Textured Yarn Technology
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Lecture – 22
Air-jet texturing contd.

So, we are continuing with Air-jet texturing. Last time, we had covered some definitions of the air jet textured yarns.

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And, we noted there are list three major processes, which are called the opening of the filaments, loop formation, entanglement. These are the three things which must happen before an air jet textured yarn is useful and is produced and some advantage and application of air jet textured yarns.

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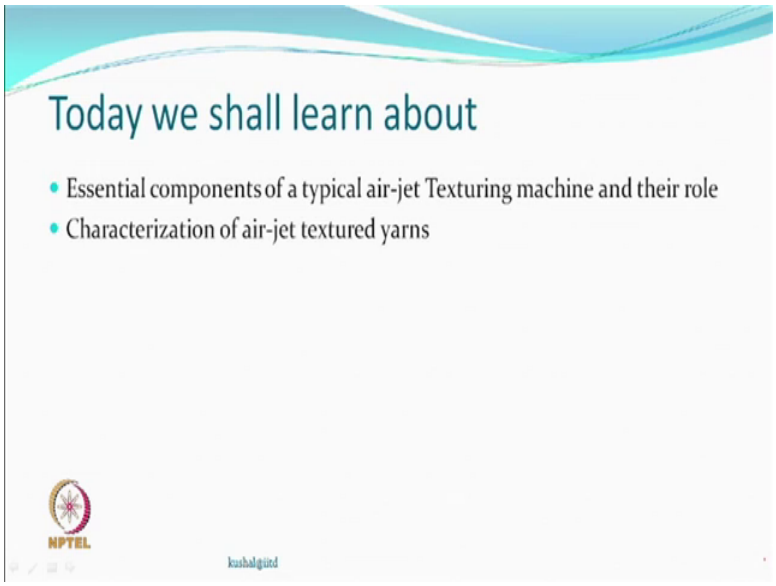

Today, we will try to learn about some other essential components of a typical air jet texturing machine, and their role and how do we characterize in air jet textured yarn.

So, let us first look into some of the possible components in a full air jet texturing machine.

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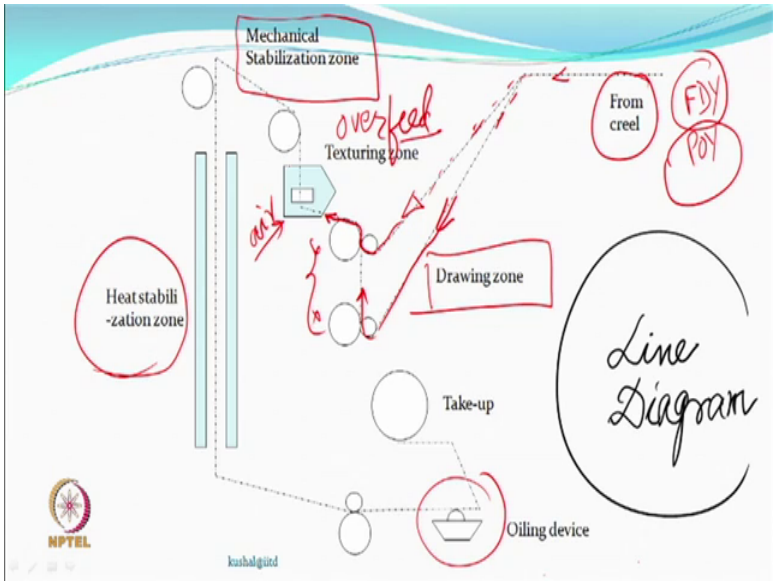

So, if you look at a line diagram of a machine, this looks a pretty complex thing with everything there. So, you have a creel from where you can pick up the yarn to be texturized. Interestingly, this can happen then you may have a fully drawn yarn for

texturizing or you can have a POY for texturizing. So, depending upon whether you have a fully drawn yarn or a POY your threading sequence may be different. For example, if it is a fully drawn yarn, it may take a path like this and go here and then from here, go to air texturing zone all right.

So, you have a fully drawn yarn which can move in this way, because it is already been drawn, so we does not need any drawing. In case you have a POY which means this is not a fully drawn yarn, then this machine has zone which is called drawings zone. So, between these two sets of rollers one can do the drawing. Now, so your threading sequence from the creel will be now different.

So, you come this way, and then go this way, and then you have a drawings zone. So, between these two rollers there will be drawing taking place. So, if you have a fully drawn yarn you take a different path, if you have on drawn or a POY yarn, which is going to be the general raw material. In such a case then you take a different path and then go to a zone called a drawing zone. If I ask this time that what kind of a sequence, this will be called this should be a sequence where first there is drawing and then there is texturing.

So, in some sense we calling, it as sequential draw texturing machine, can we think that we will be able to do simultaneous draw texturing as well can be think or design a machine where instead of sequential draw texturing which is the case, which is being shown here that if you have a POY first you take it to drawings zone, then draw and then feed it to the texturing zone.

So, what I just wanted to ask is you think it is possible to design a machine, where we can combine the drying and texturing in one process and, make it sequential draw texturing machine, the way we had done in a falls twist system can we do it.

Student: No, Sir.

No or Yes?

Student: Yes.

