Textured Yarn Technology
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Lecture – 34
Revision and clarification of doubts Session 2

So, this particular hour is going to be spent on a type of Revision, based on some of the queries that were submitted. And then we can see what else can be done.

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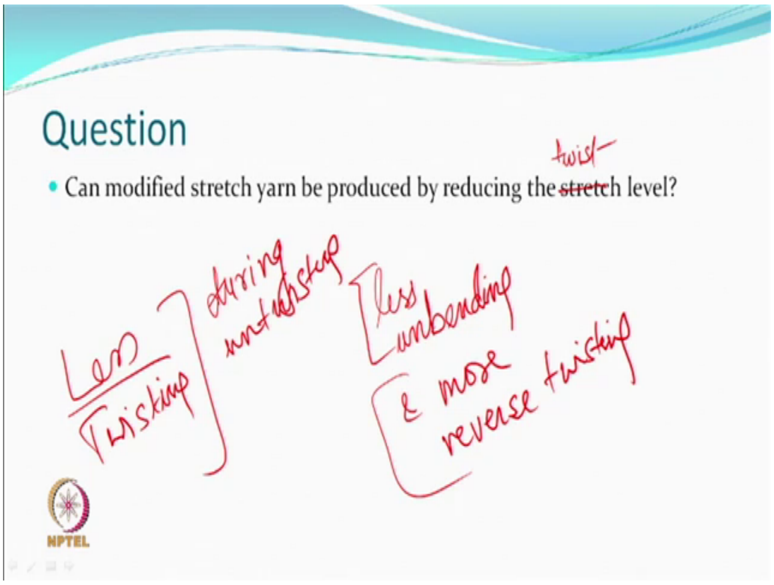

This question we had some time back answered, but appears it came again can the modified stretch yarn be produced by reducing, no it was twist level. So, that you reduce the stretch by reducing twist level.

So, this we said is not a good idea, because we have a process of twisting and d twisting. D twisting takes place after setting. So; obviously, there is some resistance to this as well. And so, what people observed was that if your twist levels are low there can be less unbending and more reverse twisting; that means you can actually see that there is a real twist. So, if you have a less twist then during untwisting, you can have less unbending and more reverse twisting.

So, if there is high bound or twist the helices are more flatter, they are flat and so, when you reverse they unbend, when twist is less the helices are more at inclined at an angle.

And therefore, because of a resistance it may just get twisted on it is own the whole yarn can get a twist, which means the yarn becomes twists lively our aim was filaments are twists lively, but the yarn per say has no twist so that becomes an issue.

Therefore, till today we are going for two heater systems; that means, so, it is a costly process; obviously, you are spending more energy everything else. So, the common sense thing does not work, they have to go little extra mile to do this job.

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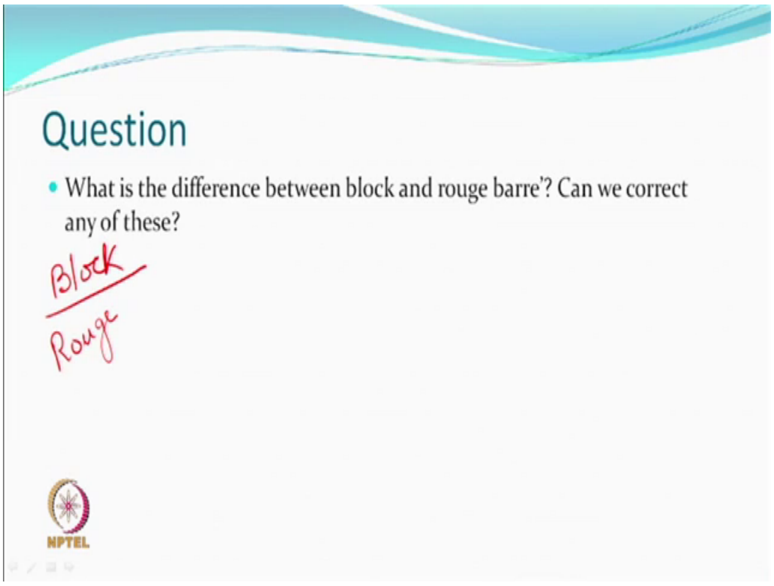

So, about the barre, the difference between block and rouge barre; so block barre is seen first the barre is a regular irregularity seen after you have dyed the material right that is one. So, block barre appears visibly only if yarns with the difference small difference appeared together. If, they are together as a bunch or a block then only you can see the difference. Because the difference between one yarn to the other may be just about 2 to 5 percent difference in shade.

So, change has taken place morphologically; morphological changes are taking place, but after dyeing actual change may be difference between the two maybe only 2 to 5 percent. And naked dye definitely has difficulty in identifying 2 to 5 percent shade difference, you are not talking about 2 percent shade and 5 percent shade we talked about is a 2 percent shade.

The next one is 2 percent to 2 percent. So, that much of a change is difficult to identify. If they are individually lying somewhere, but if they come in the block then this difference becomes little perceptible. The rouge on the other hand is basically too much different; too much different that means, the difference between one non barre and a barre or a faulty yarn is 2 to 5 times. And so, even if it is put individually anywhere after dying it will be visible. If such type of material is actually available then, you will only think of rejects. A small percentage of such rouge yarns will be seen anywhere on the fabric.

