Textured Yarn Technology
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Lecture – 17
Draw Texturing: Effect of process parameters

Alright. So, we proceed further covering more of the Effect of Process Parameters. So, what did we do?

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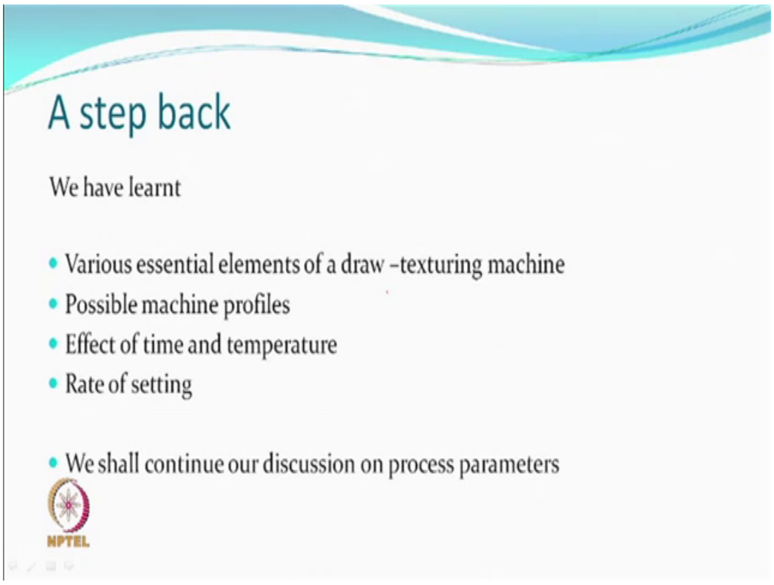

We had looked at various essential components of a draw texturing machine and possible machine profiles to ease the working effect of time and temperature. And, also in this context we tried to understand if there is something called rate of setting which can be defined. And we also understood that the rate of setting is not very specific to a material, it can vary within the same material also depending upon, how much draw you are doing what temperatures are you processing and so and so forth.

So, we shall continue our discussion on other parameters which are the process parameters.

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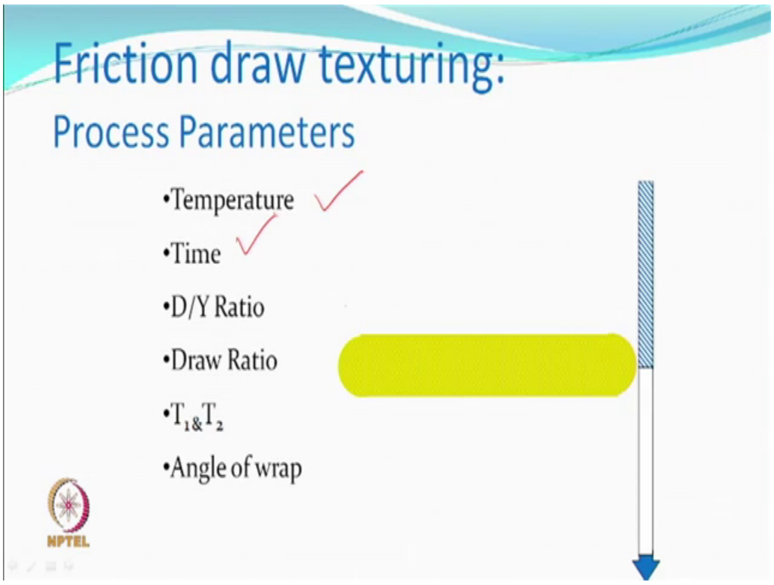

So, this these two in some sense we have finished, we were discussing something on the draw ratio D and Y ratio.

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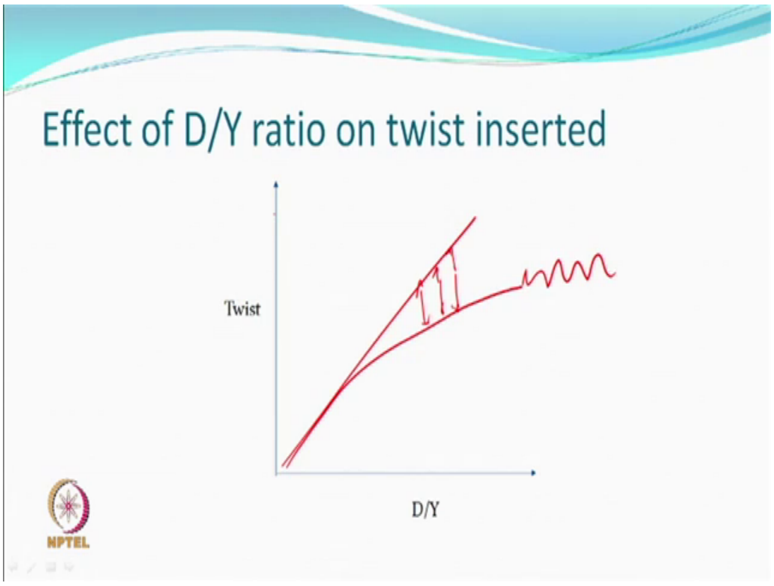

And what would we learned was that the D and Y ratio essentially, has is related with the twist being inserted into the yarn. And this twist insertion is not linear and so, there are slips as you keep on move increasing the D and Y ratio.

