Introduction to Materials Science and Engineering
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Lecture - 80
Microstructure of a hypereutectoid steel

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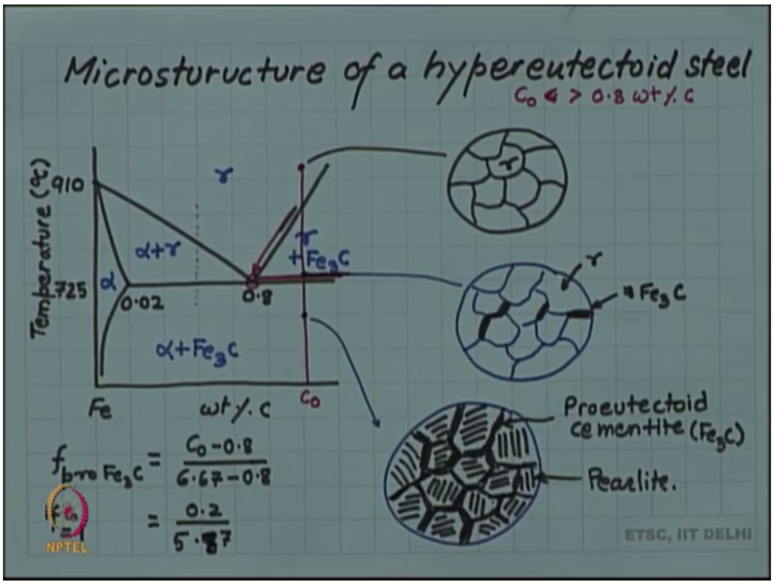

So, let us now look at microstructure of a hypereutectoid. Steel hypereutectoid means the alloy composition is greater than 0.8 weight percent carbon. So, it is on the right-hand side of this 0.8 percent carbon which was the eutectoid steel. So, let us take a vertical line, you note in that composition. So, this line represents our hypereutectoid steel.

We saw in the evolution of hypoeutectoid steel, that austenite first became alpha plus gamma which means ferrite first formed, and that ferrite we called hypoeutectoid ferrite, and then the remaining austenite transformed to pearlite alpha plus Fe3C. Identical situation happens here with the hypereutectoid steel, only the first phase to form first phase to form before eutectoid reaction is now Fe3C cementite and not ferrite.

So, you get proeutectoid cementite and then you get pearlite. So, that is the only difference. So, here also at a height higher temperature, you will have in the single-phase field, you will have austenite called a crystalline austenite. With grains and grain boundaries, but then when you enter this alpha gamma plus Fe3C region, you will start having Fe3C forming. So, at a temperature somewhere there, you have gamma. Now, the amount of gamma which will form first of all remember that, the Fe3C which forms starts forming on the on the grain boundaries. So, you will have grain boundary where Fe3C will first form.

Here, you have this is or is a austenite and this is this is Fe3C which is forming also and then you can finally, here also the austenite phase which is there the composition will evolve. And it will again evolve towards the composition will evolve towards this eutectoid composition. So, when you will be close to the eutectoid horizontal when we are reaching close to the eutectoid horizontal, the remaining gamma will be at the eutectoid composition and at eutectoid temperature.

So, it will transform as you know now. So, below the eutectoid horizontal we try to draw the microstructure. So, you have you have these austenite boundaries, I am drawing it in dashed line because I want to cover these with the Fe3C. So, Fe3C has formed along these boundaries, depending upon the amount of Fe3C which will also depend on the composition.

So, lots of Fe3C will form, I am assuming that there is a co composition is such that there is sufficient Fe3C to form along all gain grain boundaries. So, you will have a grain boundary network of Fe3C, but this Fe3C now, using the same nomenclature will now be called proeutectoid proeutectoid cementite, or Fe3C and the remaining austenite will form into pearlite, you will have pearlite forming.

Whatever austenite was left at 725 degree, on cooling will transform into mixture of alpha and Fe3C. So, that is perlite if you look at the amount here again, you can calculate the amount of proeutectoid cementite in the alloy and that will be f proeutectoid, I am just writing pro Fe3C in short, the proeutectoid Fe3C. So, you will again use a tie line above the eutectoid horizontal, the tread tie line which I have drawn. So, if you have composition c naught, Fe3C is now on the right-hand side of this diagram. So, the left arm is the represent is representing the Fe3C fraction.

So, the Fe3C fraction will be C naught minus 0.8 divided by 6.67 minus 0.8. And generally, in a steel, even in the hyper eutectoid steel it is greater than 0.8, but it is not not much greater than 0.8. So, it goes up to a 1 1.2 steels greater than 1.2 percent carbon, generally a will become too brittle. So, most engineering alloys will engineering steels will have up to may be 1 1.2 percent steel, even if they are hypereutectoid.

So, the numerator is much much smaller you can see, numerator will be if for if c naught if C naught is equal to let us say 1, for 1 percent let us calculate. So, this will be 0.2 divided by 5.87 0.2 divided by 5.87 which will be a much smaller number.

So, the fraction of cementite which will come out, will not be too much. So, that is why and they initially come on the grain boundary. So, they appear to be as a network covering the grain boundaries. So, with this we complete the microstructure of steels.