And, so, how can we correct? A rouge is very difficult to correct there is no way you can do you have to segregate them do whatever you can do, because this must be a result of let us say one heated system control temperature control is finished. And so, something else is happening and nobody is aware about it, but block can have occur any time block barre can occur any time, because small variations in time temperature not time, but temperature can always happen and so, you can have situations.

But, what was important if you can just a position the packages let us say on a knitting machine, you might be able to break the blocks. If the blocks are not there barre will not be visible, that is how one can probably try to correct this best is that you are as accurate as possible.

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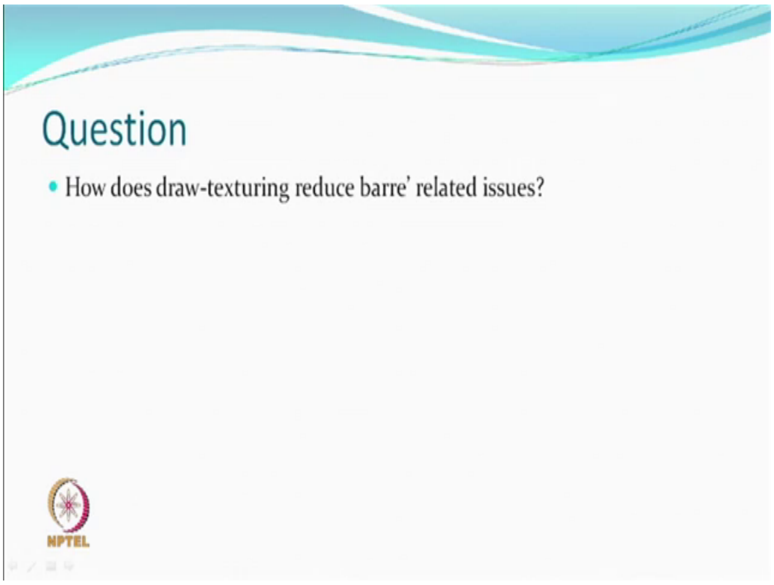

But, there is nothing called 0 variation system. This one other issue it is how does draw texturing reduce barre related issues.

So, one other thing which is there is that when you do draw texturing at least the people who are texturizing are aware of the history, because every time you make a material, then you draw; drawing if done on a different drawing machine in a different company. Everyone says well what you have done I have drawn 2 to 3 point to draw ratio extension break is this, but that is only one story the other story is whether the temperature during drawing was controlled or not.

So, you may have package to package history variation. And, so, if you have faults which are coming in the material itself, they make it accentuated and then texturing ma process may also introduce some variations and you already have more variations to begin with and so, it gets issue.

Now, what happens is if you draw yourself at least you are sure that a large package is being drawn at the same position under the similar conditions. And therefore, problems which can occur during the drawing or the variation that can occur during the drawing, because of thermal or other history they can be handled. And so, you can always say well position number 4 to 20 are exactly same and we can club them together and we can.

But, otherwise every package which is drawn package is a different package. And the person who is drawing may not appreciate what you are saying that every package has to be identified in different manner and segregated differently and given differently and you also understand well this will only go to position 45 46. And if you do not do that then the barre issue gets more prominent.

So, here large amount of package and a bit of a control on the drawing itself would lead to a reduction in the barre, it is a reduction right. If you say well I have done everything else and nothing will happen it is not a question. The question is how much seriously problem is as long as this is not serious and public the eyes cannot perceive this, then you are alright.

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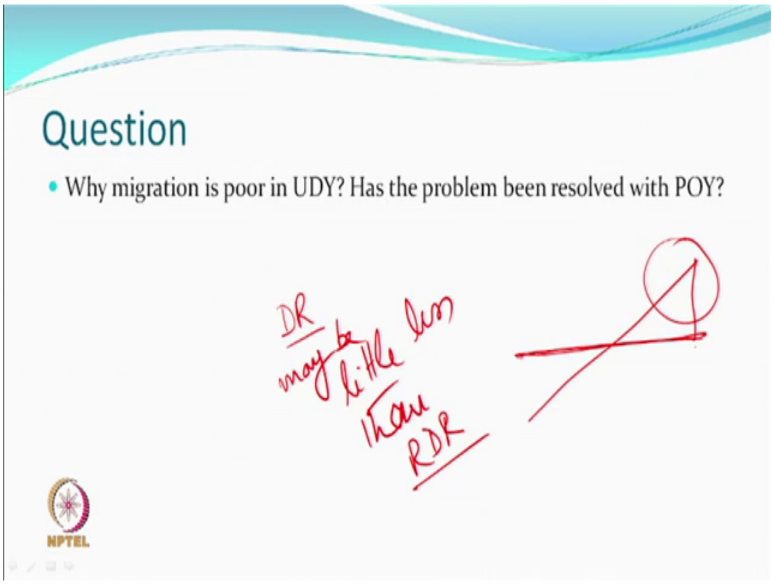

So, we buy draw texturing partly has been handled. This question somehow related to the migration because it was said the tenacity of the simultaneously drawn textured yarn was less. So, one of the reason was that migration is poor, why is the migration poor this was the kind of question.

So, one has to; obviously, answer the question first why at all the migration takes place. Migration means when you are twisting the yarn the filaments on the surface have a tendency at a different point in length to go in the core and the ones and the core want to come out on the surface. This happens because there is a tension difference between the filaments which are inside and the tension which are difference outside.