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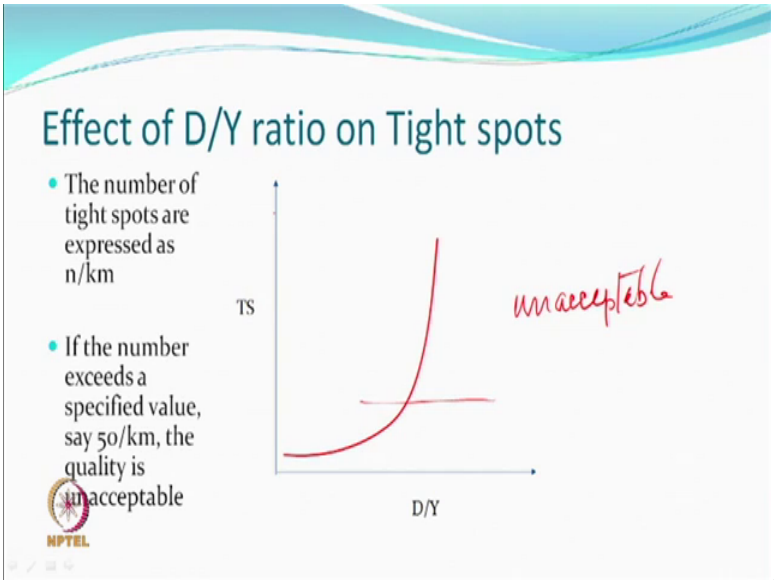

And also this found that because of this the tight spots increase exponentially after a certain value of the D and Y and therefore, one has to worry about the number.

This number could be expressed; obviously, numbers per unit length. The unit length you are expecting is kilometer. So, some numbers per kilometer of a yarn and this number should not exceed a certain value could be 50 per kilometer lesser the better beyond this there will be client is not going to be happy with the quality of the textured yarns. So, remember we are now talking about not the crimp rigidity which of course is important, but in the case of friction texturing, we are also interested in the quality which is being characterized by the tight spots.

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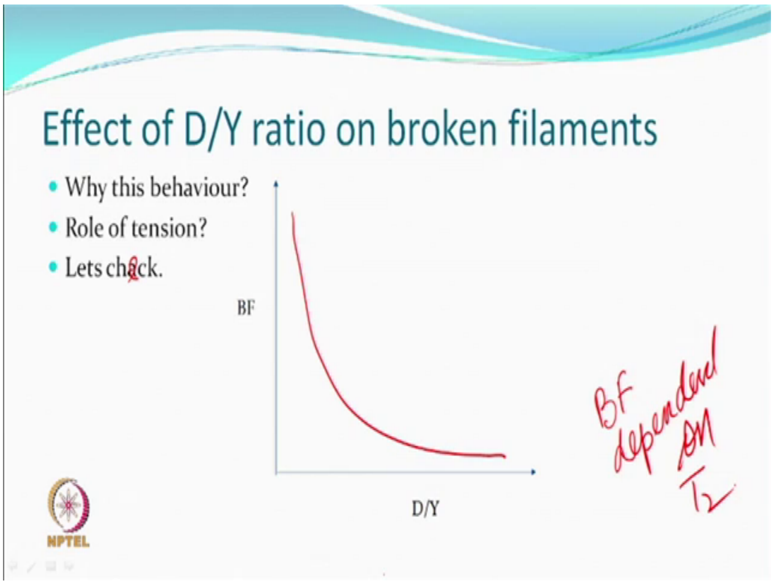

So, we were somewhere here and we try to argue in some way maybe need not. The behavior so the broken filaments are concerned as the D and Y increases, the broken filament level decreases in some way it is the silver lining, same parameter when you increase one characteristic falls and the other characteristics increases. And therefore, you have a reason to be at an optimum D and Y ratio. So, we wanted to understand as to why the broken filament level which also could be expressed in numbers per kilometer or something. So, we would like to see why does this happen.

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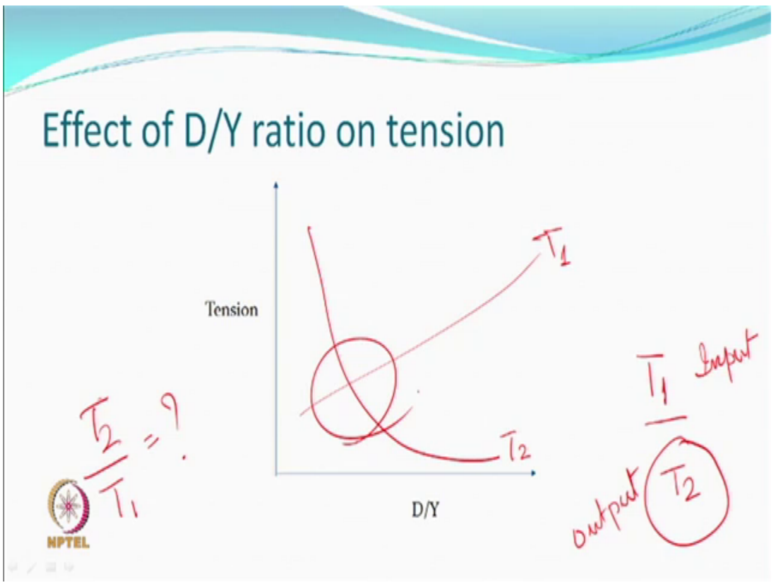

So, before we answer this question let us see we look at another relationship if at all exists, if you remember when we said the D and Y ratio increases the twist level increases we also said something will be happening to the tension in the filament.

Now, a tension which is measured in the twist zone is the T 1 which sometimes is also known as the input tension. So, if we want to approximately draw a curve of T 1 as the D and Y ratio increases, what kind of a curve do we expect, you must remember that when we increase the D and Y we are trying to insert more number of helices per unit length. If everything else is constant the draw ratio is constant time temperature is constant, then what would happen to the T 1 will it increase or decrease.

Student: Increase.

Increase right. So, let us say there is some increase in T 1, but as we said in a false twist friction texturing we are also interested in what happens to the output tension, this word input or output is in relation to how the yarn is entering the twister and exiting. So, we can measure tension T 1 we can measure tension T 2. So, what do you think should be happening to T 2.

Student: Constant.

Yeah.

Student: Increasing.

Increase.

