Elementary Stereology for Quantitative Microscopy

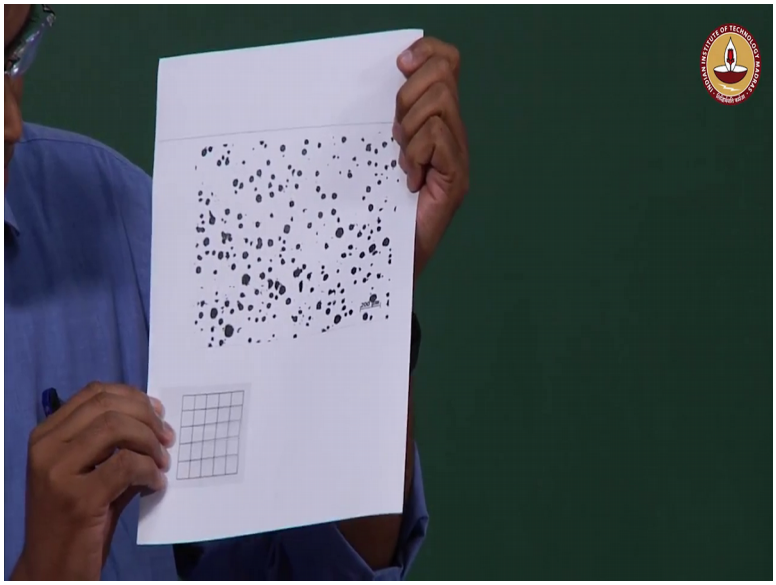
Prof. Sandeep Sangal
Department of materials Science and Engineering
Indian Institute of Technology, Kanpur
Prof. S. Sankaran
Department of Metallurgical and materials Engineering
Indian Institute of Technology, Madras

Lecture – 02
Volume Fraction and Particle size

Hello everyone; just now we have seen the Professor Sangal are talking about this basics of stereological methods and then he has also introduced couple of probes. How are you going to analyze the some of the spherical shapes or particle size and area measurements and point fraction and so on.

What I am going to do is, I will just take the actual microstructure which is of this nature this is a microstructure of a cast iron.

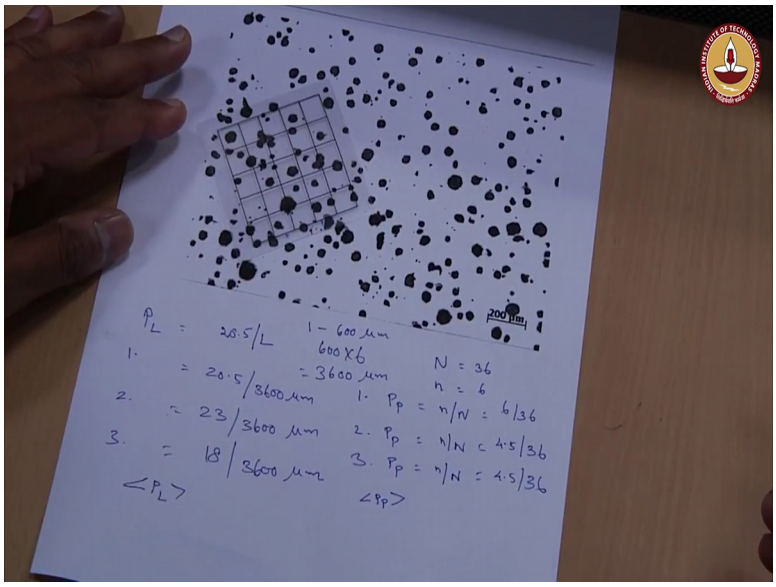
(Refer Slide Time: 00:56)



So, and we are going to use a probe of this nature which is of about a grid of this, so, now what I will do is, I will now demonstrate using this probe how are we going to calculate the point fraction and then how that is related to area of fraction that is P P and then again the second demonstration professor mentioned about how to measure the P L, that is which can be related to the average diameter of the particles of this microstructures.