So, now one would like to remain always under tension and therefore, they keep on replacing each other and so, keep migrating. From surface to core and go to surface or where for position that you have. So, it is a tension difference which is more important. And under on yarn because the surface filament after twisting here also will be under more tension, but instead of remaining under tension, they release their tension by extending fully drawn yarn does not extend easily.

And therefore, tension is stored, but undrawn yarn just gets extended, it has to traverse a larger path on the surface and so there is a tension and the result of the tension is the filament gets extended. And so, tension difference between the filament which are in the inside of the yarn versus on the surface reduces and so, migration becomes poor.

If someone says that have you solved all the problems with the pio why no we have reduced the problem? So, it is not as per, but it is not; obviously, as good as a fully drawn yarn, but during spinning which is high speed, the residual draw which could have been 3.6 3.7 comes down to 1.5 to 1.6. So, large amount of orientation has taken place.

And, so, if you further want to stretch; obviously, the stresses are little more. So, stretching is offers in dual filament is relatively your spend more energy. And that energy if it is more than tension differences could be there, which would allow them to keep shifting their positions. That if you say well we have will have as good as the fully drawn yarn that not be a good thing to say.

And, therefore we said that the actual draw ratio, machine draw ratio, may be little less than the residual draw ratio which is decided by the material. Idea is that not any filament is overdrawn, because if you have a simple story when this is the draw ratio some of them can be under drawn, some of them can be overdrawn, if this is the center point.

So, these will be under always ball stress. So, they can have some difficulty. So, you bring the whole thing shift the baseline a bit in a matter, that the no one is overdrawn some of them are; obviously, underground.

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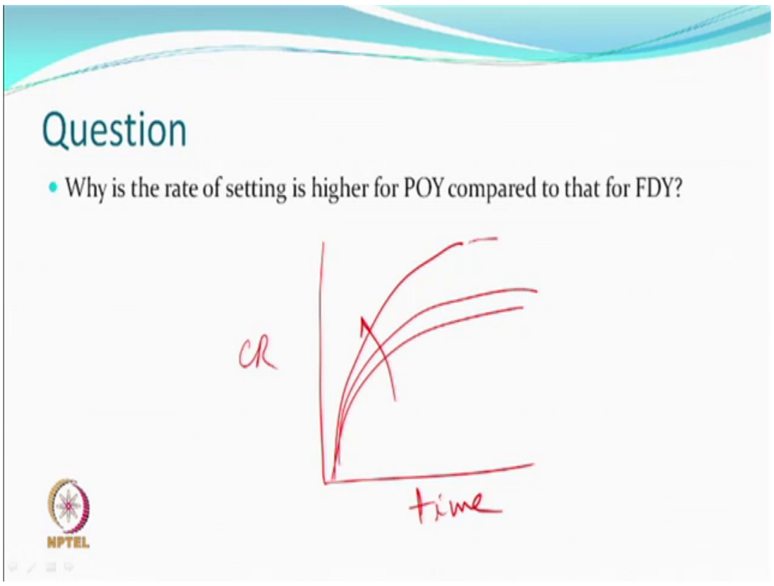

So, why is the rate of setting higher for POY compared to that for fully drawn yarn? So, you must have seen some of those curves say the current purity increase in one case like this it can go this way or this way. So, you have a rate of setting increase this is called the crimp rigidity and this is the time.

So, it is simply because let us say in the case of polyester which is the real classical example where the crystallinity of a POY yarn is less around 2 percent 2 to 3 percent. So, to go to a new state for achieving setting you can do it faster. So, rate will be high and time will required will be low. So, when you get the maximum possible crimp rigidity, it can be achieved much earlier.

So, that is how the rates can be different. Because the material by itself can be changed at lesser energy or at a smaller time you can run the machine faster; that means, the production could be high and that is the advantage also of the POY. In the case of draw texturing also because when you draw and we said the adiabatic changes that take place during drawing process. Can also locally increase the temperature and where wherever naking is like you take place, that is the time where there is going to be changes for the stresses are concerned and that is being molecules being polled to get paralyzed, in whichever in the direction of the stress of course.

And, so, that advantage also you can have with the POY and extra temperature coming from somewhere else quickly you are reaching the point and so, it can help in some way. A fully drawn your normally for example, polyester is 27 28 percent crystalline. Normally is 37 percent crystalline polypropylene is almost 75 to 80 percent crystalline. So; obviously, you spend more time partial melting recrystallization.

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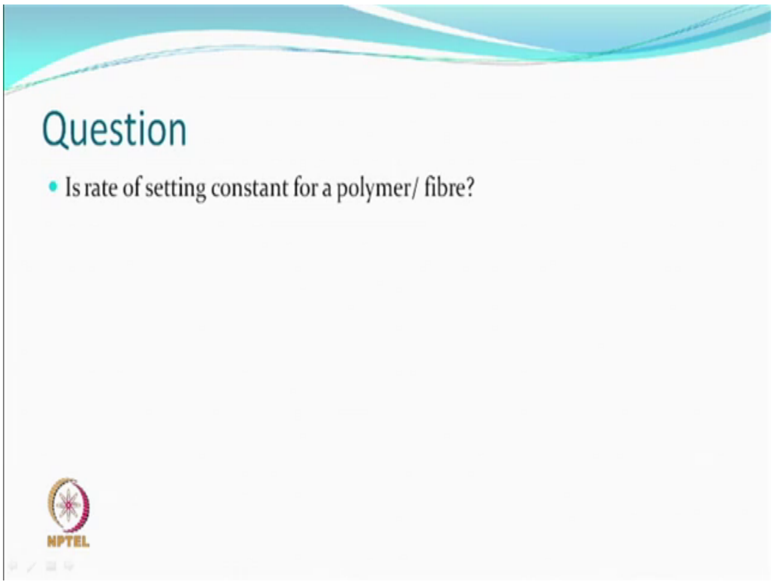

This was also there is the rate of setting for a particular polymer or a fiber a constant like you talk about specific heat of a material or a thermal expansion coefficient of expansion. So, this is not there, because this whole process involves heating the yarn first on the surface.