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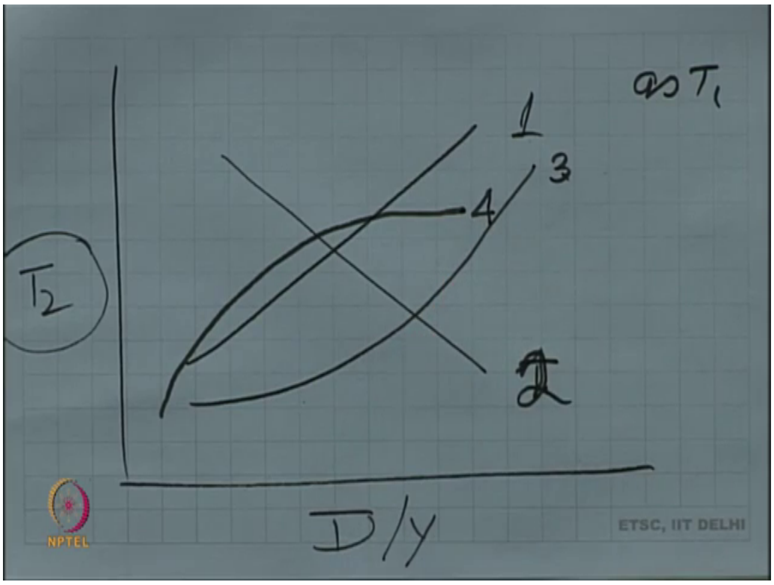

So, when we say increase let us say T 2 will increase as T 1.

Student: (Refer Time: 06:28) decrease (Refer Time: 06:28).

Yeah.

Student: Decrease decrease the number of (Refer Time: 06:37).

Decrease decrease so, this is curve number 2 this curve number 1, we talking about T 2. So, anything else.

Student: (Refer Time: 06:55).

Yeah.

Student: Exponentially increases.

Exponentially increases anything else.

Student: Sir first increase tendency.

First increases and then levels off.

Student: Right Sir.

So, seemingly a simple question has different answers. And the answers are quite different so; that means, the p a p a is the nothing is as simple; as you talked about T 1. So, let me see if we got an answer for somebody who said it will decrease. So, can you tell us to why would it decrease.

Student: Because there was detwisting is happening that is why tension will decrease.

So his argument is that as you move out of the twist twister, the zone before the twister was a twisted yarn. And as you get out there is a detwisting taking place. If the detwisting takes place the tension in that zone can reduce, looks good the yarn is moving over a disc invariably whenever you move any yarn over any material.

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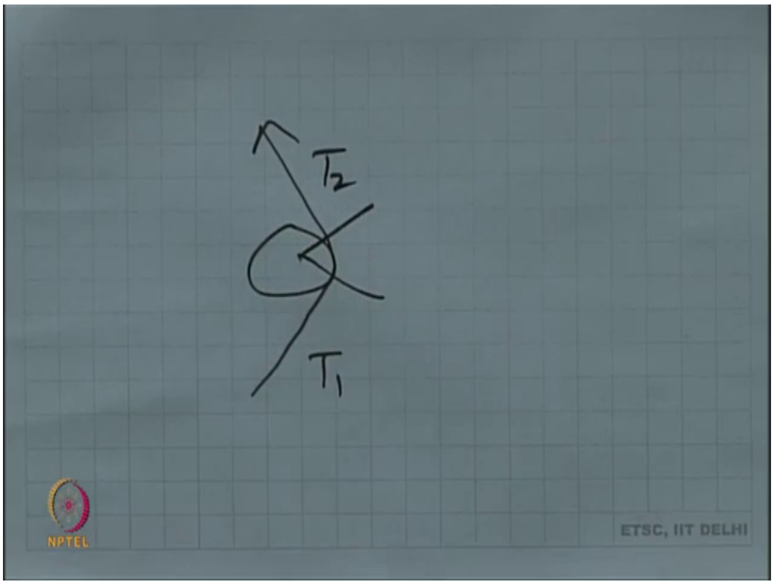

So, based on this rap angle if this is T 1 the T 1 and T 2 are related with friction and the rap angle, invariably T 2 may be high in this case, where our case is different the yarn is not just passing over something called a disc it is also twisting and also simultaneously untwisting, at one area it twist in the other area it untwist. If twisting means increase in tension untwisting should mean opposite of that right.

So, this is surprising, but not so surprising; that means, the T 2 actually can follow a curve like this that is when.

Student: Sir.

Either it is not rotating then T 2 is going to be high if the disc does not move only yarn is moving you can do that, you can always stop the disc rotation and if only yarn is moving so, there is only friction which is working. So, whatever your tension below the tension above could be more right, but as you increase the twist level. So, we are expecting detwisting level also will increase.

So, as you keep on increasing the D and Y ratio the tension in the output zone keeps on decreasing right, is there that part clear no questions what. Now, we can try an answer this question, why the broken filaments are found to be less as we increase the D and Y, what do we think. So, we just went and try to understand what is happening to T 1 and T 2.

Student: (Refer Time: 11:05).

Does it correlate in some manner. So, at least one thing is appears that the broken filaments are more dependent on the T 2, why should it happen, because after untwisting you have a parallel bundle of filaments before it is a twisted yarn one single unit they behave like a single unit. So, when any rough weather like for example, slippage and other kind of thing happen, now individual filaments have to withstand the torture so, nobody else is supporting now. If the fellow happens to be wrong place wrong time and tension is also high then it will break like for example, when the D and Y ratio is less T 2 is high filament is individual and get is a rough and slippage occurs or something it just breaks.

But as you are increasing the D and Y ratio more twisting is taking place therefore, more untwisting is taking place tension output tension is reducing therefore, broken filaments reduce good for us; so this is in some way gets related. So, what becomes important for somebody is to find out of course, you are interested in the absolute values also you will be interested in absolute values, but ratio will be important this will be an interesting zone, where the tension levels are equal and so, and optimization could be thought of.

