Textured Yarn Technology
Prof. Kushal Sen
Department of Textile Technology
Indian Institute of Technology, Delhi

Lecture – 02
General principles involved in the manufacture of textured yarns

Alright, so we meet again today and we will be going further. And the further thing is that we will look at the principles involved in the manufacture of the textured yarns. So, there are we understood there is a broad classification and so we will go further.

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So, what have we learnt till now is the terms and the definition related to texturing right. So, what is called texturing texturization those are the issues we think and the definition as to what kind of a process is a texturing process and what kind of a yarn could be texturing. And we also understood that it is not that the texturing process got generated developed only after the advent of synthetic fibre.

Likely the work had started before and people must have also found that a bulky material is a better from comfort point of view. And therefore, you can get different kind of structures which could be stretchable and which can retract and give you comfort. Also we learnt about the advantages and possible applications of those kind of textured yarns. And we had done a broad classification, we done a broad classification of the textured yarns. So, let me just go back a bit.

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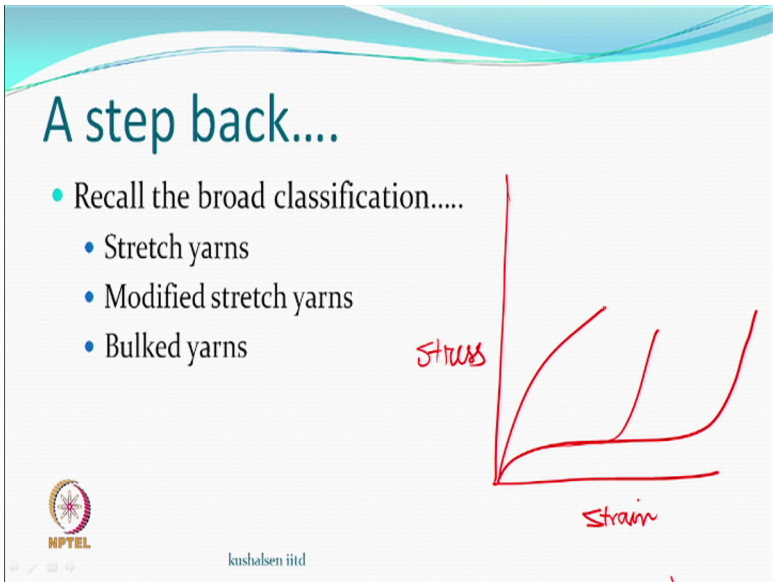

And we remember that the broad classification said that there is stretch yarn and the modified stretch yarn and the bulk yarns. So, you remember what kind of a material will be called a stretch yarn? What type of material will be called a stretch yarn? The one which can stretch up to 300 to 400 percent and the one which are modified stretch yarns would be doing the same thing, but at a lesser stretch ratio.

And we did say that if it is a stretch yarn the stress strain curve of a stretch yarn would be something like this and the modified stretch yarn would be something like that. And the bulked yarns probably may work like this. That they do not stretch and therefore, the stretches that gets developed in the yarn is immediately as you strain them. And this could be one of the ways in which you can find out whether the stretch yarn it is not a stretch yarn.

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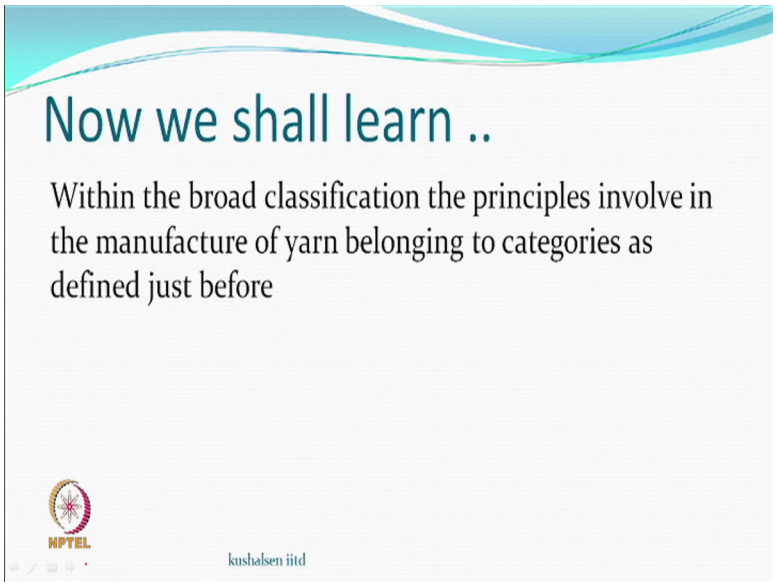

Today as I said within these classifications we will try to see what type of a principle are used to generate a stretch yarn or a modified stretch yarn. Then if time permits we will go to the bulked yarn otherwise we will stop and do it next time. So, the stretch yarns.

