Iron Making
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Lecture - 09
Iron Making

So, this figure show the effect of coke addition and other binders moistures on green ball formation.

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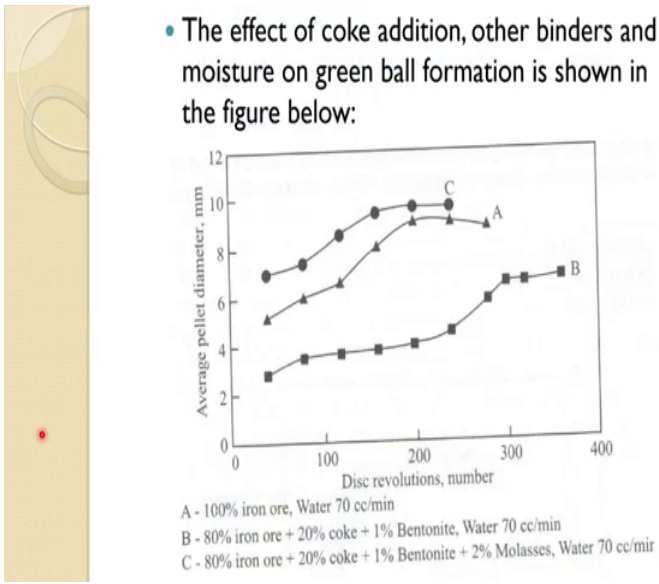

Ah and as one can see just with the iron ore and water , you get a very good average pallet diameter when the disc revolution is about 200 or so. And you get the maximum one if you add 1 percent Bentonite, 20 percent coke and 2 percent Molasses with water and that gives a almost 10 millimeter average pallet diameter. But with without molasses and 1 percent Bentonite that gives a quite low average pallet diameter and there are various parameters and other different parameter which affect this.

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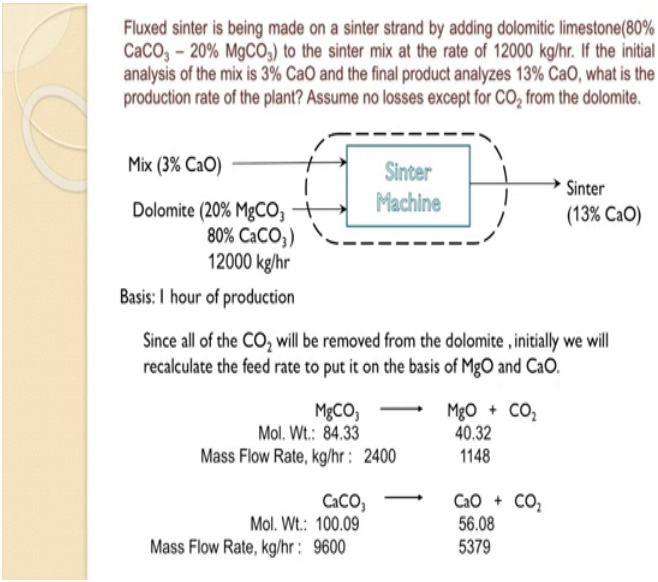

Now, we will go to the one example for this sinter making. So, the flux sinter is being made on a sinter is stand by adding dolomite dolomitic limestone. So, dolomite dolomite usually has calcium carbonate and magnesium carbonate to the sinter mix at the rate of 12 ton per hour. If the initial analysis of the mixture of 3 percent CaO and the final product analyze 13 percent CaO and what is the production rate of the plant as you know losses except for CO 2 from the dolomite.

So, we have to find a production rate of the plant. So, we know 3 percent CaO is there in the mix. So, we can make a material balance figure and we are 14 dolomite 12 ton per hour which is containing 20 percent MgO 3 and 80 percent calcium carbonate and the sinter which is coming out contains 13 percent CaO which is given.

So, our calculation straight on for our basis. So, since all the CO 2 will be removed from the dolomite like MgO plus CO 2 and CaO plus CO 2 with high temperature in the sintering ah. So, initially we will recalculate the feed rate to put it on the basis of magnesium oxide and lime. So, we can write this equation of dissociation of magnesium carbonate. So, 84.33 kg in one ways gives you around 40 kg magnesium oxide. And if we look at the flow rate is this and 20 percent magnesium oxide. So, really that will gives you about 2400kg per hour and input of the MgO, Mg, magnesium carbonate and the equivalent MgO which one will expect about 1148 kg.