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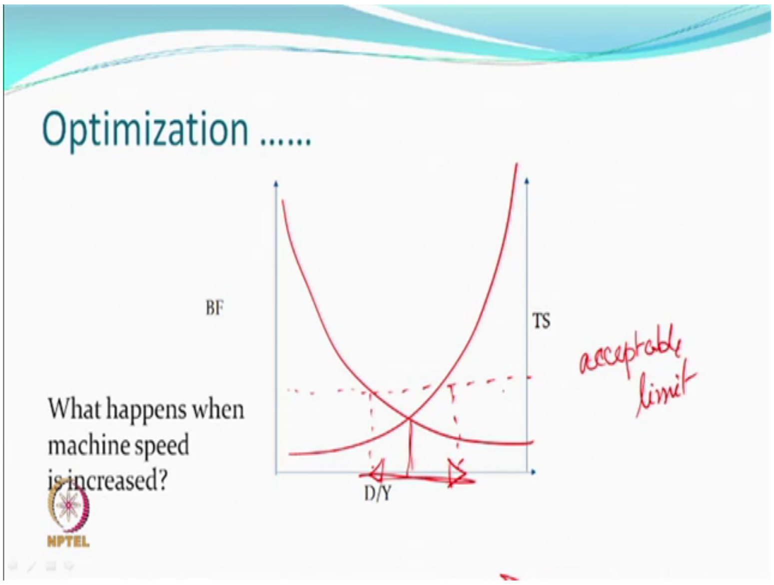

So, what we have is if you look at the TS the TS increases like this the broken filament decreased like this. So, ideal maybe we work here this D and Y ratio, but how do we know you know. So, what we have is in case we have some acceptable limit of these characteristics, then you can get a range of D and Y where you can do some optimization.

So, you have a range and it will be interesting to see that in this range the tension levels are quite close. So, do you get another parameter to monitor, if you have online measurement of tensions T 1 and T 2 and you find that the ratio is going here, where you can apply some control. Otherwise what I will you first texturize the yarn then go offline and measure how many broken filaments and how many tight spots are there and then come back and change the D and Y that of course, is possible. .

But if you measure tension which can be measured without measuring crimp rigidity without measuring broken filament without measuring tight spots, then you have some correlation which is going to be helping you to remain in a range.

So, if we increase the machine speed let us say I am running at 600 meters per minute and I wanted to go to 800 meters per minute and go to 1000 meters per minute, I am just changing the speed, what it means is you are changing the time residence time, but then you say well I am a heaters are fine and my their length is fine and they can look after I run the speed that is one part of it.

So, crimp rigidity can be affected if you increase the machine speed, what do you think would be happening here. So, if we increase the machine speed; so everybody be happy increase the machine speed productions is higher. So, the difficulty that comes is as you increase the machine speed, this range gets lower because this the curves will change in a manner, because there are vibrations, because the more speed means more vibration more vibration more slippage when slippage occurs something will occur. So, you will probably have less leeway on the D and Y optimization, but that is ok, if you are accurate enough you can still be able to do that.

So, because we do not have a real good control on the twisting mechanism and therefore, there is a slippage so, you have additional problem. And so no one talks about 0 broken filaments in 0 tight spots you say something will happen anyway. So, you only talk about limits ok, if you want to increase the speed then and also want to have a large leeway maybe your limits on the broken filament and the thing may have to be increased, but that may not be acceptable to the uses.

Student: Sir what would be the significance of the diminishing effect of this range of D D Y or acceptable limit of of D Y.

Well it is the twist level and twist level increases the has some influence on crimpicity also. So, while we are controlling this; obviously, must be controlled, but something else will change; so it is not that they will be totally independent and you can independently change the moment you change any of these things, there will be some effect somewhere and one of the effect will be crimpicity itself, but then still people will say crimpicity little bit of less probably we will be able to tolerate, but if broken filaments keep increasing people will reject even before testing.

So, the next parameter which you have some control on is the draw ratio, the draw basically is dependent on what, it dependent on the residual draw of the P O Y. So, you do not have too much of a choice here you cannot say well I will do only half the draw ratio; that means, you are getting a material which will have larger more elongation at break and have different property and you cannot even say that I will extend too much, because then you will be coming in a zone where breakage is can also be there.

So, you will have very less play with the draw ratio if your client sells that this is the percentage extension of the textured yarn I am looking at. So, we will be doing everything to meet the expectation. So, you will do the draw ratio adjustment to draw ratio in such a manner that the final yarn has a certain acceptable breaking extension, but if you find well actually it is going beyond your acceptable limit, then you can advise the person can look do not worry about extension break at the moment otherwise this will be there or optimize in some way or the other all right.

So, despite the fact that we have p o y the draw ratio may be a 10 percent less than the residual draw. So, that even if there is a issue of any migration not taking place properly, you will not be over drawing any filament, draw has to be done. So, you do not overdraw we may have some under drawn because filaments are migrating.

So, the migration in this case is not equal to what you would have expected in a fully drawn yarn, it is better than let us say the undrawn yarn which we defined, but even if we accept whatever it is still being drawn. So, when you draw there will be something some filaments on the surface which if you draw exactly same ratio to the same ratio, then some of them will be more drawn than the others no doubt about that.

So, you will try to minimize that so, you do not over draw draw a little less and then; obviously, work around your crimpicity tenacity etcetera etcetera elongation at break, but then whether draw ratio also has any effect on the quality characteristics of the textured yarn let us see that.