Then the temperature of the core rising it is not question of the temperature of the surface which; obviously, rises faster, but for changes to take place this temperature of the hole of the yarn should be similar, if it is a heavy denier yarn. So, it will take more time, other than the specific heat of the material, other than the thermal conductivity, but the dimension itself of the material can change the rate of heating and therefore, not rate of heating in sense the whole mass has to be heated.

So, there is a thickness involved. And so if this kind of things change the draw ratio changes material become thinner, you will probably find a different rate constant, but there is no doubt that same material with a POY versus same material fully drawn yarn, the POY rate will be higher.

So; obviously, it is not material dependent, but it could have been fiber dependent, but you can always change the draw ratios you can change the conditions and so, it will not be one value, it will do the experiment dependent how you perform the experiment? So, what these guys must have done is taken the different POYs texturize them at different times taken the out measure the crimp rigidity and then plot the curve. They plot the curve and then find out what is the equation, the equation would be nature would be same, but the constants may not be.

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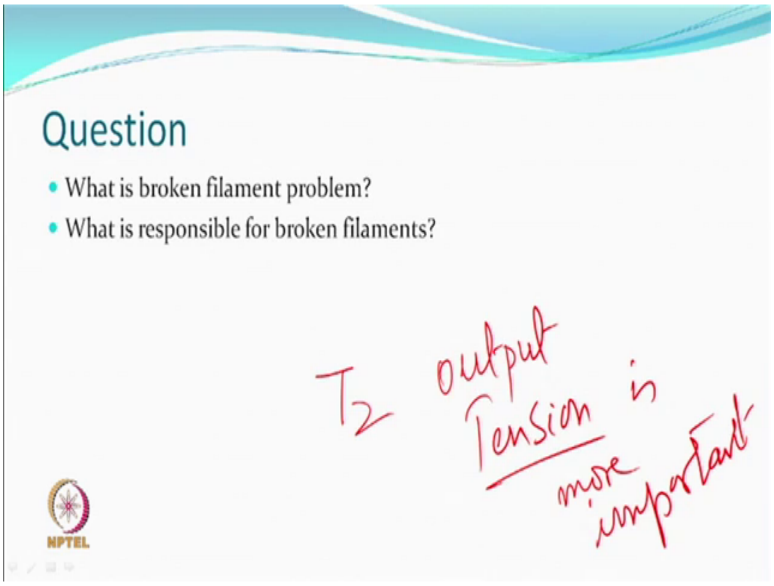

So, the other question is what is broken filament problem? So, one thing which has to be remembered it is a fun single filament or one or two of the bunch of the filament that are breaking. And why does it occur? Because, I have also noticed that somebody who would actually written the answer to this question has almost been answering as if this is the problem related to tight spot this is not, slippage yes, but tight spot is a different problem.

So, if there was a confusion I thought can be brought out. The broken filament are not nothing to do with real twist. The broken filament are there because during untwisting when each filament is an individual entity, after the twisting and if tension levels are high for whatever things and slip also takes place from a solid abrasive surface versus a soft filament yarn under tension then it can break.

So, this filament break does not happen in the zone before the twister. They are already twisted and they behave like a single bundle, but when untwisting take place whichever the filament happened to be in contact, and also in the greater tension, and slip also takes place abrasion will take place and then it may break. So, that is one it is therefore, different slip is of course, responsible, but T 2 is also very much responsible.

So, this is if T 2 wherever T 2 is going to be high this problem will be there. So, this is one thing. So, tension related issue is this and less of real twists getting inserted there is no reason, but these things can happen simultaneously. A slip occurred the broken filament also came untied spot also, there is no independent processes they can happen at the same time both the things can happen, but broken filament is a broken filament and tight spot receptor.

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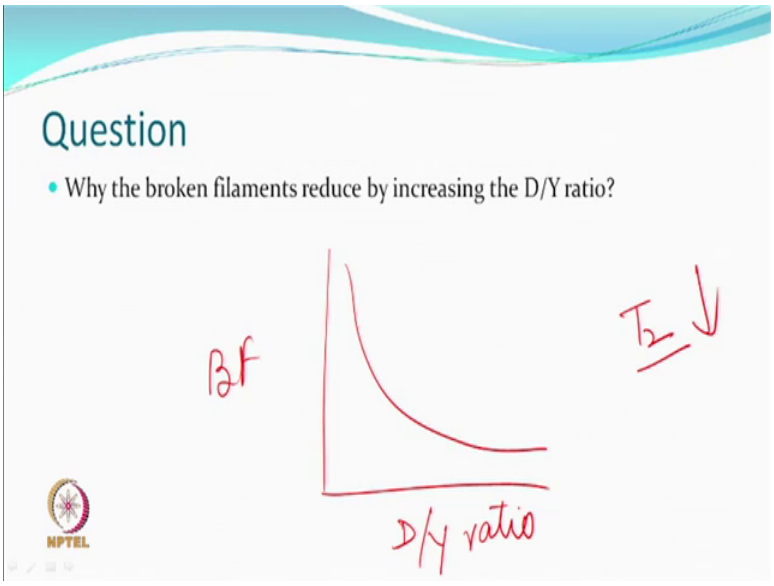