Similarly, we can do the calculation for calcium carbonate association and all lime goes to the sinter. So, the mass flow rate of lime 80 percent of this between 9600 kg per hour which will gives you 5379 kg per hour lime.

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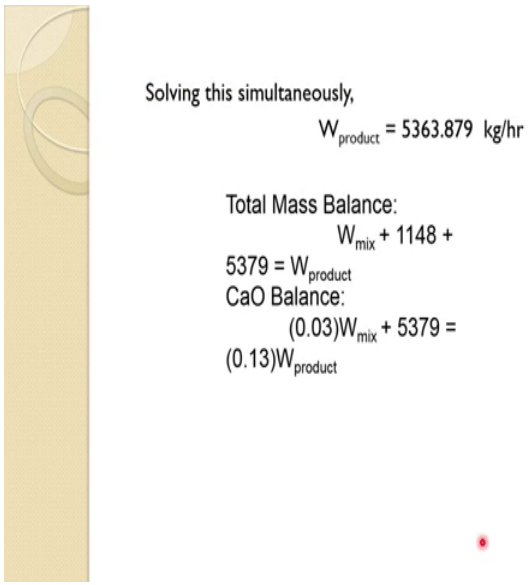

And now we will be solve this together, doing the mass balance we will get a project product 5363.9. I think there, there is a change in this. So, total mass balance if you do it. So, W mix plus 1148 MgO plus 5379 CaO equal to product. So, now, W mix is no for CaO organs such a 0.03 it is saying about 3 percent it said CaO in the mixture. So, this plus this should be giving 13 percent CaO in the product.

So, this another CaO balance , this is normal mass balance. So, 2 equation 2 variables we solve it , we get the product which would be 5363 kg per hour.

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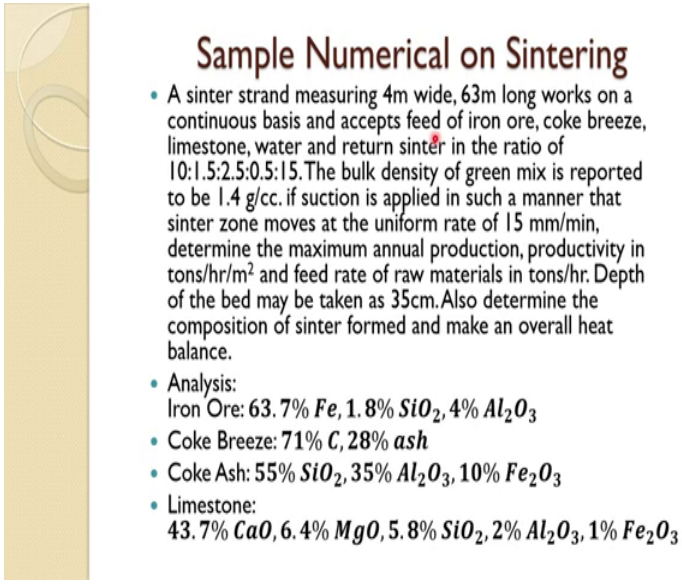

So, this is the the production rate of the plant. So, 5363 kg per hour sinter we will get. Another example for the sintering ah; so, this is a sinter strand measuring 4 meter wide, 63 meter long it is strand works on a continuous basis and accepts feed of iron ore, coke breeze, limestone water and return sinter in the ratio of 10 to 1.5 to 2.5 to 0.5 to 15.

So, the bulk density of green mix is reported to be 1.4 gram per cc, centimeter cube. So, if suction is applied in such a manner that sinter zone moves at the uniform rate of 15 millimeter per minute , determine the maximum annual production productivity in transfer hour per meter square and feed rate of the raw material in tons per hour. So, depth of the bed it is given 35 centimeter and determine decomposition of sinter formed , make an overall heat balance.

So, analysis of iron ore is given 63.7 percent of 1.8 percent silica and 4 percent alumina , coke breeze about 71 point 71 percent carbon 28 percent ash and the ash analysis 55 percent silica, 35 percent Al 2 O 3, 10 percent Fe 2 O 3 and limestone 43.7 percent lime , 6.4 percent magnesium oxide, 5.8 percent silica, 2 percent alumina and 1 percent Fe 2 O 3.