Yes, all right. So, there is one response called the yes, that sequential all simultaneous draw texturing can be done. Any other response? No response all right.

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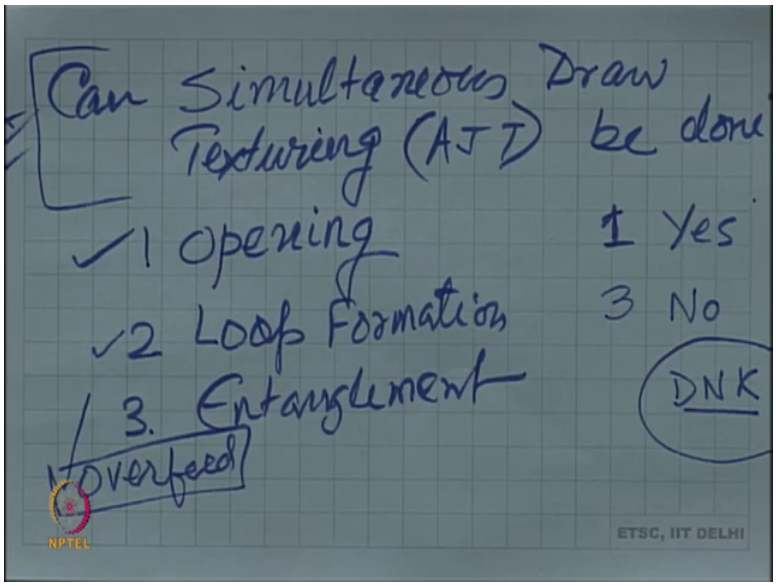

So, the question is can simultaneous draw texturing and which means we are talking about air jet texturing be done. So, somebody says yes, so you making a design and other response is not come here; that means, it can be done. At the belief or they somebody who likes it cannot be done; yes, you saying something. So, I believe that there are three answers a no, and yes and do not know.

So, how many people believe that it can be done which is yes, the one person who said there is also can know it is there. So, we have at least one person saying that, how many people believe that it is no. So, after all the hard work we have about three people, who think it cannot be done. And, the others obviously, are in this range, because the class is pretty big all right so ok.

So, before we answer this question you should obviously know approximately the basic steps that we had discussed last time, for making an air jet textured yarn were opening, then loop formation and third was entanglement.

So, opening can take place; let us say which are way takes place that the filament get separated; how do the loop formation take place?

Student: Sir, overfeed (Refer Time: 08:50).

Overfeed. So, this is an important thing. If overfeed has to take place and then, we ask this question. So, can you do drawing as well as overfeeding together? So, simultaneous

draw texturing and air jet texturing machine cannot be done. So, I hope when next time somebody ask this question, everybody will have the same answer, they will be interesting.

So, we come back to our own original sequence line diagram. So, it says that either you need a drawing, if you need then you go to a drawing zone. First draw the machine, there is a yarn and then feed it to the texturing zone. In the texturing zone, when it is fed, it is actually a fully drawn yarn, when it is being to fed to the texturing zone.

So, between the texturing zone, what will be there? Some texturing must be a creel; that means you will give overfeeding, we said overfeeding. So, between these zone you will have some overfeed. Of course, you will have some air pressure compressed air, which will be there to do whatever will job. So, this is like a zone, which is the texturing zone.

So, theoretically in a air jet texturing machine this is these zone, which is because of which is called air jet texturing machine. What we are doing before is the requirement of the material. So, zone texturing is happening there. After, that you see something called a mechanical stabilization zone.

So, after texturing is complete, most of the machines would also have a mechanical stabilization zone. If you remember we said air jet textured yarn, textured yarn, will be successful yarn, useful yarn, if entanglements are good. If the loops that have been formed can open then it is not a good yarn.

So, if you supply the yarn immediately after which has been just air jet texturize and give it to the user he may complain that it has got very unacceptable instability all right. If it is unacceptable instability then obviously your material you are going to comeback. So, they say whatever how will you find that is unstable, because maybe it is using is the op yarn there is tension. If there is tension the loops will open.

So, this is says why not we put the tension. So, that the let the loops be open in the manufacturing area. So, that when you give it to the customer this follow is happy.

So, there is something called a mechanical stabilization; what it means is you are giving tension; give tension in the zone. So, what will clear mean is? You are doing some amount of scratching that is how we put the tension. So, you have overfeed and then you

have a stretching. Then, the machines may also have a thermal stabilization or a heat stabilization zone which is just like you can see it is a tubular heater, it is a tubular heater, where yarn which has already been texturized, which is already been stabilize the bit is now being pass through another heater.

This will be used only if there is a thermoplastic yarn. If you have a viscose being air jet texturize, you do not have to use this zone. But what you will do it the heater is will not be resist on the machine may still have because you do not make a machine for viscous in the other machine for that ok. And, then of course, after this it will go through oil application device, in case something you going to be lost, then you have already learnt the lesson in the falls list this may be replenished.

So, if you look at this whole machine, it looks like as big and as complex machine as any other machine. So, you have a creel from where the things will start; creel will obviously have detecting system is whether the yarn is broken, not broken it is being fred, something will be there and then you can take it through. Theoretically, you can also have another feeding system, where all of them let say even if all of them are fully drawn you may like to give different overfeed.