Why the broken filament reduce by increasing the D by Y ratio you. So, this is the kind of curve that we see and it is also related to T 2, because when the D by Y ratio increases; obviously, twist level increases, T 1 definitely increases number of helices per unit length also increase. So, it would have it is own impact on the overall tension of the yarn as well as the crimp passivity of the yarn, but at the same time, it also as the moment it gets untwisted extra length also is available in the D twisting zone.

And so, tension level goes down because of the D twisting more is twisting, more will be D twisting and therefore, more reduction in the tension T 2. So, because T 2 gets reduced therefore, the broken filaments keep getting reduced it also means is that that you can think of a broken filament more, when the D by Y ratio is less, because at that time the T 2 could be much higher than the T 1. Because, there is a drag; the drag is going to play more role than the untwisting part of it.

But, after some time when we approximately believe that when the T 2 actually becomes less then the broken filaments also come to a level, which are probably near the acceptable range. And that is why if suppose somebody has to say that well I am going to do online control of these quality characteristics. So, online control means you should do measure and respond immediately.

The only way that you can respond immediately is by measuring tensions, if you actually go check the book and filament and come of course, you can think of optical sensors which can see the broken filament at what speed running a 1000 meter per minute. What is the time that is available for a sensor to actually measure and say well this is more or less a broken filament just gone run a machine at 1000 meters per minute and think of the area at which the sensor works could be 1 millimeter to 4 millimeters that is the kind of sensing that you will do.

So, what is the time available for the sensor to check, but on the other hand when you measure tension you are not measuring where it has broken you are only saying well the quality is likely to go down, because the tension differences are being seen. So, accordingly if it is possible you can change you can change. So, that is advantage also is there, if you measure the tension online which is continuously the measuring tension the good idea.

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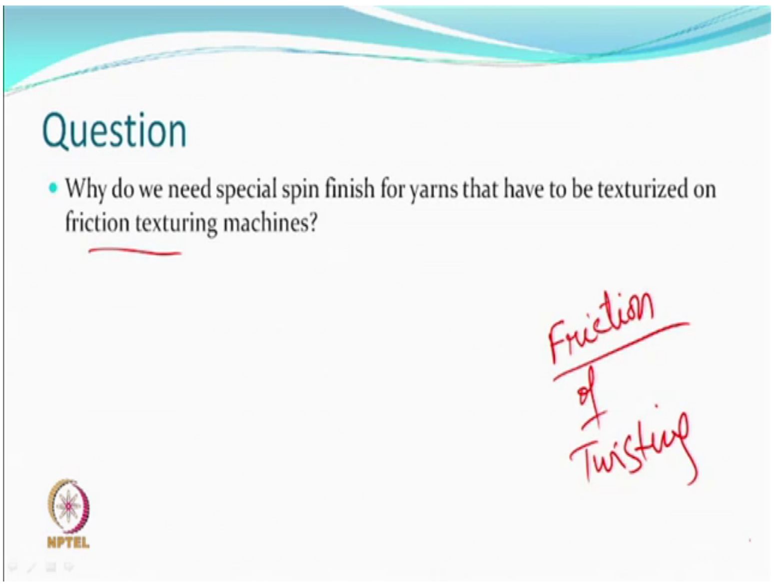

So, this is ready to spin finish for friction texturing. So, because it is friction texturing therefore, friction is important. Friction for twisting, we already know that there is going to be a problem of slippage and a friction also less there will be more slippages, the amounts of the torque generated also will be less. And. So, the D by Y may be very high, but the actual twist level and getting inserted will be very low and there will be more slippages.

And, so, you wanted the friction is an opposite opposing requirement compared to any other application of the textile filaments. They are everywhere you want friction to be less over guides winding unwinding, yarn to yarn friction, weaving knitting, everywhere you want the tension the friction to be less, but here the opposing requirement. And therefore, you have to create a situation where while the yarn is going to be twisted, at that time higher frictional torque is a better idea. If therefore, friction should be high, but spin finish already has been added which has lubricant, because it still has to wind unwind pass through various guides and other devices.

So, the only thing that they say is that the recipe now can have a lubricant whose boiling point is less than the temperature of texturing, which in the case of polyester for example, could be 200 plus degree centigrade. And, so you go to have material which can evaporate before this. So, of course, you can find material which can evaporate to different temperatures. Whether also means that if you do nylon 6, then you nylon 6, 6 and you do polypropylene texturing the temperature of all these fibers optimum temperatures are going to be very different; that means, the same finish for different fibers may not function.

There is only just a concept, but the concept has to be put in practice that you will say well this is a special finish for saying unless and until you say well I have added a material which actually can evaporate at eighty degree centigrade. So, it is good for everyone right. So, you will have to think about it.