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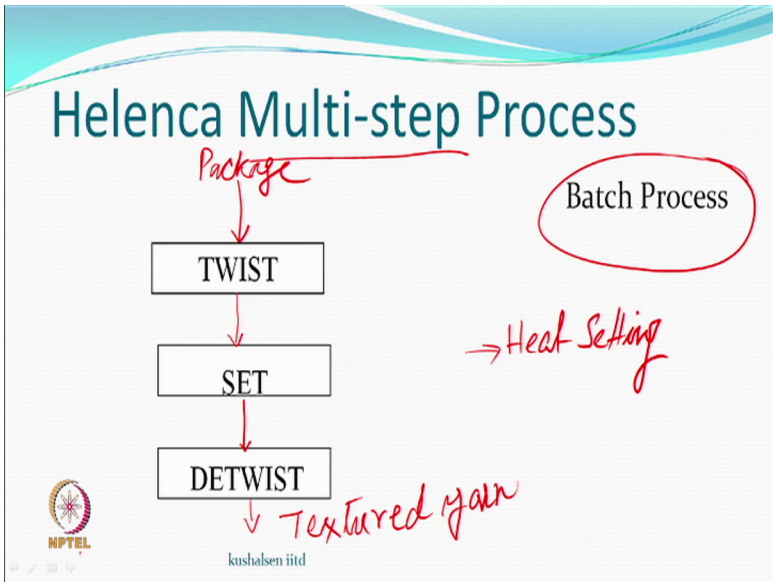

So, what of the process that has been used to produce stretch yarn is called the Helenca multi step process, It is called multi step because there are many steps involved like there is a process which is to be done called twisting. So, it is a multi step process. So, you

have to twist so there is one, you remember which other process was also using twist. Last time we talking about the historical perspective you remember any name.

Student: (Refer Time: 04:10).

Well the one which use the f false this of course, we talked about. But in earlier time we had a process which was used for texturing of multifilament viscose yarn. And therefore, twisting was used that was called the Heberlein process, if you remember that Heberlein process. So, that also used twist and this Helenca finally, also uses twist. This was commercially successful process so there was a process in which you had multifilament yarn, you would twist them starting from some package. And after twisting you go through a next process called setting that is you must set the test you know the twist.

Now, how do you set would depend on what type of material it is. It is a thermoplastic material it is a non thermoplastic material or whatever. Let us say it is a thermoplastic material; if it is a thermoplastic material then maybe you will do the heat setting and this heat setting; obviously, from one package you have come to another package which is also twisted and has been subjected to some treatment like this. And after that the same package is taken to another machine for de twisting and then after de twisting what you get is a textured yarn. So, you have a package then you go somewhere and do the twisting and then go somewhere maybe an autoclave because you have to keep them for setting and then go to another machine for de twisting and therefore, it becomes a batch process.

So, you will do many batches in one way maybe there are many spinning heads spindles where you are twisting. Then you take the packages put them in somewhere for setting then take them out, cool them de twist and then get another package where you will have textured yarn. So, this is a multi step process which is the batch process.