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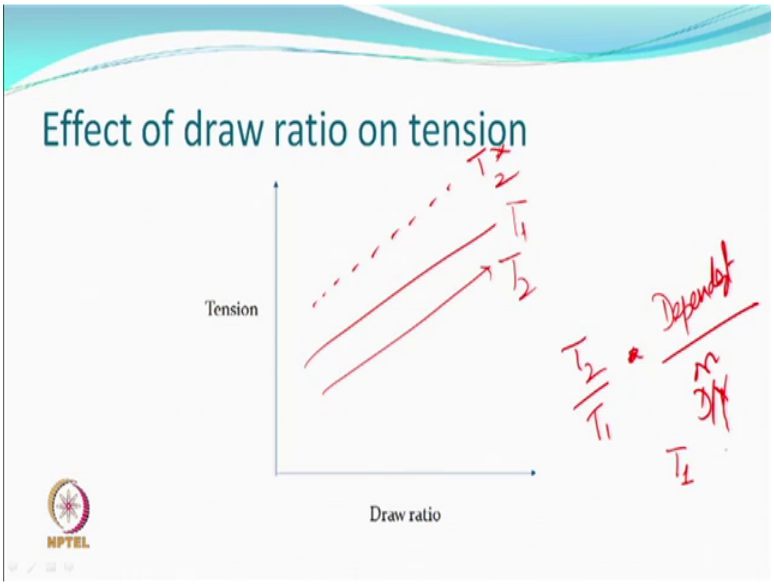

So, before looking at that because we found tension is an important parameter let us look at that. First which we consider as the T 1 if the draw ratio increases, because you are increasing what will happen to T 1 doubts increase the draw ratio what will happen with T 1.

Student: Increase.

It will increase.

Student: (Refer Time: 22:22).

There should not be any doubt you doing nothing except pulling.

Student: (Refer Time: 22:25).

So, that has to directly result in the increase in tension twist was still a indirect method of increasing tension, here that is almost the more you stretch the more is the tension. So, T 1 will follow this T 2.

Student: (Refer Time: 22:43).

Yeah.

Student: T 2 decrease.

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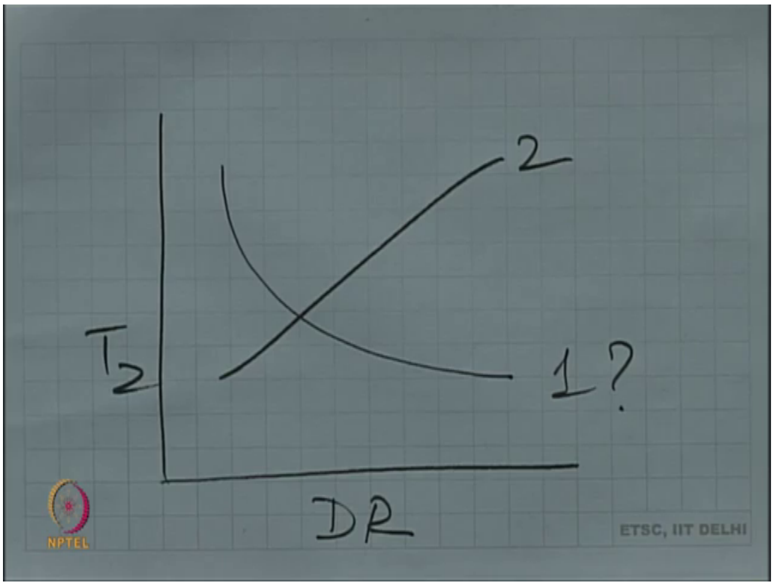

T 2 will decrease it is all based on T 2 alright. So, T 2 would decrease in the same manner no any values what.

Student: Increase.

Will increase.

Student: (Refer Time: 23:11).

Yes increase alright. So, there should not be too much of you know difficulty in accepting that you are just pulling and there is no nip in between, there is a twisting element over which you are just pulling. And you keep pulling more and keep pulling more expecting the tension is going to go down is too much of expectation. So, the T 2 would also increase the question is whether the T 2 will be below T 1 or above T 1.

Student: (Refer Time: 23:57).

So, T 2 will increase T 1 increase whether it will be below T 1 or above T 1.

Student: Above below.

Yeah.

Student: Below above above.

Above alright; so we put above also T 2 star. So, some people are saying above some people are saying below. So, what do we think. So, both are right it could be above or it could be below based on the D and Y ratio. If the D and Y ratio happens to be in the range, where T 2 is supposed to be high it will remain high and keep increasing with the draw ratio, if it is in the other zone, then will remain below and keep increasing.

So, effect of draw ratio will be will result in an increase in both the tensions the T 2 and T 1 T 2 by T 1 ratio would be dependent on D and Y this we know earlier not proportional, but dependent. So, if your D and Y is optimized in whichever manner will wrap; obviously, you will like T 1 T 2 to be as close to each other as possible here also.

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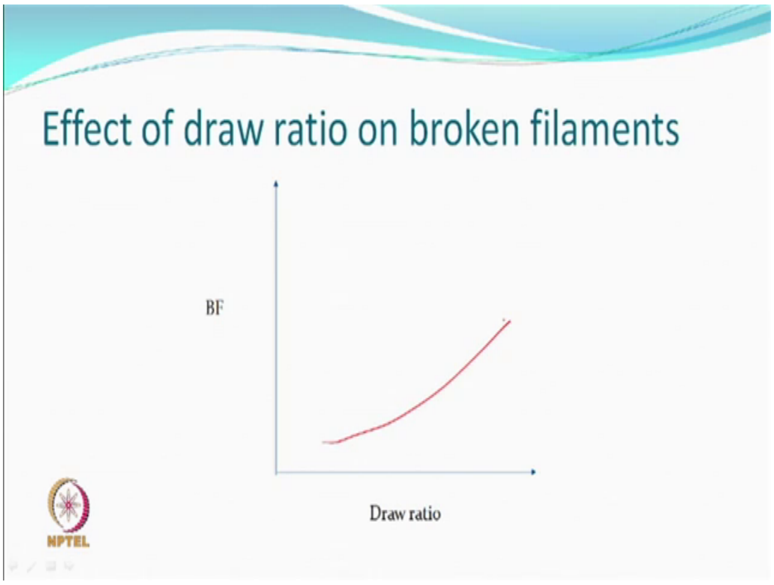

Now, we know something from the previous arguments that we have done, when we increase the draw ratio what do we think should be happening two broken filaments right, they will increase why because T 2 is increasing and the increase may be following T 2 or maybe more.