So, within the same jet you may like to give different overfeed to different yarns and what will that happen? It will be able to take some of the yarn to the surfaces of the surface of the yarn, some filaments will go and the core preferentially, because overfeed may be less.

So, you can have another system, where different amount of overfeed can be given to different yarns which are together being fix, finally being fed to the air jet texturing zone. So, you can make fancy yarns, you can make core and effect yarns, within the same thing and of course, if one of them is a POY are there is a viscose.

So, you can feed viscose directly, take the POY let us say polyester through the drawing zone and finally, they go to the air jet texturing zone together maybe at the same overfeed. If they go with the same overfeed, then they will get properly mixed. So, you will find polyester as well as viscous on the surface approximately probabilistically in equal amount. If you do the little bit of manipulation; that means, polyester is given less overfeed viscose is given more overfeed, then you will be able to get another yarn which

will have large number of possibility of large amount of viscose on the surface and polyester mostly in core that can you think produce.

And, of course, all of them should be stabilize mechanically and then it is re stabilized.

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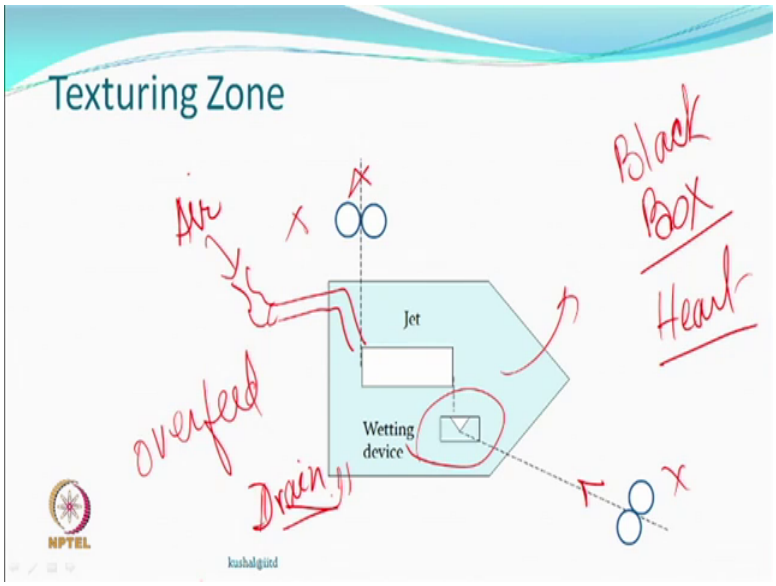

So, the texturing zone, which is the heart of the machine, it is look like a black box which is the heart of the machine. If, one opens the texturing zone, it may be a box, the box may have a led which you can open, a led which can be open, it may have a threading sequence that the yarn is coming from somewhere and getting out, between these two sets of rollers you have overfeed.

Of course, in between it may be connected to compressed air and it may also have a device which is called a wetting device, where the yarn is initially given a little bit of moisture applied, a little bit if moisture before it enters the air jet. So, this so called texturing zone, which is got two sets of rollers where overfeed can be done. You of course, have a air jet which is the main component which is responsible for whatever is happening to the yarn. May have a supplementary component called a wetting device. And, this whole thing is covered two things once you cover the noise level comes down, because this whole process will have make some noise you can do that. In case there is something called wetting happening you may do you may not do, then they may be some spraying of moisture. So, which may not go everywhere; so, it may remain contained

within that small box and you can drain it out in case there is a water which condenser you can may have a drain.

So, simple system, but still you may have little bit of a complex things. So, what we do here obviously in texturing zone, you will probably try to have some control on the overfeed, you may like to have some control with air pressure, you may like to have some control on wetting, and then become. So, there is the main part of the machine.

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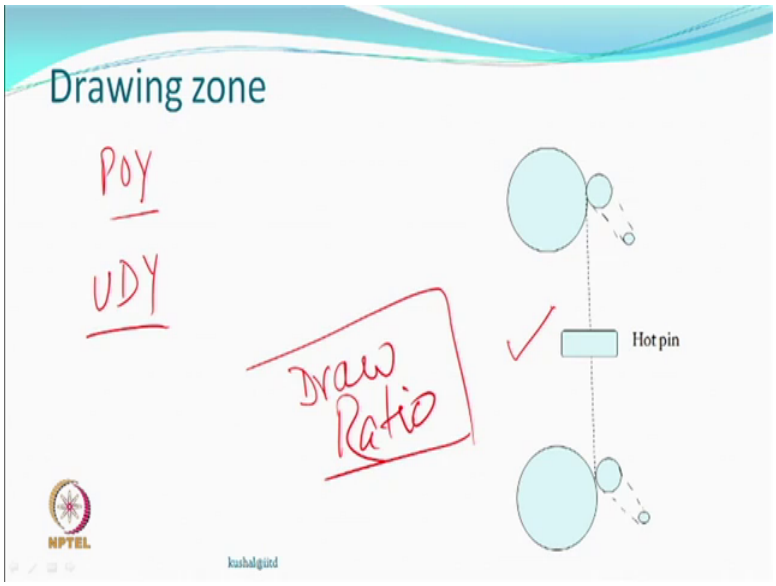

Drawing zone; obviously, for the undrawn or POY machine materials only, if one uses. So, it have two sets of got it is, where there will be drawing taking place. So, you will give some want of draw you show here based on the characteristic of the POY or undrawn yarn so that finally, you are able to get a fully drawn yarn at the end, it is written somewhere this is the hot pin, what it means is that in case you have materials like polyester, which needed to be drawn at a temperature higher than the room temperature. So, you take it overdose hot pins.