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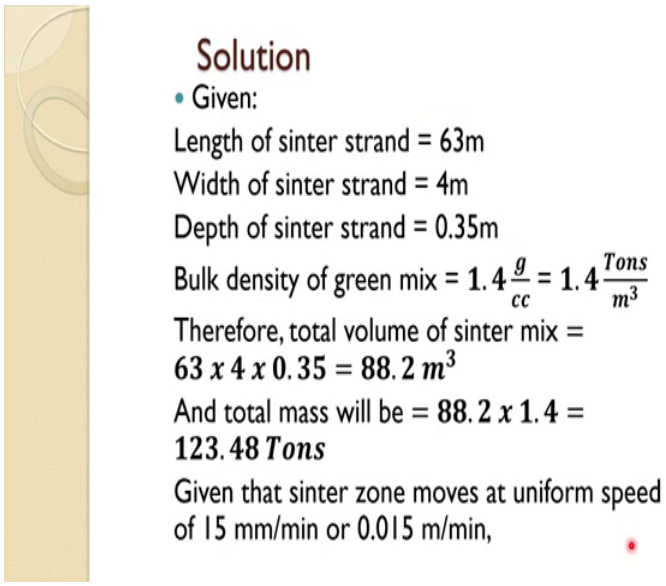

So, if we because this is a given strand length and the strand width is given and depth is given and green density is given of the mixture.

So, which in the form of 1400 kg per meter cube or 1.4 ton per meter cube could be the density and the volume of the mix can be obtained by multiplying this 3 which come to the 88.2 meter cube. So, that gives the volume of the mix which is there on the strand. So, total mass should be multiply this with a green density will give us the total mass of 1 point 123.48 tons. So, given that sinter zone moves as uniform speed of 15 millimeter per minute we can get the speed in meters per minutes 0.015 meter per minute.

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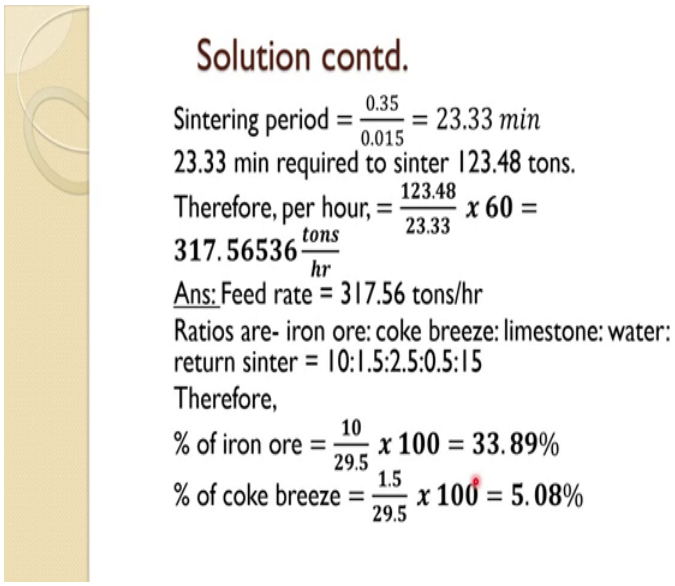

So, sintering period in that way we can calculate because it is a depth is given 35 millimeter. So, from that , we will get the sintering 23.3 minutes. So, it will take about 23.3 minute.

Ah and in 23.3 minutes ah, total mix of which is getting synthesis about 123.5 ton ah. So, therefore, per hour if we do it on per hour basis, it will come to 317 tons per hour. So, feed rate it is required ah, that what is the feed rate. So, feed rate would be about 317 ton per hour and ratio is given.