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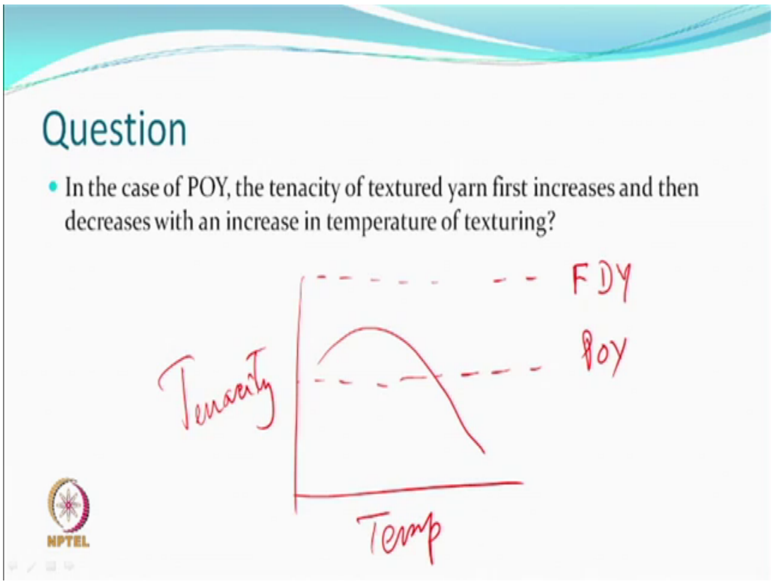

In the case of POY the tenacity of textured yarn first increases then decreases with an increase in temperature of texturing? So, if this is the parent yarn POY. So, textured yarn can have more and then come down, while a fully drawn yarn tenacity maybe somewhere else.

And, so, because it is a material which can be drawn an orientation of the entities whether amorphous region or crystalline engine can be increased by drawing, where it is a really under on material. And therefore, if the overall orientation seemed to increase despite whatever we are doing they are twisting and drawing. It will still be facilitated if the temperature is high the changes that take place, in terms of stretch and then generation the orientation could be better then, but after some time of course, it will go down. And always be less than the FDY strength, because there is the maximum orientation and texturising only reduces orientation and certain I still go down. So, that difference between the fully drawn yarn and a POY.

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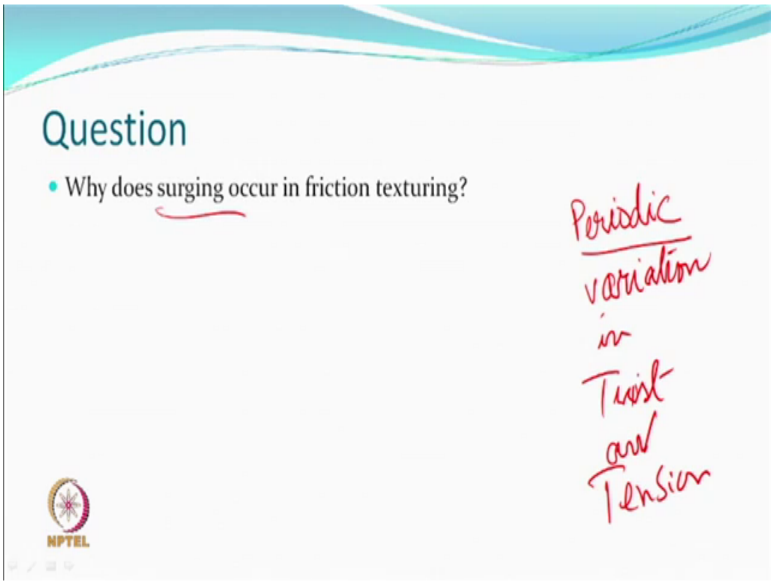

Why does surging occur in friction texturing? Surging we said is a periodic variation in tension and twist, in twist and tension. And why does that occur is a stick slip phenomenon, you start from a 0 twist in a yarn and start building the twist as the process goes on, as you keep twisting whatever you may do there is an internal resistance also increasing within the yarn.

So, there is an external torque which is being generated because of frictions that you have between surface of the disk and that of the yarn. And the normal force that you have created by increasing the tension in the yarn, as well as by the angle of wrap, that is will generate the external torque which you are trying to control, but the resistance which also takes place within the material itself which does not want to change it is position; that means, it is opposing.

So, now whenever this thing happens that the internal resistance becomes equal to approximately the external torque it just slips. And then within a fraction of second will again stick and again go to the same level and again slip. And so, this will occur because of the internal resistance which is; obviously, opposing any twisting process.

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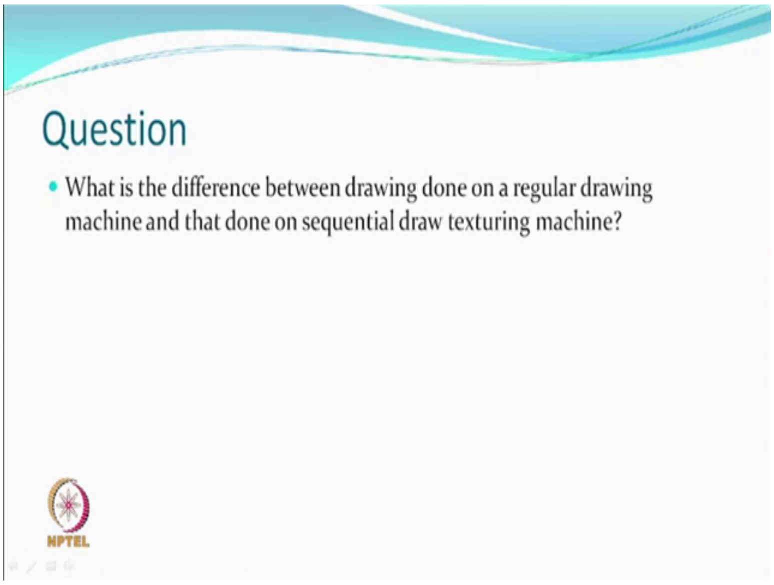

This would have the interesting thing what is the difference between the drawing done on a regular drawing machine and that done on a sequential draw texturing machine.