So, temperature will rise and you will be able to do the drawing more effectively. In case you have materials like nylon, where the glass and temperature may below and nylons can be drawn at room temperature also. So, you would not need hot pin or you may not hit the hot pin all right and you can do the drawing. So, once the drawing is done. So, therefore, every machine will have a drawing zone may be used, may not be used.

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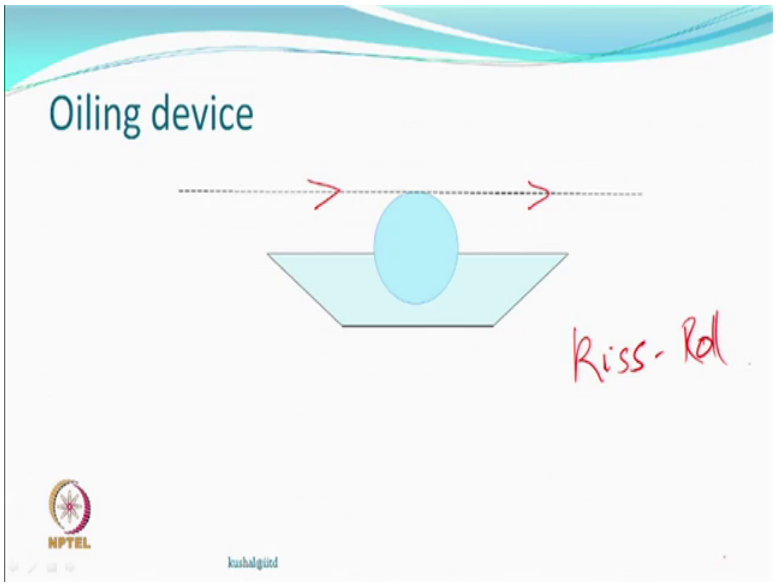

The oiling device with only in case you have used a heater and because the POY may be finished spin finished with the same type of a spin finish as is being used for the POY for falls list. It may have components which can get evaporated, then you would require an oiling device. In case you are not using thermoplastic yarn roll, then you do not need to use this, you can always bypass or just let it be there.

So, there is only reason why you may like to use and same type of oiling device which is like a will works on a kiss roll principle.

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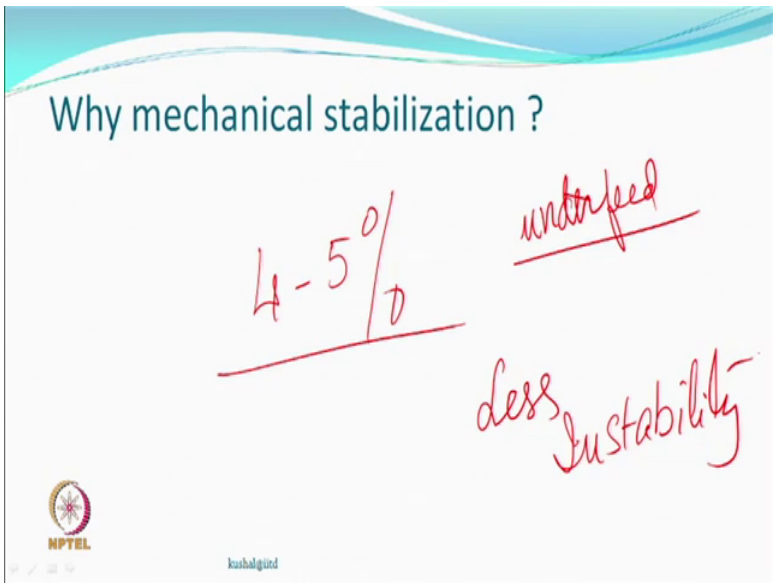

So, we now understand why do we require a mechanical stabilization zone, here you will do underfeeding; how much underfeed this will depend on what ever done in your air jet texturing zone; sometimes 4 to 5 percent stretch you may give. So, that loops which are not entangled very much they get open. And, entanglements which were probably less tight may be come tighter.

So, in the next time when you want to use this, you will find entanglements are better. Because, there may be opening and some things which are let us say covering the rest of the bundle, they may when you open they may become tighter. And, once they become tighter obviously, entanglement is more effective and so at a later stage, this may not open.

So, you will be producing yarn with less instability, this is to satisfy your customer.

