Hello Students, welcome for today's session. Myself Miss Shradha Parab,

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Education.
Title of the unit for today's session is phase equilibrium.
Module name is phase diagram of two component system: Involving incongruent melting point that is sodium chloride - water system and module number is 16.

In this module we will going

to learn introduction to the incongruent melting point

examples of the system, showing incongruent melting point and

features of the phase diagram of sodium chloride water system.

At the end of this module, students will be able to explain the term

incongruent melting point, cite examples of incongruent melting

point and describe different features of phase diagram of incongruent melting point.

So Let us have an introduction to 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 a compound is said to have Incongruent melting point.

i.e. In case of incongruent melting point compound decomposes into a new solid compound and a solution.

Which is having a composition different from that of the solid phase and the corresponding temperature is called its incongruent melting point.

The difference between congruent and incongruent melting point is that in case of congruent

melting point compound melts sharply at constant temperature

having composition same as that of the solid phase, whereas in case of incongruent melting point compound

rather than Melting congruently decomposes into a new solid

Compound and solution with composition different from that

of the solid phase.

So here we have examples of system showing

incongruent melting point : sodium chloride-water system,

sodium sulfate-water system and copper sulfate-water system.

So, let us have a look at sodium chloride water system, showing

incongruent melting point.

In this case, sodium chloride combines with water to form dihydrate, so this is the only

hydrate sodium chloride can form with water.

The dihydrate form is so unstable that a particular temperature and at

particular composition it decomposes into a new solid

phase and a solution which is having composition different

from that of the solid phase.

Features of the phase diagram of sodium chloride water system having incongruent melting

point.

Point A,B & C

Curve AB, BC & CD

and

area above ABC, under ABE, below EBF and under CBF.

so let us have a look at this features in detail

As we can see in this phase diagram, Point A is freezing point of water that is temperature 0 degree

Celsius at one atmospheric pressure. As we know zero degrees Celsius is the freezing point of water.

So at this point we can have water and ice both in equilibrium.

Next we have point B, point B is eutectic or cryohydric point. The temperature at this point is minus 21.2

degree Celsius and the composition at this point is 23% of sodium chloride by weight.

As We know, zero degrees Celsius is the freezing point of water, ,but as we add sodium chloride,

the freezing point of water decreases and this decrease in

freezing point of water Is observed till point B. At this point, that is at Point B

new solid phase separates out i.e. dihydrate $NaCl.2H_2O$,

So at point B we have three phases in equilibrium that is

ICE, solution and dihydrate. Hence we can calculate degree of

freedom using reduced phase rule Equation, F is equal to C - P +1, Where in number of components are two, number of phages are three. Hence the degree of freedom calculated is zero and
such a system which is having a zero degree of freedom is called as non variant system.

Next we have Point C, Point C is incongruent melting point and the temperature at this point is

0.15 degrees Celsius. Above this temperature the dihydrate is

unstable and it decomposes into anhydrous sodium chloride in solution.

Decomposition of dihydrate at this temperature is known as transition or peritectic reaction. Now let us see Curves of the phase diagram.

So first we have curve AB, as we know a point A having temperature zero degrees Celsius is the freezing point of water and the freezing point of water decreases as we add sodium chloride. So this

decrease in freezing point is observed till point B. so we can say curve AB as Freezing point curve of Water and on this curve we have two phases in equilibrium i.e. ice and solution.
The degree of freedom calculated using reduced phase rule equation is 1 and this system we can call as univariant system or we can also call this system as mono variant system.

Next we have curve BC, Curve BC is a solubility curve of dihydrate. addition of

sodium chloride will not decrease the freezing point of water below point B.

So as after point B as we add sodium chloride, the solubility

of this sodium chloride increases with increasing

temperature along the curve BC and on this curve that is

on curve BC we have solution and dihydrate in equilibrium.

The degree of freedom calculated using reduced phase rule

equation is 1 and hence we can call this system is univariant

system.

Next we have curve CD which is the smallest curve that

we can observe in this diagram, this curve is called solubility curve of anhydrous

sodium chloride. This anhydrous sodium chloride is stable to a

very high temperature and on this curve that is on curve CD Anhydrous sodium chloride is in equilibrium with the solution.

The degree of freedom calculated using reduced phase rule

equation is 1 and we can call this system is univariant system

and last we have areas of this phase diagram.

So first we have area above ABC, above ABC We Have only one phase which is

unsaturated solution.

Next we have area under ABE which consists of ice and saturated solution.

Then area below EBF consist of ice and dihydrate and area under CBF consist of

Dihydrate and saturated solution.

These are my references.

Thank you.