So, now let us go and do this measurements, after that what I will do is I will come back to this computer then I will open an excel sheet and take the data from each of the scholars who are measuring it and then we will document it and then we will analyze it one by one ok.

(Refer Slide Time: 02:15)



Now, let us start measuring this the P P first. So, what I am doing is I am placing this probe on the microstructure in a random orientation. So, let us not put like this try to keep a symmetric it should be random like this. So, I am just putting it like this so, what is that first I have to do, I have to just count the number of grid points. So, 1 2 3 4 5 6, 1 2 3 4 5 6 so, about 36 grid points I have so, capital N is equal to 36.

So, now I am just going to look at the number of intersec sections which is falling on this each one of this spherical particles. So, let me start counting now one see the other important point you have to note down is the intersection point which is just touching this particle is counted as half ok. Even the line which is touching the periphery again counted as half when you do a diameter count, but then right now we are looking at the intersection point which falls on the particle.

So, let me start doing that so, this is 1, half and then 2 and then 3 just 2 and half 4, 4 and half 5 and then 6. So, this small n for this count is 6. So, I will have P P is equal to n by small n by capital N that is 6 by 36. So, I will have for this measurement so, now, I will put this probe into different area of different random orientation like this.

So, now let us start counting again. So, now, this is 1, this is half, this is half 2 and then half 2 and half and then 3 and half 4 and half again it goes like this and then this is about 4 and half right so, 4.5 by 36. So, we will put one more random measurements somewhere here and again start counting this let us see what is that we get.

So, now, this P P; I will start counting 1 2, 2 and half and then this is 3 and half and then 4 and half again. So, this is n by capital N is equal to 4 and half by 36. So, like that what we can do is when we take the averages of all this P P we will get the average point fraction like this what professor has written.

So, what I will do is I will collect this data from the entire class and put it in the excel sheet and before I go to that let me also now demonstrate how I am going to use measure the P L a P L. So, again I will put this grid into a random position and then I will start counting the intersection of the boundary of the particle.

So, now what we will do assume is, we will assume that the vertical lines are not there we will use only the horizontal lines and let it fall on this microstructure let us look at the intersections. So, now, I will start counting 1, 2, 3, 4, 5, 6, 7, 8, 8 and half, 9, 9 and a half 10 and 10 and half 11, 12, 13 , 14, 15, 15 and half, 16 and half, 17 and half, 18 ,18 and half, 19, 20, 20 and half yes it is 20 and half.

Now, this is per unit length so, that l you have to now calculate. So, how do you calculate the L, you know this for this micrograph this length is about 20 micron. So, you put that line here and then it is approximately 1 and then now it is 400 micron. So, it is approximately it is about 600 micron so, one line is 600 micron 600 micron.

So, now we have used 1 2 3 4 5 6, 6 lines you have used so, it is 600 into 6 is equal to 3600 micron is a total length. So, this so, like that we will put 20.5 divided by micron so, this is event 1. So, now I will do the event again another random orientation like this.

So, the event 2 will start again I will put the start measuring I will use again one direction this horizontal line not the vertical lines. So, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 12 and half,13 and half, 14 and half, 15, 15 and half, 16, 17, 18, 19, 20, 21, 22, 23. So, even 2 is 23 divided by 3600 micrometer so, even 3 I will put now I will now measure randomly.

So, now I am started counting this half, 1 and half, 2 and half, 3 and half, 4 and half, 5, 6, 7, 8, 9, 9 and half, 10, 11, 12, 13, 14, 15, 16, 17, 18,. So, even 3 gives me 18 divided by 3600 micron. So, like that we will take this and you can calculate this average P L for the number of events, what now I will do, is I will collect this data from the entire class.

So, I will get the eve number of events is almost we have about 9 10 11 12 13, 13 students. So, even if I collect 2 measurement from each candidate I will be able to get close to 30 because I have 3 29 maybe I collect 3 from each one of them. So, I will get about 36 even measurements then I will put it into an excel.