So, from the product point of view if 3.7 draw has been given in the drawing machine and the same draw has been given on a sequential texturing machine, from the product point of view you may not see much of a change because drawn. And you are also maintaining temperature like nylon can nylons can be drawn at room temperature, but polyesters may have to be drawn at little higher temperature, and the same temperature they are also using.

So, you do not expect too much of a change as far as the drawn materials insane, it is crystal T will rise orientation will improve everything will be their; only thing which we know is the speed of the drawing machine could be higher, that was the case in the pin texturing. And, today a situation is slightly different that you are actually going for a simultaneous draw texturing using a POY and the speeds have also increased, but this material is very different than the material that is drawn on a drawing machine, because there is no twist their orientation is very nice.

So, these two are doing, but the question was on sequential draw machine. So, speed was the only thing at time and now we are not looking at sequential drawing as an alternative.

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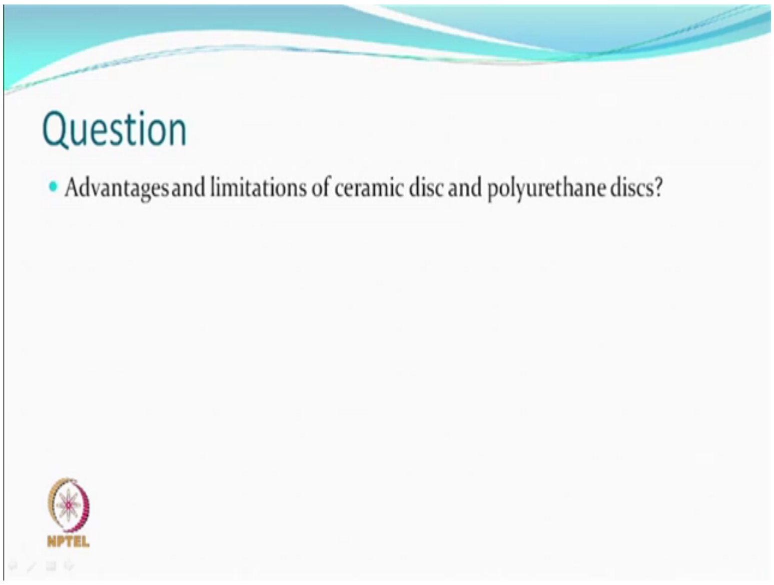

This question related to ceramic disc surface and polyurethane discs and something like this is to why should you use this and not use that kind of thing. So, what we are looking at advantages of let us say ceramic discs. Advantage is the long life, the disc is going to have a longer life it is more rigid, but then slippages can be more as far as the fiber filament and the surface of the ceramic disc is concerned.

Because mu is going to be less you will try whatever you had tried, but we are looking at long term. On the other hand the life of polyurethane discs is going to be lower, because also softer. And therefore, it can also get a braided, in the previous case only the filament will be a braid the ceramic disc could not really get braided. In this case polyurethane discs you may actually see that the disc also may get damaged. So, it is life is less advantage; obviously, is that coefficient of friction is high, less number of discs may be required in a stack and slippage is can be low.

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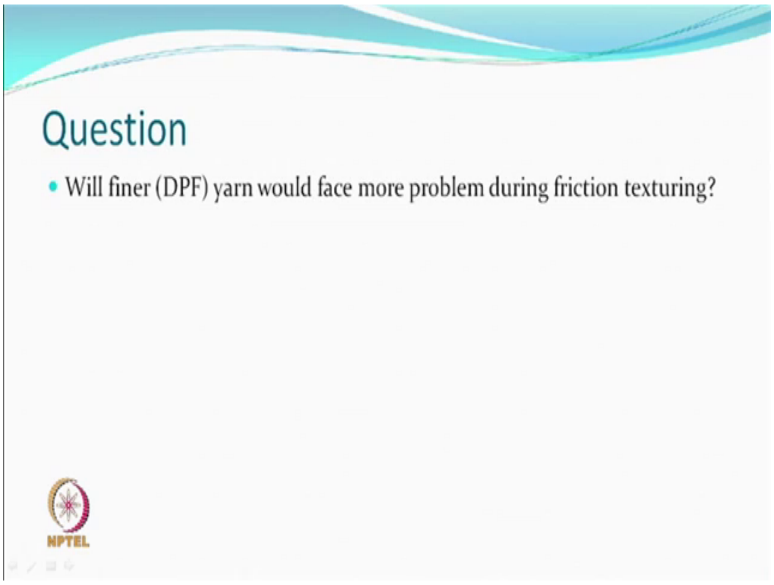

Will the finer denier finer yarn is there the denier per filament is less. For example, a denier filament per filament of 2 to 3 versus a micro denier material, where denier is less than 1, 0.8, 0.6 denier per filament, so, what kind of a problem? So, definitely you will see more broken filaments, because it is finer despite the fact that you are doing whatever you can do.