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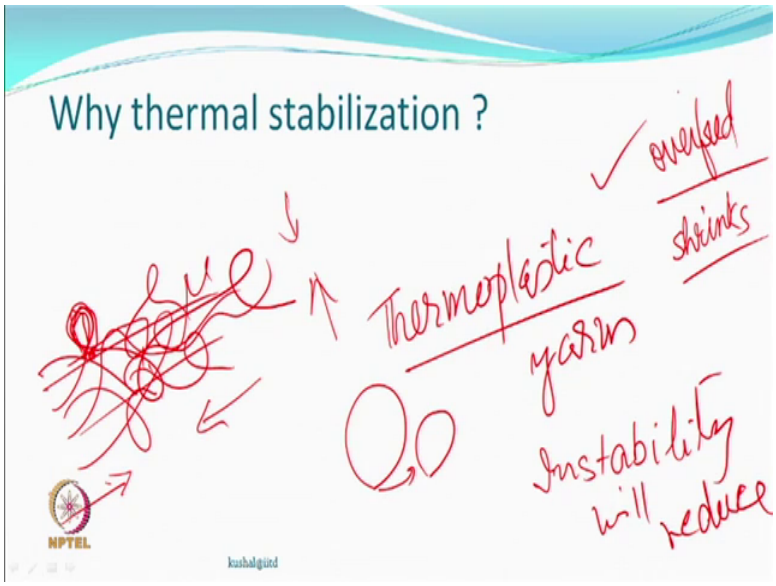

Then, we said thermal stabilization in case it is required, obviously it is for only if you are using thermoplastic yarns. In this zone a thermoplastic yarn whenever it is going to be heated it will shrink. A fully drawn yarn when heated or thermoplastic fully grown yarn when heated will shrink, you should so what would happen? The yarn that you are giving is a fully drawn yarn, but already air jet texturized. This is not a parallel bundle of element.

So, the yarn may have loops, protruding and entangled may be; so what would happen? When the shrink, there is a possibility that this may shrink like this, there is a possibility that it may shrink like this, there is a possibility that the loop size which is here the loop shrinks by itself which is entangled somewhere there. So, a large loop after thermal treatment may become a smaller loop, but if there is something called in entanglement like this, this will also shrink and it will again become tighter.

So, whatever you are trying to do with the mechanical stabilization, this will only be accentuated further. The larger loops can become small, the yarn overall can shrink, the entanglements can become tighter, and so instability will reduce. So, instability reduces. So, this is a good thing to happen from the customer point of you and therefore, for the person who is the manufacturer also.

So, what will to do here underfeed or overfeed in the zone?

Student: Over feed.

So, we will give some overfeed; does it mean then we no tension the yarn, because your overfeeding no tension in the yarn, yes or no. There will be tension because it will shrink, it will shrink. So, you will not have, you will not have additional length. So, that additional length which we are giving as an overfeed will become less, because it shrinks. So, you will give overfeed here ok.

So, now you have look at this drawing zone, you are obviously, giving a draw ratio stretching. Air jet texturing zone, you are over feeding; mechanical stabilization, you are stretching, in thermal zone, you are overfeeding. So, you are not making life easy for anyone. So, theoretically everywhere there is a parameter which can be controlled go to drawing parameters have to be controlled. If, we go to heat stabilization that parameters to be controlled, you mechanical stabilization that parameters to be optimize air jet of course, of course, has to be done.

So, we looking at only air jet, but if we look at the whole machine you got many more components all of them will have to be handled correctly. If, you make mistakes in one so there with you will have some consequences also.

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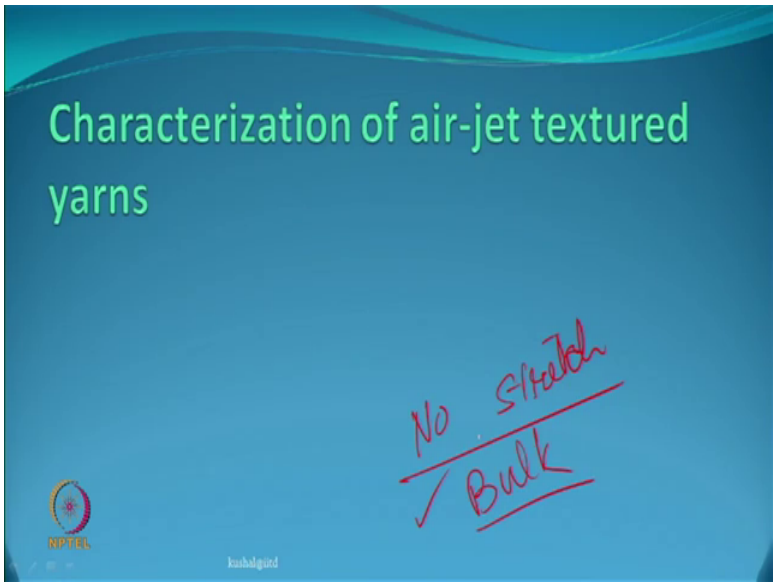

So, before we say that optimization parameter etcetera. So, we should know exactly, how would you like to characterize and air jet texture yarn? In fall streets if you remember we had crimp rigidity, cream stability etcetera, which were the important characterization technique methods. Here we have to do it in different way; why? Because this yarn has no stretch remember, there is only we expect only bulk to increase. So, obviously, we say bulk must be measured, so bulk is one part which you may be interested.