So, it will only increase, because when it is T 2 they are untwisted yarn an untwisted yarn the filaments are vulnerable at that prime, whenever you increase the T 2 and the tight spots so, tight spots so, they will decrease increase.

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Student: Increase.

Increase. So, your broken filament also increasing and tight spot is also increasing any other option that you have increase decrease.

Student: decrease

Decrease. So, actually [FL] it could either increase or decrease, sometimes they remain same that is the trichotomy two quantities a could be equal to b a could be less than b a could be greater than b and the fourth one is quite difficult to find, but we will have to have a reason for that whatever you say, those who actually thought that it should increase, what are the reasons you know what a tight spot is. So, what is a likely reason say anyone.

Student: More.

More.

Student: More slippage due to high tension.

More slippage due to tension more slippage anyone, else as any other curve and an argument for that and a curve and an argument no curve no argument so, you accepting.

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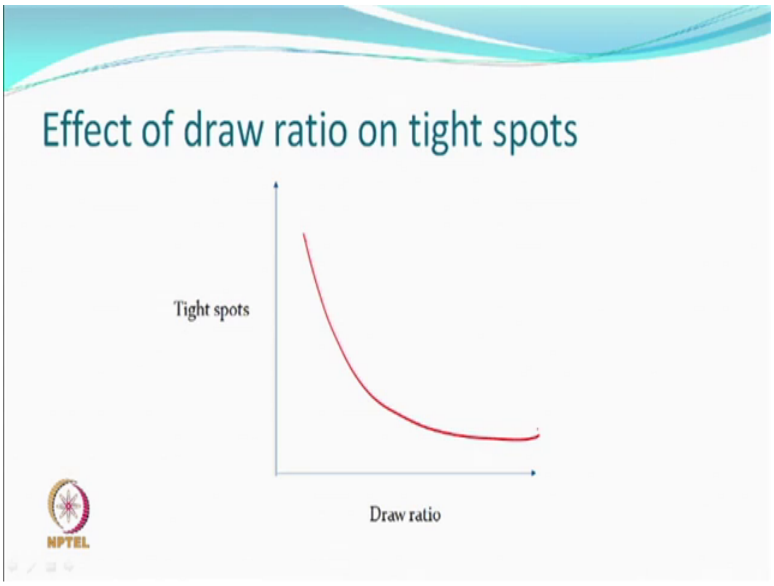

Student: (Refer Time: 28:13).

Yeah. So, this is not right does not happen what you will get is like this, that is you increase the draw ratio, the tight spots are going down again good for us. One of them is increasing the other is decreasing so, we have a way in which we can get our optimum value somewhere.

Student: Increasing.

But question is why does it increase decrease why does it decrease.

Student: Number of helices decrease.

Number of.

Student: Helices decrease.

Number of helices decrease.

That should reduce the crimp rigidity, why should it reduce tight spot if that is true. So, for tight spot you got to; obviously, remember what is the tight spot and why does it occur.

Student: Real twist (Refer Time: 29:15).

Yeah.

Student: Real twist gets inserted.

Right. So, real twist gets inserted why does it get inserted, because there are slippages.

Student: (Refer Time: 29:25).

You are assuming there are slippage therefore, real twist get in inserted so, by increasing draw ratio why is it reducing.

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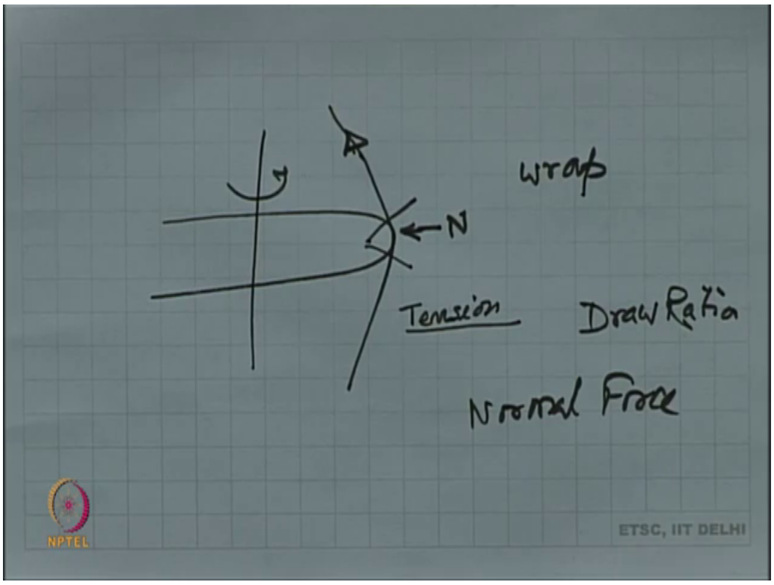

Now, when you increase tension whichever tension you are looking at which means draw ratio, what would happen to the normal force, because normal force is related to friction frictional force and related to torque.

Because this is at some angle therefore, there is a wrap if you have a wrap, then if the tension is put increase in the yarn, this would result in more normal force. And what if the result of this the result of this would be better contact, the result of this would be less slippage, result of this would be also more twisting maybe. So, draw ratio is giving effects opposite to that you observed for a D and Y ratio.