So, when it is individual filament we have to withstand all this torture of slip a final filament is likely to break first. And therefore, the friction texturing people and would not like to easily agree to texturize micro denier filament yarn. Because, there will be errors, but if somebody wants you can do it anyway.

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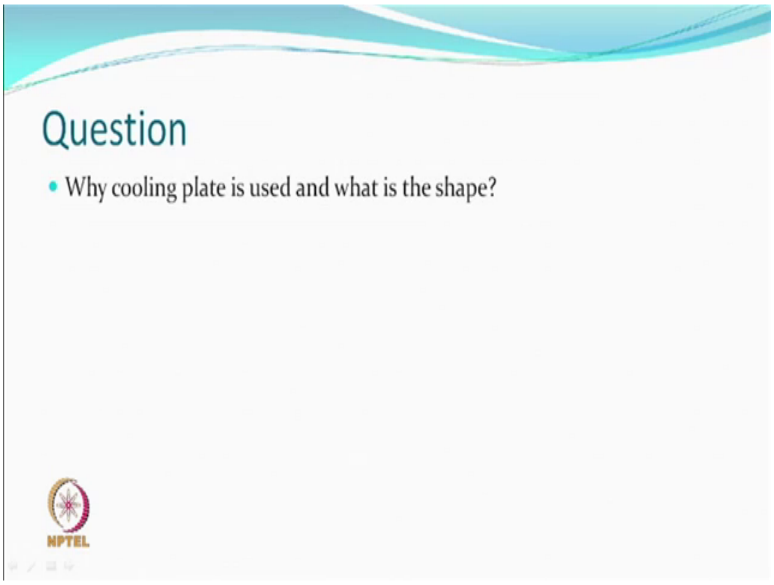

Why is cooling plate used as the machine speed started increasing the time available or the cooling length required for the temperature of the yarn to come down to a level which is below the glass temperature was; obviously, high. Like normally why should require anything because this is a cooler environment heat will automatically flow out, you do not want to use anything it is good that no abrasion nothing there simply is moving to think that is the best thing.

But, if you run a machine at a faster speed and also have a free length, which is also longer because you have to cool it and it is twisting. This is not a yarn just going from where, if something is twisting you may see well uncontrolled long lengths can give various kinds of ballooning effects.

So, you have to guide them contact help that also, but before that the transfer of heat by conduction mechanism is faster. And, so, you contact rather than believe in automatic transfer to the environment. And, because it is contact therefore, the shape is convex.

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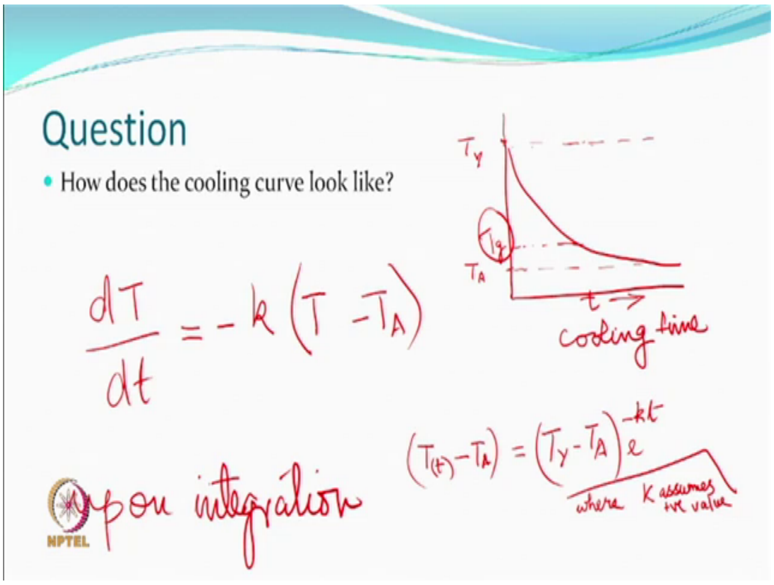

How does the cooling curve look like well you have a high temperature as it exits the heater? And will cool if it is cooling naturally otherwise some constants will have to be changed. Then this type of a curve can be seen, that ambient temperature which is let us say T A and a yarn temperature let us say T Y. At some stage it will come it will become equal to 2 a and after that temperature will not change, that is why this time is also important at what time this happens?

So, this curve may be important. If this happens at a later stage you will have to do something else and that is why cooling plate came into existence because you do not want. So, you may not be interested in T A you may be interested in something called a T G, where it still may be somewhere there, but still the rate of cooling will be also important.

And, as such is we know that the rate of cooling the difference between the temperature with time is proportional to negatively proportion the rate keeps on going down. And, so, equation of this kind may be valid. The temperature at any given point of T minus the ambient when the yarn temperature and the ambient temperature, which is constant difference may be following this type of a rule norm. And what it means is the k is a positive value and therefore, the negative sign is there. Someday says my k actually I am putting a negative value, then I leave a positive sign I think that is all what are the questions that I could pick up from whatever assignment that is submitted. So, we can stop here.