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Phase field modelling: the materials science, mathematics and computational aspects

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Module No.2
Lecture No.10
Some references

Welcome we are looking at binary allies especially alloys which undergo phase separation are ordering, we are looking at thermodynamic models which describe such alloys, we have been looking at a specific model which is known as the regular solution model using which we can understand why systems undergo either phase separation or ordering based on how the inter atomic interactions are.

We have also looked at how the free energy versus composition diagonals look like and what kind of phase diagrams they lead to and how diffusion is a process that spontaneously takes place to reduce free energies and what the classical loss of diffusion are which are given by Fick's, which are given by Fick's laws and we have also looked at how the Fick's law has to be modified for looking at of certain systems which undergo phase separation specific systems which have a concave portion of free energy.

So we have been looking at these things and I think it is a good point for me to give a couple of recommendations for reading. One is a textbook by Porter and D sterling is called phase transformations in metals and alloys it is a very good textbook some of the material that I have

been discussing is from this textbook and we will have a chance to use more material from this textbook during this course.

So I strongly recommend especially the first three chapters okay, so we have covered some aspects of the first chapter and some aspects of the second chapter in this module still now. And we will have chance to learn more from some of the other chapters. So I strongly recommend that you take a look at porter and D sterling and try to read and look at the problems the book comes with a solution which is given at the end of the textbook but it is a good idea to solve the problems on your own and consult the solutions only if necessary or to confirm that your solution is okay.

The second book which I recommend is a chapter from a book which might be a little bit harder to get hold of this is a volume called phase transformations which is based on a seminar which was held sometime in 1968 by American society of methods. And the seminar topics that were discussed in the seminar where put together as a book as a volume it is called phase transformations by American society of metals it was published in 1970.

There is a chapter in this book chapter 12 which is by Hilliard which talks about some of the things that I am going to discuss today some of the next few modules will be based on this chapter of Hilliard. Hilliard's chapter is very well written I also like the attitude of Hilliard when he wrote this article because he explicitly states that in this chapter derivations of the important expressions are given in full on the premise that it is easier for a reader to skip a step than it is for another to bridge the algebraic gap between it is easily shown that and the ensuing equation.

So all of us have this experience there is an article which says it is easily shown that this follows from this and sometimes we are stuck. So Hilliard has taken lots of effort to make sure that that does not happen, because he thinks that if suppose for somebody it is obvious they can skip the step that is easier than for somebody who does not know how it follows to actually figure out what is happening.

So this is very, very pedagogical attitude this is one of the reasons why I like this chapter a lot and it is also extremely well-written and it also has a nice balance of what the experiments say and what the theory says and it makes contact between the two. So some of the material that we will do in the next few modules will be based on Hilliard's article. So I strongly recommend the article of Hilliard chapter 12 is called spinodal decomposition from the volume on phase transformations published by American society of metals in 1970. Thank you.

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