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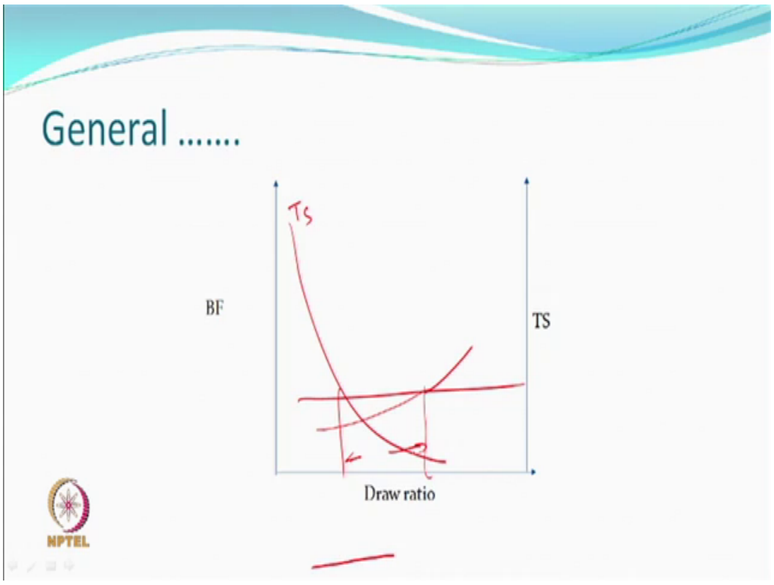

So, the tight spots decrease which is also a good thing for us and in general therefore, we again have a situation, where the tight spots which are here they decrease the broken filaments all right.

So, they increase and so you again have a limit where you should be able to optimize the draw ratio; that means, you may be able to meet the clients requirement also. And if you are not able to meet then; obviously, you have a problem suppose this range comes in between then you know quality will be maintained and extension at break would also be maintained, if this range is big good for us if range is smaller.

Then you have a limited way to play around to meet the requirements, because characteristics the quality characteristics are more important you cannot; obviously, do without it. The other effect which we should be concerned about is the angle of wrap.

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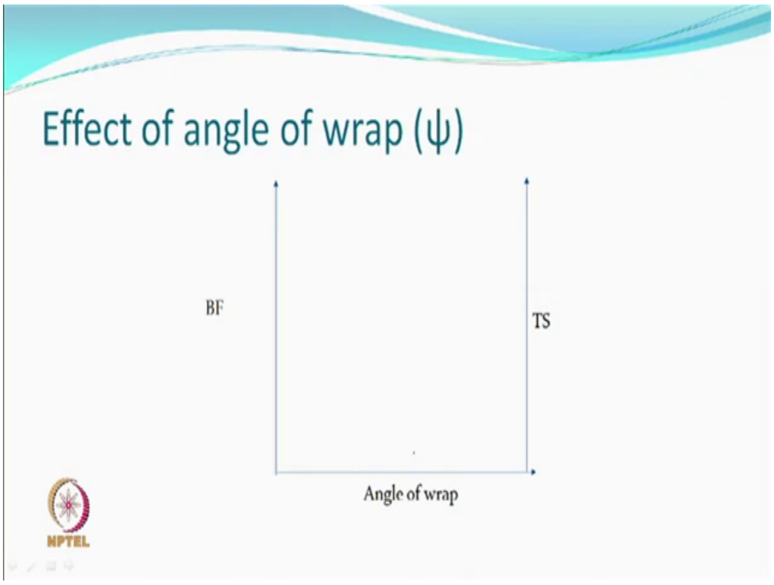

Sometime represented as psi you think it is a good idea to leave this discussion, on you now you know what is the broken filament why does it occur, now you know what is tight spot and why do they occur. And so now, you have an angle, but remember important thing about the angle of wrap is that this angle of wrap cannot be very easily changed, there is a twister and it has a configuration.

So, change the angle of wrap you have to change the twister, because there are guides which may be placed at a certain distances so, that the wrap occurs ok; that means, this experiment is more suited to the machinery manufacturer. So, changing an angle of wrap would mean changing configurations, but it does not matter whether manufacturer does this experiment or the texturizer does this what I meant was that as a texturizer, you would not have an option of very easily changing angle of wrap of course, you can change one twister with another twister which has been designed for a different angle of wrap right.

So in fact, what will happen is that for such denier of material, please use twister x and for the other rein use twister Y, but; obviously, somebody decided that why should you use this kind of a twister. So, that parameter is a parameter not under your control so much, but the control of machinery manufacturer or the one who designed the twister, but anyway we should be able to wrap it up sometimes all right the angle of wrap. So, I am not doing this we will see.

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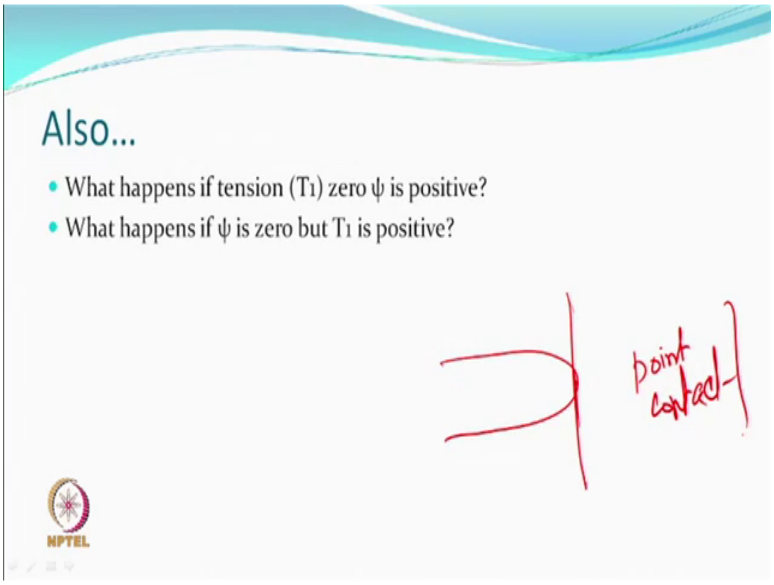

So, considering whatever happens and whatever we understood, if the tension level let us say T 1 because T 2 is related in one way or the other based on D and Y or draw ratio is 0, you have working nicely and the angle of wrap which is psi is positive. So, we have a texturing machine and we have started adjustment of this kind, what will happen what will happen some people will like it, because tension is less therefore, setting will be better molecules will be able to do and go to whichever configuration they want to go.