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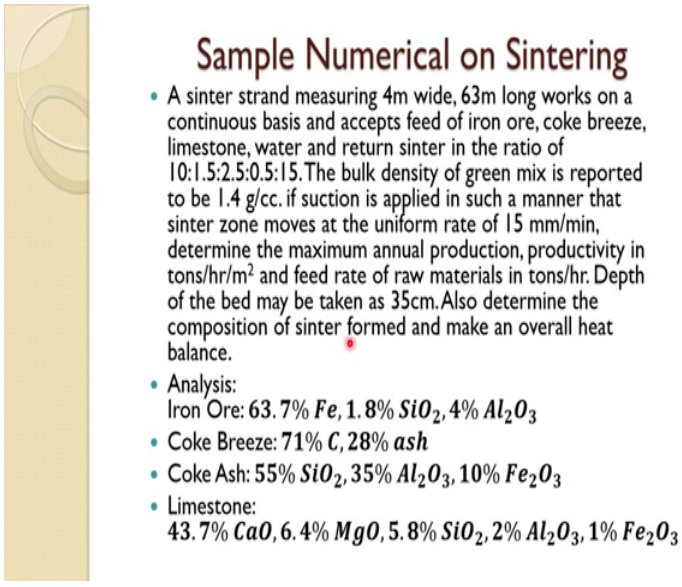

Now the second question is coming about so maximum annual production productivity and feed rate. So, feed rates you got it. Now the annual product production and productivity, now it is given this iron coke limestone water and sinter return they are in this ratio.

So, therefore, iron ores in terms of percentage, we can write it total of this is 29.5. So, percentage vise iron ore would be 34 percent ; similarly coke breeze could be 5 percent.

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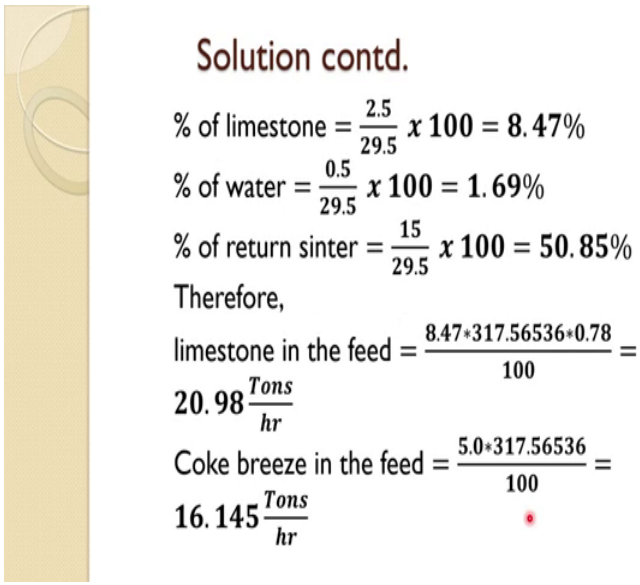

Limestone would be around 8.5 percent, water is 1.7 percent and the sinter return is about 51 percent. So, once we know this, then we can calculate the feed of lime limestone in the feed we know at 0.47 then, now we know the total this fee feed rate and the percentage of what we have in the limestone with the of CaO we can and from that we can calculate this factor.

So, it comes to 21ton per hour and coke breeze in the feed get the value of 16.1 tons per hour.

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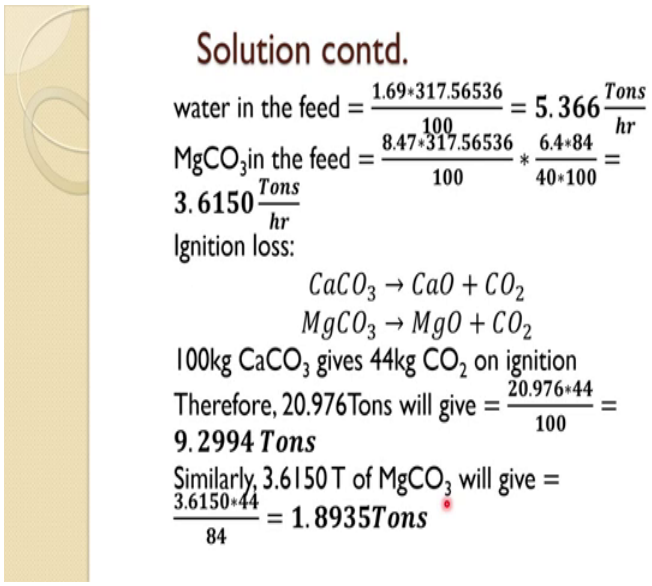

And waters also we can get in a similar way. Magnesium I can with a, what is the percentage given in the limestone with that. We can get 3.6 tons per hours in the feed. Now ignition loss because only calcium magnesium carbonate dissociate into lime and magnesium oxide. So, 100 kg gives about 40 kg CO 2 and the comparisons. So, the. So, we know our limestone is about 21 ton. So therefore, this many ton will gives us about 9.23 tons of CO 2. Similarly, we can calculate for magnesium carbonate, the CO 2 which would be going away. So, that would be the ignition loss.