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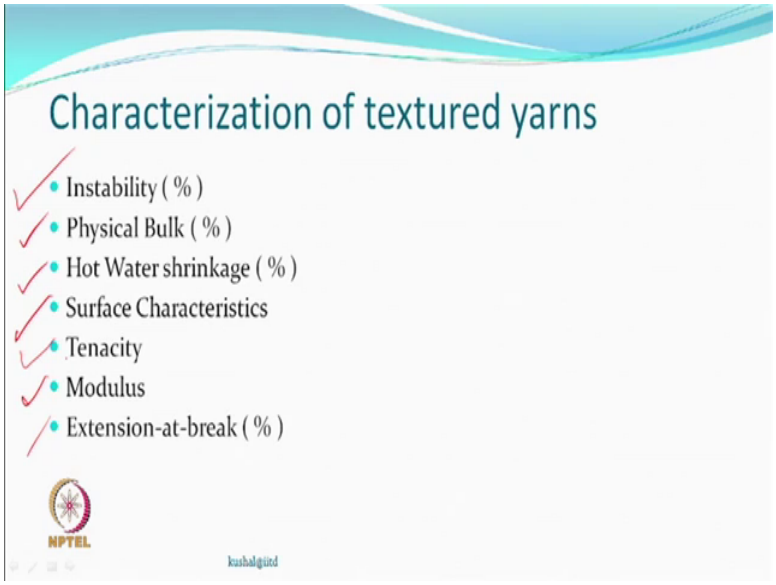

So, people may like to have many types of method, you can still add on to this one way or the other. Instability is one important parameter which must be measured. Because, if instability is more, there is no point and you can say then yarn. And, that is the reason if we remember our machine speeds originally have been very slow, so that you could at least do something to the instability.

Physical bulk percentage; so you want to know you started from whatever bulk that the specific volume and at the end of the texturizing process, complete texturizing process, which may have gone through the air jet texturing may have gone through mechanical stabilization, may have gone to thermal stabilization. After, the end of the day what is the final increase in the bulk, that you will be interested?

Shrinkage anybody will like to measure anytime whenever you want to do the shrinkage. Hot water shrinkage means, that you actually looking at thermoplastic material which actually can get affect by thermal treatment this is one, but you can measure any kind of shrinkage, one always believe that a room temperature shrinkage may be less. So, you go for a little higher and look at us because we say washing machine or anything else the temperatures could be different.

Surface characteristics means that you obviously this yarn does not look like the way it used to be is got loops, crinkles and we said that it looks more like aspen yarn, whether it does not, one may be interested in measuring. Some of the characteristics, which may be connected to what the above three properties are there in some way.

Of course, you may like to worry about tenacity. If, it is let us say a non-thermoplastic yarn is gone through mechanical process which is the air jet texturing. So, no micro structural morphological changes are going to take place within the filament we expect that. If you do thermal stabilization of course, you can expect something, but if you are not doing any thermal civilization.

Then, do you do not expect any intra fibre morphological change, no crystallinity change, no orientation change, no module I change should take place within the filaments. What about the tenacity? In the other case, which is the falls is texturing. We said the tenacity of the textured yarn a lower right. Because lot of morphological change we taking place, orientation was had changed, crystallization was taking place and so on and so forth.

Here, what do you think? I mean we must be interested in measuring tenacity because we have to cell yarn. So, just giving this question assuming that there is no thermoplastic yarn or even if there thermoplastic yarn we have not gone through the thermal stabilization zone. What should be what should be happening to the tenacity compared to the parent yarn that you taken. And, here you can appreciate the parent yarn finally, which is going into the texturing zone is a fully drawn yarn. Yeah. Yes, not much change let me just me let me go back here. Now, whatever looking at tenacity of a textured yarn, Air jet textured yarn.

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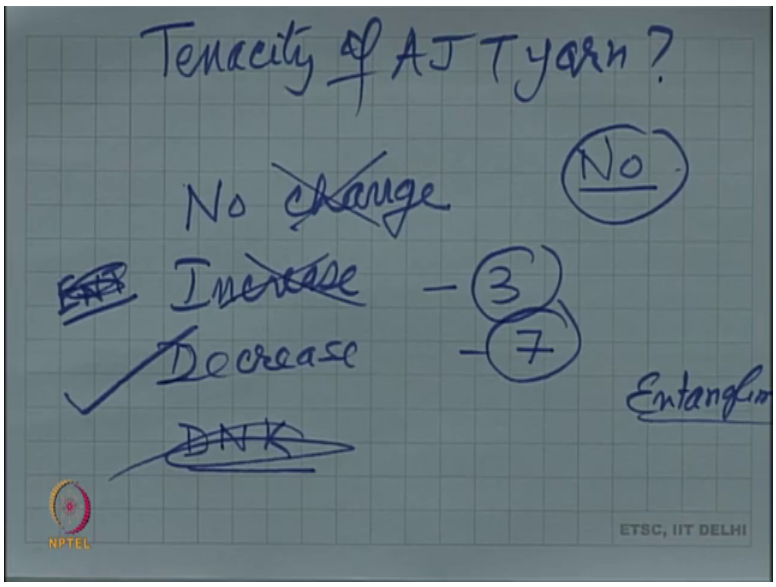

So, one response I receive just now, something called not much of a change. Any, other response instead of let us say, response we put it in terms of tenacity no change, we are comparing with parent yarn, it will increase, it will decrease, let us put it all the options in life, that we have law of Tracheotomy.