So, what will happen will there be twisting there will be no twisting no texturing what I going to be optimizing, because there will be only slipping, because for twisting you needed some normal force and just by putting tension and things are happening. And if you just remove tension things do not happen for example, this will be difficult to obtain if the tension levels are reduced to 0 all right. And then second question what happens if angle of wrap is 0, but there is tension.

Student: Yes sir.

Yeah.

Student: Yes sir.

No there may be.

Student: (Refer Time: 37:18).

Contact with the disc you can always make sure that there is a contact.

Student: Yes (Refer Time: 37:23).

This is going it is a point contact what will happen.

Student: No twist again.

No twist again right therefore, in friction texturing and the kind of friction texturing we are talking about the tension and psi which is the angle of wrap have a definite positive role. And whenever they change something will change the amount of twist will change, because of tension itself say even if you like it you do not like it, twist getting inserted because contact will be more therefore, the torque is going to be different if external frictional force is going to be different.

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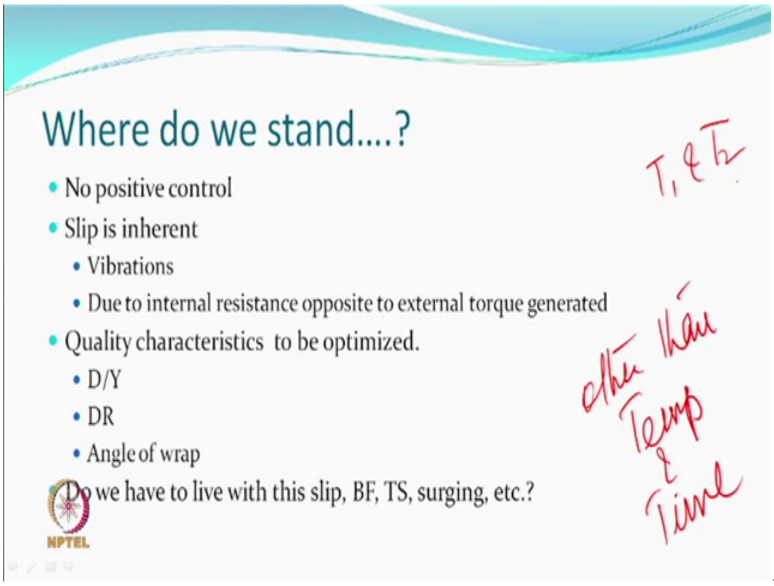

So, where do we stand we stand now saying that there is no positive control in the friction texturing and slip is inherent, because of vibrations which will happen whenever you run a machine, or it may be because of the internal resistance which is equal and opposite to the external torque. The more you twist the more is the internal resistance. So, whenever two opposing forces work, there can be slip which is surging is what we talked about.

So, there is a slip the quality characteristics which need to be optimized of course, other than all right other than time and temperature. Are these three and these three in some way control T 1 and T 2 in some way the third one we have not discussed, but I am sure you can guess there will be controlling. And therefore, we have some way to understand what has happen the question that remains is do we have to live with this slip and also the problem the broken filament tight spots surging etcetera and snow generation because there is slip right.

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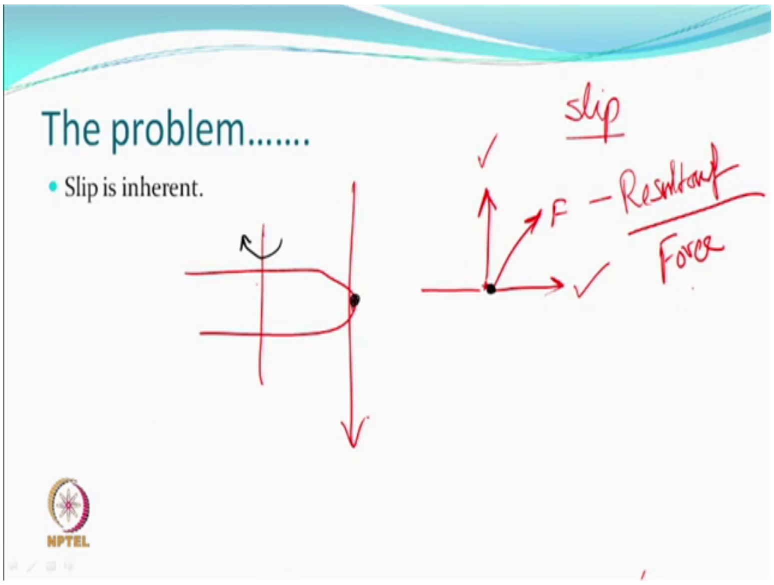

So, we just look at this problem and then finish today, what is the problem the problem is that there is a yarn let us say we are talking only at a point contact, this can be extrapolated integrated later at that particular point of contact, the frictional force are acting on this yarn let us say the yarn is moving downwards here. So, the frictional force because of the movement of the yarn, will be upwards acting opposite the motion. The disc is rotating in one direction opposite to that there will be another friction force.

So, there are two forces one this and one this are at that point acting on the yarn, but because they are two forces and they are vectors therefore, there a resultant force resultant force which is neither in the direction of the yarn movement nor it is in the direction of the movement of the surface of the friction disc. So, forget about the thing that you were thinking maybe it is lagging yarn is; obviously, going to follow they are moving slowly disc is moving faster that of course, but we know that at some stage if everything is good maybe it will pick up and get to the same kind of revolution, but what is this.

The direction of the frictional force will never be the same as the direction of the motion of the yarn or the direction of disc. And if this is the kind of thing that you are expecting, then you will have a slip right because direction motion is different. So, the friction force somewhere else the surface is going to pulled in some other direction surface being pulled in direction, the yarn was to go somewhere else rotation also happen, because this difference will exist and so, slip is inherent avoiding this in the situation that we have discussed.

So, we live with it till the time you optimize reduce things, but you say well I am going to create something in this kind of situation. So, considering this you will see that there is slip. So, there is a problem if there is a problem there is going to be you have to keep worrying about it all the time. So, I think we stop here and then we will pick up from here next time.