Quadrant II – Transcript and Related Materials

Programme: **Bachelor of Science (Second Year)**

Subject: **Chemistry**

Paper Code: **CHC-103**

Paper Title: **Physical Chemistry and Organic Chemistry**

Unit: **Phase Equilibrium**

Module Name: **Phase Diagram of two component system involving congruent melting point. (Zn-Mg)**

Module No: **15**

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Notes:

Congruent melting point: A substance is said to possess a congruent melting point if it melts completely at constant temperature into liquid phase having same composition as that of solid phase from which it is derived.

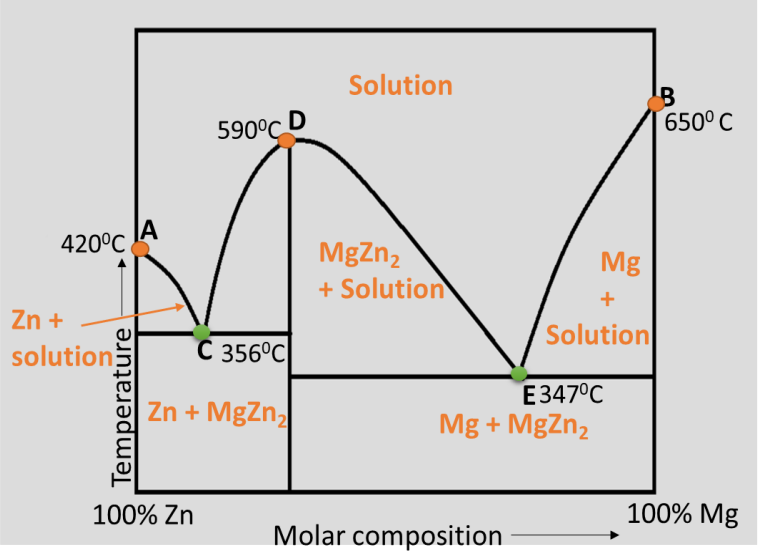
Examples of system possessing congruent melting point:

1) Zinc – Magnesium system
2) Al – Mg system
3) Gold- tin system
4) Phenol-aniline system
5) $FeCl_3$ – H_2O System

<u>Zinc – Magnesium system:</u>

It is a typical two components system which involves the formation of an intermetallic compound $MgZn_2$. Compound is fairly stable and melts without any change in composition.

System has four phases: solid Mg, solid Zn, solid $MgZn_2$ and liquid solution of Mg and Zinc. The phase diagram of Zn-Mg shows two eutectic points.



The curves AC, BE and CDE (DC and DE):

Curve AC is the freezing point curve of Zn with melting point of pure Zinc as 420^0C which is lowered on the addition of Mg. This continues until the point C is reached where new phase solid $MgZn_2$ appears.

Further addition of Mg, raises freezing point until point D is reached which is maximum point on the curve CD. At this point compound $MgZn_2$ of solution phase is identical with that of solid phase. Hence this temperature is known as congruent melting point.

The curve DE represents the lowering in freezing point of compound $MgZn_2$ by addition of Mg.

The curve BE is the freezing point curve of Mg with melting point of pure Mg as 650^0C which is lowered on the addition of Zn. This continues until point E is reached where new phase solid $MgZn_2$ appears.

Along all this curves, phases in equilibrium are two thus applying condensed phase rule degree of freedom F is given as.

F = C -P +1 = 2- 2+ 1 =1 thus System is univariant.

Points:

Eutectic point: there are two eutectic points in phase diagram point C and E

At point C – Solid Zn, solid $MgZn_2$, and liquid are in equilibrium.

At point E – Solid Mg, solid $MgZn_2$, and liquid are in equilibrium

Degree of freedom F = C -P +1 = 2 - 3+ 1 =0 therefore non variant.

Congruent melting point:

The congruent melting point of the compound $MgZn_2$ is 575^0C. At this point the composition of the solution of liquid and solid compound $MgZn_2$ becomes same.

F = C -P +1 = 1 - 2+ 1 =0 Therefore system is non variant at congruent melting point.

Areas: Area above the curve AC, CDE and BE represents the solution of Mg and Zn.

Area below point C represents solid Zn + $MgZn_2$while area below point E represents solid Mg + $MgZn_2$.

The single phase exists. Applying condensed phase rule degree of freedom F will be

F = C -P +1 = 2 - 1+ 1 =2

System is bi-variant.