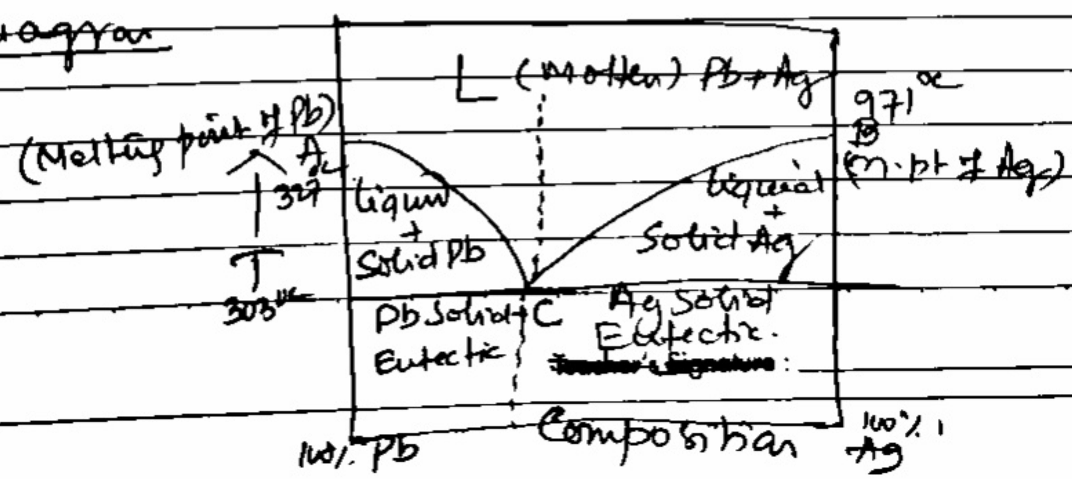
In this System there are Two Compo-nents i.e Pb & Ag and both are Solids, and these two are immisible, and its melt Pb + Ag which is miscible So the total no. of phases are three in System.

P = solid Pb + Solid Ag + Melt Pb + Ag = 3

By Gibb's equation F = C − P + 2 (C = 2)
= 2 − 1 + 2 (P = 1)
= 3

It means we need 3 independent variable i.e T, P, & Composition but three independent variables we can not show so one variable should be taken Constant, in System Pb & Ag are in solid State so the role of pressure is not so dominent hence Pressure will be kept Constant (P = 1atm), & we will explain in between two independent variable i.e T & Composition.

Phase diagram



In Composition i.e x-axis there are two Solid Components i.e Pb & Ag. the Component Pb is 100% in the begining but as we move toward right hand side conc. of Pb decreases & Ag increases, Similarly in right corner of x-axis there is Ag as we move toward left Ag conc. decreases & Pb increases. The Melting point of Pb is 327°C & Ag is 971°C

In the phase diagram it is shown As A (melting point of Pb 327°C) gradually decreases and meeting to point 'c', similarly ~~Melting~~ at point B (M.pt of Ag is 971°C) but gradually decreases and meeting to point 'c'. Here c is the Eutectic point.

there are two Curve i.e Ac & Bc.

Ac = Freezing point Curve of Pb

Bc = Freezing point ~~of~~ Curve of Ag

Point 'c' = Eutectic point.

$F = 3 - P$; $F = 3 - 2 = 1$. for Ac $(P = 2)$.

Similarly for ~~Ac~~

$F = 3 - P$, $F = 3 - 2 = 1$ for Bc $(P = 2)$.

but for c point (Minimum freezing point of Both)

$F = 3 - P$, $3 - 3 = 0$.

Eutectic point: →

Eutectic point is possible in two Component System. In eutectic point the component shows actually minimum freezing point/M.P and exist in liquid state. Two Components which are in liquid state & miscible at this temperature are called eutectic mixture, as already we have seen. In This case the melting point of Pb & Ag are different but on mixing with each other a temperature comes when the freezing point of both the components are at the minimum point, this temperature is Called Eutectic point. At eutectic point the degree of freedom becomes zero. by using reduced phase rule. ~~At this temperat~~

$$F = 3 - P$$

$$F = 3 - 3$$

$$F = 0$$

At Eutectic temperature F = 0, and both the Component exist at equilibrium by maintaining lower temperature of Freezing / Melting.