**Introduction to Materials Science and Engineering**
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**Lecture - 68**
**Uses of phase diagrams**

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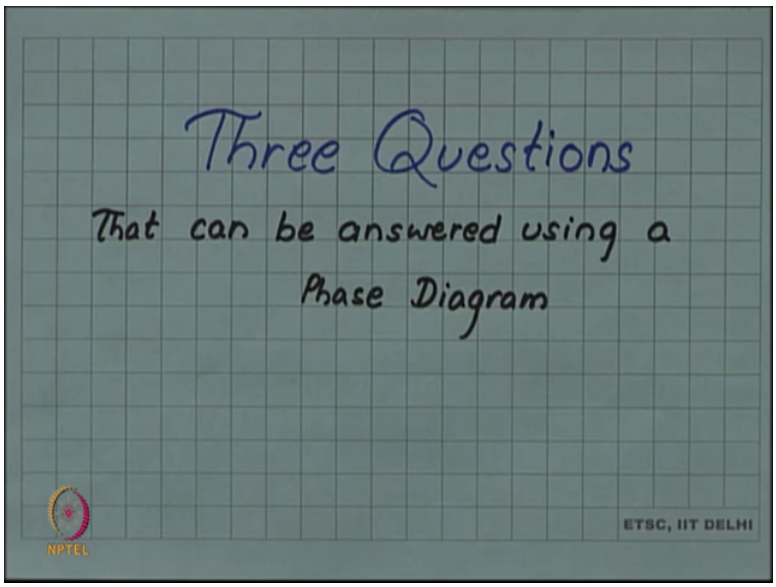


We are discussing phase diagrams and there are three important questions, which can be answered with help of a phase diagram. So, we will look at those questions that what are the questions what is the use of a phase diagram before that let us define something called a constant constitution point.

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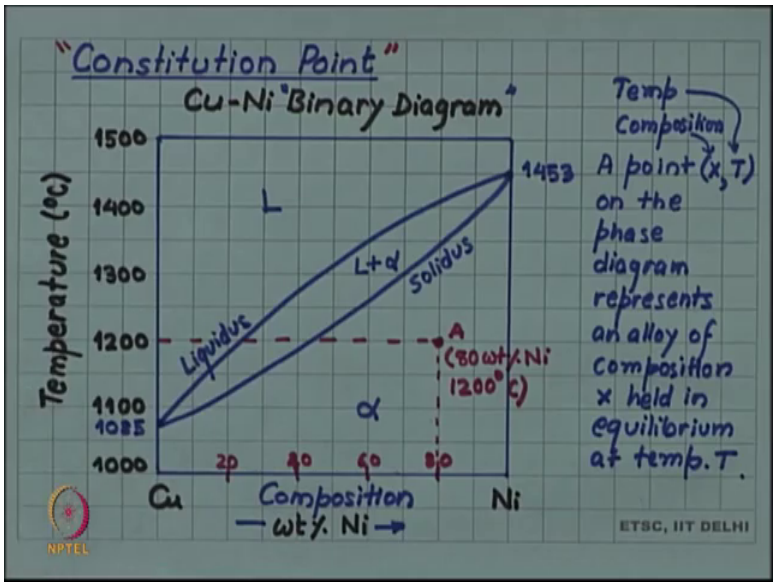


Basically as we have seen that phase diagram and as I told you we will mainly focus on binary diagram, which means two components and in this particular example the two components are copper and nickel, which is written on the x axis here and the temperature is on the y axis. So, our thermodynamic variables a composition the composition and composition in this particular case is being expressed as weight percent nickel.

And the other thermodynamic variable is the temperature. And we have seen that the copper nickel phase diagram is a very simple phase diagram where there are two boundaries, one boundary the upper boundary is the liquidus boundary and above that we have a liquid phase, which is in equilibrium. The lower boundary is a solidus boundary and below this a solid solution phase is stable and we have established this convention and this is quite common that the solid phases we will represent by Greek letters.

So, I have written alpha for this particular solid phase, and in between the two boundaries we have a two phase region liquid plus alpha should we have seen this in the last discussion. Now this phase diagram is a diagram in the composition temperature space. So, any point in the diagram if I marked any point, if I put my pen at this point let me call this point A. So, this point represents since it is a point in temperature composition space its x coordinate the x coordinate of this point is a composition.

In this particular case you can see that if I try to find out its composition it is easy. So, it is 80, 80 weight percent nickel is what is its x coordinate. And its y coordinate is a temperature and in this case again the temperature is 1200 degrees Celsius. So, this particular point represents an alloy of 80 weight percent nickel 80 weight percent nickel held in equilibrium at 1200 degrees Celsius.

So, such points which are the points of our interest, we will call constitution point. So, any point in the phase diagram can be a constitution point. So, a point a point on the phase diagram let us say point a point x t where x is the composition and T is the temperature x is the composition and t is the temperature.

So, any point x, T in the phase diagram represents an alloy of composition x headed in equilibrium at temperature the temperature T and that is the point which I am for the moment naming as constitution point. Now with respect to any constitution point three questions can be asked and let us list those three questions.

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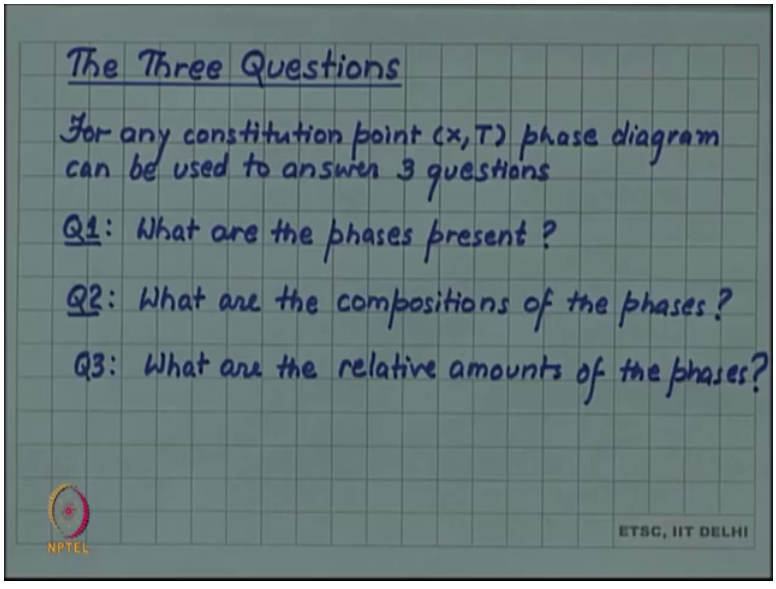


So, for any and the phase diagram can answer those questions. So, these questions are important and it is important to learn how to use the phase diagram to answer these questions. So, first let us make a list of these questions. So, for for any for any constitution point x, T we have three questions. So, phase diagram can be used to answer three questions and what are those questions ?

So, let us write that down question 1 what are the phases present. So, for that alloy at that temperature, what are the phases present in equilibrium? So, this; obviously, is the first job of any phase diagram, that with the help of phase diagram we can find what phases are present in equilibrium for any given composition and temperature.

Another important question is; what are the compositions of the phases present. So, once we know what are the phases present, they may be a single phase or more than one phase then we would like to know what are the composition of those phases that is what is the fraction of components in those phases and the third question is; what are the relative amounts of the phases.

So, we will look at the answer to these questions as we go along in the discussion of phase diagram. So, we will take these questions one by one.