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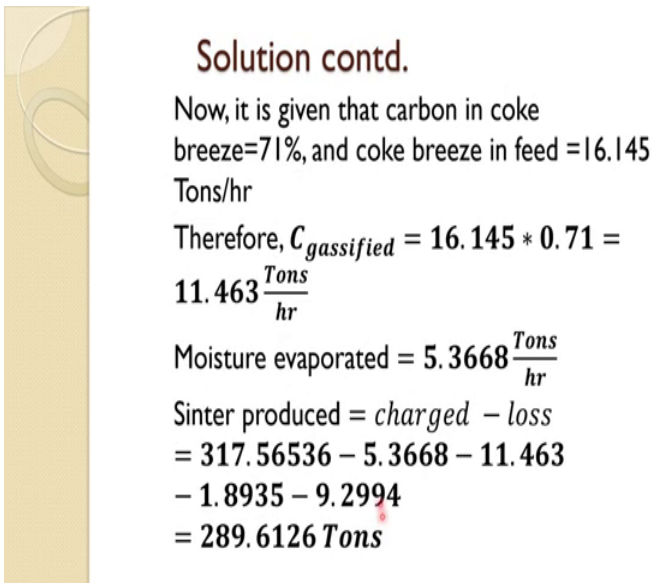

and it is also given that coke breeze has 71 percent coke in that.

So, and feed rate is 16 point 16.145 tons per hour. So, carbon gasified because the all carbon is getting 1. So, this into 0.71 will gives you the fixed carbon. So, this is the tons per hour carbon is being gasified. And moisture evaporated, water vapor moisture is there water gets evaporated which we calculated previously. So, sinter produced equals charged minus loss. So, that this is the charge and all the moisture and CO 2 this would with a loss. So, essentially, you get 289 tons at the sinter produce.

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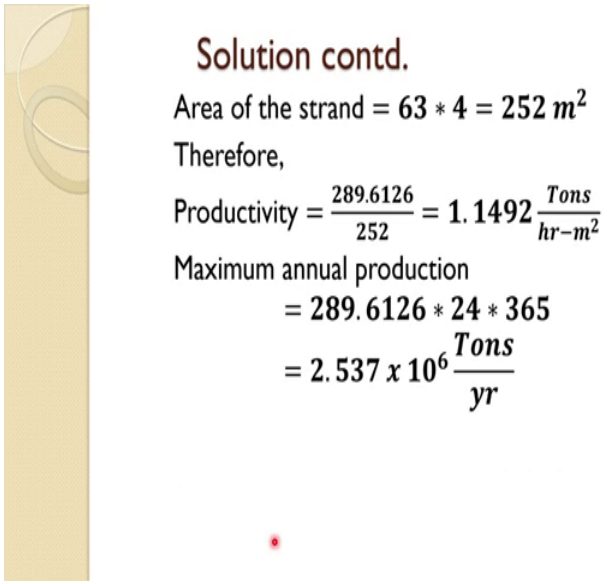

In terms of Productivity, we know the sinter strand area. This is given the length and the width. So, we divide this one. So, we our sinter product. It will gives you about 1.1 ton per hour meter square and that could be the sinter productivity in terms of usually productivity is or productions give it in terms of ton per year. So, we can multiply this hours, days and year, 1 year.

So, that will gives you 2.5 into 10 to the power 6 tons per year. So, this would be the product, production of the sintering plant. And this would be the productivity of this sintering machine ah. I have left this there is another question about the ah; determine the composition of sinter form and make an overall equivalence. We have already got how much case is forming and going out; in this same way, this can be done and I will leave this to the readers or who are taking this course as an exercise and this would try to calculate this ah. We have done this sort of example in the last part.

So, it should not be much problem in that. So, this example show the simple mass balance and how do you calculate the productivity and the products on in any plant. So, this were related with the sintering.