

Quadrant II- Transcript and Related Materials

Programme: Bachelor of Science

Subject: Chemistry

Paper Code: CHC 103

Paper Title: Physical Chemistry and Organic Chemistry

Unit: 2

Module Name: Phase diagram of two component system involving incongruent melting point (NaCl – H₂O)

Module No.: 16

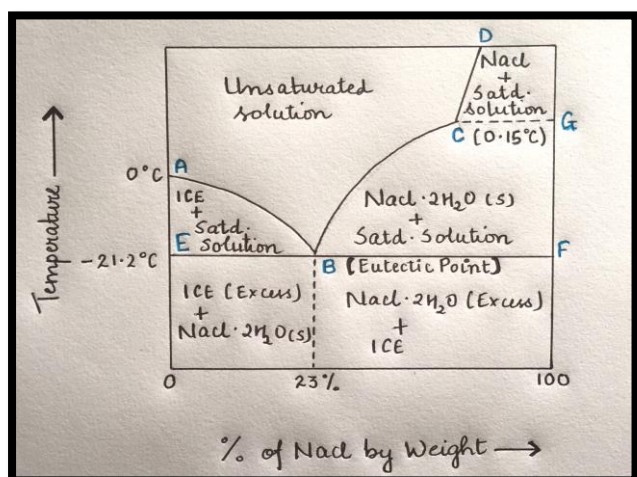
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Notes:

Incongruent melting point: many two component system forms a compound which is so unstable that on heating it decomposes, instead of melting congruently to form a new solid compound and solution with composition different from that of solid phase. Such compound is said to have incongruent melting point.

i.e compound showing incongruent melting point decomposes before reaching its melting point.

Example: NaCl-H₂O system



At particular temperature and particular composition NaCl react with water to form dihydrate. The dihydrate formed is so unstable that at particular temperature it decomposes to form solid compound and solution of that solid compound which differ in composition and such dihydrate is said to have incongruent melting point.

Different **features of phase diagram** are as follows:

Point A: freezing point of water. At this point water starts freezing and we have ice and water both in equilibrium.

Point B is called *Eutectic or cryohydric* point and corresponding to this point it contains 23% NaCl by weight. At this point a new solid phase separates out i.e. $\text{NaCl}\cdot 2\text{H}_2\text{O}$ and the three phases i.e. ice, solution and dihydrate exist in equilibrium. Degree of freedom for such a system is zero and is called a non-variant system.

Point C: At point C the temperature is 0.15°C and this temperature is called *incongruent melting point*. The decomposition reaction of $\text{NaCl}\cdot 2\text{H}_2\text{O}$ at this temperature is known as a transition, meritectic or peritectic reaction.

Curve AB: As we add NaCl to water it starts solubilising in water and water rather than freezing at 0°C , it freezes below 0°C so curve AB is the freezing point curve of water and on this curve ice and solution exist in equilibrium. Hence degree of freedom for such a system is 1 and is called a monovariant system.

The decrease in freezing point is observed up to point B, after point B addition of NaCl will not further lower the freezing point of water.

Curve BC: After point B further addition of NaCl, trace the curve along BC and further with increase in temperature solubility of NaCl will increase and hence this curve is called a solubility curve of dihydrate. Along this curve solution and dihydrate exist in equilibrium and hence degree of freedom is one and is called a monovariant system.

Curve CD: this curve is called a solubility curve of anhydrous NaCl. This anhydrous salt is stable to a very large temperature and along this curve anhydrous NaCl is in equilibrium with its own solution. Degree of freedom is 1, and hence monovariant system.

Area above ABC: unsaturated solution

Area under ABE: ice + saturated solution

Area below EBF: ice + dihydrate

Area under CBF: dihydrate + saturated solution