So, how many people believe there is no change. How many people believe?. Raise your hands; at least one should have been there ok. That is also gone, how many people believe in increase. So, there are at least two, three people who believe that it can increase. And, how many people believe there will be decreasing? Though more number of people who believe that there will be decrease and, rest of course, another think do not know ok. But, in any case why do people who think it should increase, they believe that you should increase? Those who said that that can increase, why should increase?

Student: Because of entanglements.

Because of entanglements; that means, there are entanglements. So, because of entanglements, which are not there in the other yarn, it may increase, because there is a compressive force right. The people who believe that is going to decrease, why do they believe that they will decrease? So, it would not just the polling you know, it has a consequences, you electron government, then you will have to basically see what happen ok. So, where you believe that there is no change, no there is a decrease or was it in arbitrary nice thought yes.

Student: Filament orientation is decreased.

All right. So, one answer is come that, the filaments after air jet a shrink or not parallel to each other. In a fully drawn yarn before texturing all the filaments were parallel to each other. And, now after all these loop formation entanglements, the filaments are not parallel to each other. And, therefore, they are not contributing to the tenacity or the strengths, some of them may be almost oblique to the direction of the force which is being applied. So, the percentage of the filaments contributing towards the yarn tenacity, textured yarn tenacity, maybe less and so it decreases.

So, this is not right this is not right change of course, must take place we do not know what is this. The tenacity of the air jet textured yarns will decrease after texturing, because the filaments are not parallel to each other the contribution is low not so much so, if you really produce a very good air jet textured yarn. The tenacity can go down by 40 percent, 50 percent, which was not even the case, when the falls is texturing is done (Refer Time: 38:16). A material process at which does not change anything in the yarn can finally, change the tenacity reduce tenacity significantly.

So, somebody should be interested in measuring tenacity. If we does chain, then it does chain. So, in fact, if you just take it put it the other way, if you do a bad job in air jet texturing that mean instabilities high, your tenacity maybe high, not higher than the parent yarn.

But, if you done a good texturing where your entanglements are very good, loops have been form quite a lot, bulk has increased tremendously, you say that tenacity is gone down and significant. Of course, you will be interested to know about the modular which

will also means that how much resistance is being offered and extension break these are some more thing, which you may be able to measure in the same normal way, the way you measure anything. This yarn obviously, does not have stretch Instability.

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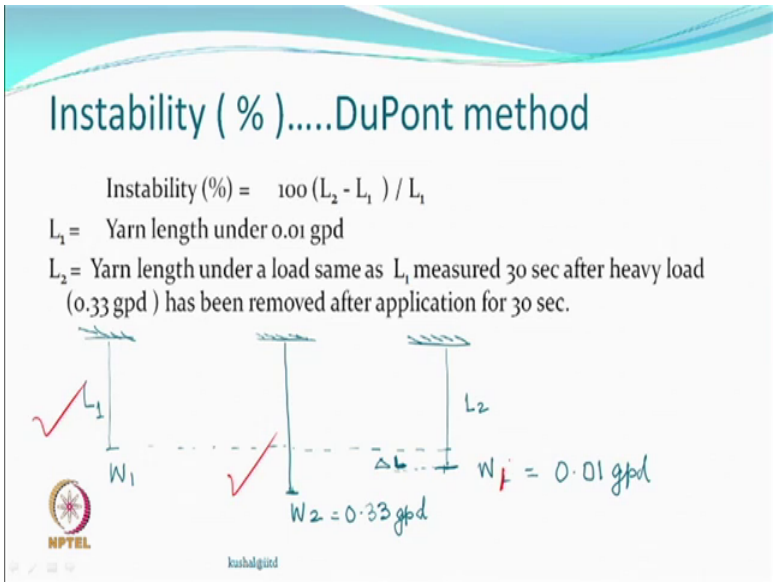

So, what you do? You put a weight, which is W 1 you can call it to measure the length of the yarn. Let us say whatever the length of the yarn is and then you put another load, which is heavier the W 1 is about 0.01 grams per denier, W 2 is 0.33 DuPont somehow decided the this is kind of load that will have to this is one of the processes there are other processes also. So, then you remove the load, the heavy load and under the under the small load, it is retracting. So, it retracts. So, initially you have some load just to measure the length, then you put a heavy load, then it extends and then maybe it recovers, but does not go back to the same level, but under the load which is the same load which is W 1, W 1.

And, then see, what is the permanent change in length? So, you might find the length is permanently increased. So, obviously, you do not want permanent increase in lengths to be high. If the length increase is more than 10 percent I am sure people not going to be happy. I maybe everybody have is happy having a more number of meters of the yarn instead of 1 kilo meter, you have 1.25 kilometers of the yarn. So, you can be happy, but the mass is same. And, of course, it is opened and so you do not exactly what you are going to do how do you control your processes?

So, that is one method of measuring instability, you will want the instability to be as lesson the possible. So, when you say I am going to optimize in terms of pressure, in terms of overfeed, in terms of anything else, you will be tempted to first measure in stability. It is the reverse of the stability, but that is how people believe, they like to measure rather than measure stability. You could have done the reverse and then stability of the yarn, but the somehow got stuck to the instability, which had cause more problems in so this is how you work around there.

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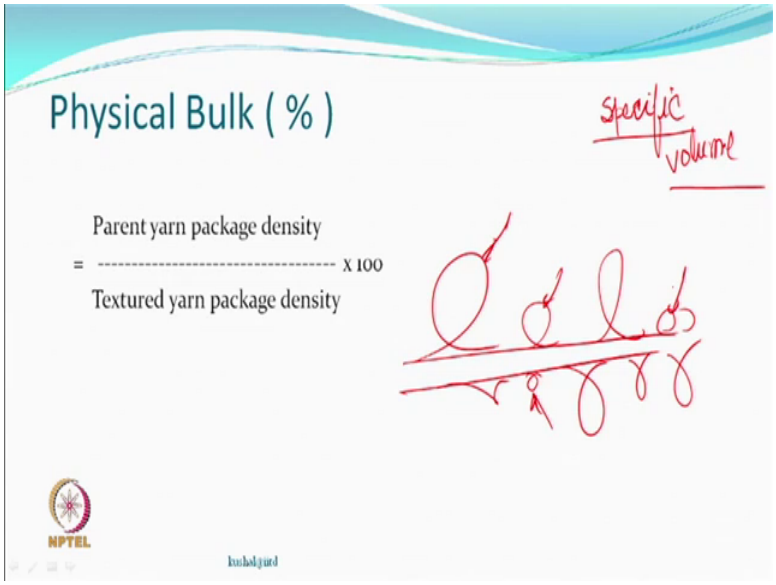

The bulk, bulk means specific volume. So, how would you measure the physical bulk? Now, you have yarn which has been produced and now you have the, you see the bulk is increased now want to measure how do we measure? So, suppose you want to measure that there was a parent yarn we have something and now you want to measure the textured yarn. What does the possible ways in which you can measure, let us put it this way.

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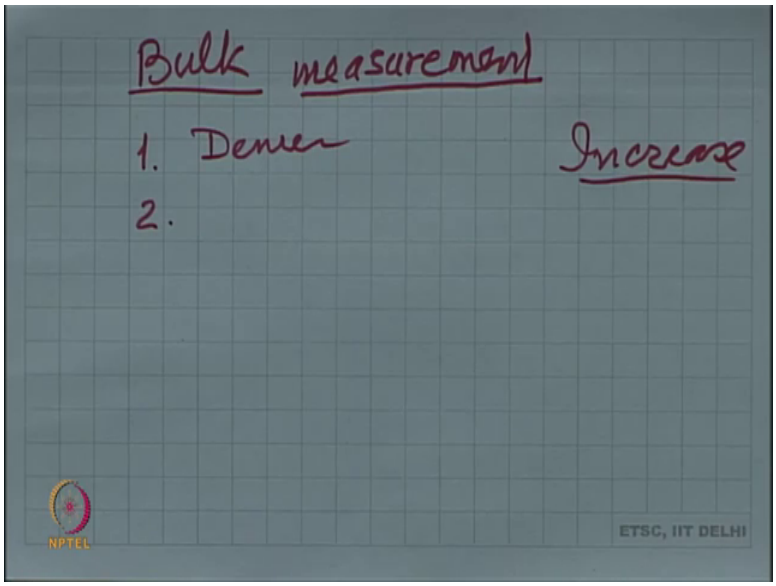

Can you say something, what about denier, cannot be used, cannot be used, what can be used in? How would like to measure will the denier change or not of the will it increase or decrease?

Student: It will increase, increase.

Yeah?

Student: Increase.

It should increase I believe, why, because you are given some overfeed, for the same length of this new yarn you have more mass you true a not.

Student: (Refer Time: 44:41).

So, overfeed the denier are in some once related, but after giving overfeed you may have given mechanical civilization. So, overfeed may be related, but you are doing undoing something; one does not know there may be assumption thermal shrinkage in case you are looking at then it will do something else, but finally, we have to have some way of measurement.

So, what I do is tell you exactly what people do and then, you can think of many other methods also. So, they would measure parent yarn package density you make a package. So, they measure let us a package density. And, then you have a textured yarn, which

also is found on the package and you measure the package density. And so, the bulk is defined as the simple term, but that is now the only way you can measure the bulk.

So, there is the reason why people will like to measure the bulk like this. A suppose you have a yarn, which is got where is types of loops and you want to measure the bulk. Linear change, it is no difficulty right you can measure the length and have the mass and so everything fine. But, that is not necessarily gets correlate with the bulk. The contribution of this versus this, versus this, to the bulk may be different. A suppose you compress, which loop is likely to give you more bulk; a smaller loop or a larger loop? Larger loop will give you higher bulk right. What does happen? Because the larger loops rigidity is so less you compress you just falls flat.

So, when you touch and see, yeah there is bulky, you say this fellow is not contributing. The smaller loop, if it is done by if you try to compress this fellow actually resists compression, does not want to change and if you have large number of small loops, versus small number of large loops, in the same overfeed. By changing let us say the condition of compressed air right the pressure. And, you might create more number of larger loops or smaller number of larger loops; so based on that the effective bulk will be different.

And therefore, people said that why not wind it on a package and then see which one is contributing more, which one is contribution less instead of that let us say wind it under the specified tension. And, you should be then able to see actual value of a bulk increase in practical sense. Although, other methods cannot be denied that they cannot be used all right. So, we will stop here and then pick it up next time.