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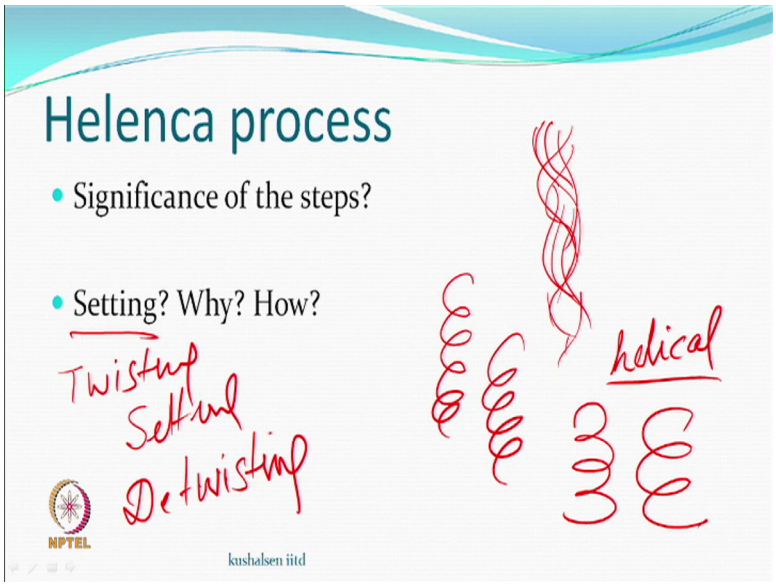

So, significance of these steps; the significance; obviously, is unless you twist you cannot go to the next step. So, what will the twist give. If you look at anything called twisted material. So, when you twist possibly in this condition the filament if it is the filament yarn the filaments will be taking some type of a helical path in the yarn. And if they take a helical path and then you do something which is called setting. So, after untwisting theoretically and practically also each filament probably may have taken some path like this, based on whether you are giving S twist or a Z twist this could be this or that.

But interesting is the setting, if you do not do any setting then yes this will be twisted, you do untwisting we will get untwisted. So, you will get the same material with which you would started. We therefore, have significance of all the three steps which we said twisting, setting and de twisting. And if this is what we do we will get a textured yarn. So, principally you are twisting sometime this type of method you also called twist texturing that you are using twist as a medium of defamation. So, you are deforming the parallel bundle and then retaining that shape by some method and that setting.

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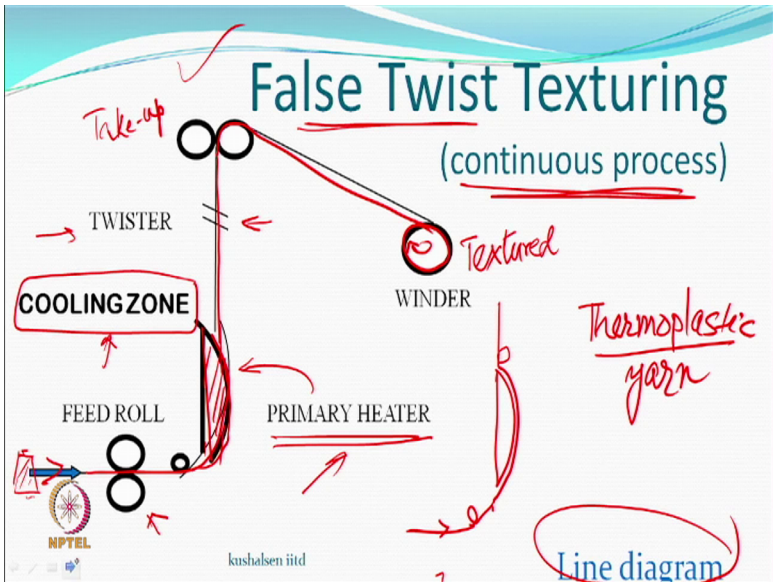

This is a line diagram of another method which is called false twist. So, the yarn comes from this side, maybe from a package feed roller you take the yarn then there is something called the heater. So, the yarn passes over the surface of the heater and guided to another thing which is the take up role and between these two roles you have this is what we call as a primary heater. So, there is a heater if we are again looking at a thermoplastic yarn. If there is no thermoplastic yarn then heat is now going to be the one which is functional part we will have to do something else. But let say we have a thermoplastic multifilament yarn.

Then in that case we have a feed roller and take up roller and in between you have a heater, the heater basically is convex. So, that when your yarn passes through this it is generally in contact with the surface. So, if this is true, then we expect that the yarn get heated. But is the process different than the previous one? What was the previous process principle? Twist set and de twist, the change that we are saying is false twist. It does not mean that we are not going to be twisting it does not mean that we are not going to setting and also does not mean that we are not going to be de twisting. So, all the three steps will be done, but in a manner where twisting untwisting is happening in a manner which we now call as a false twist.

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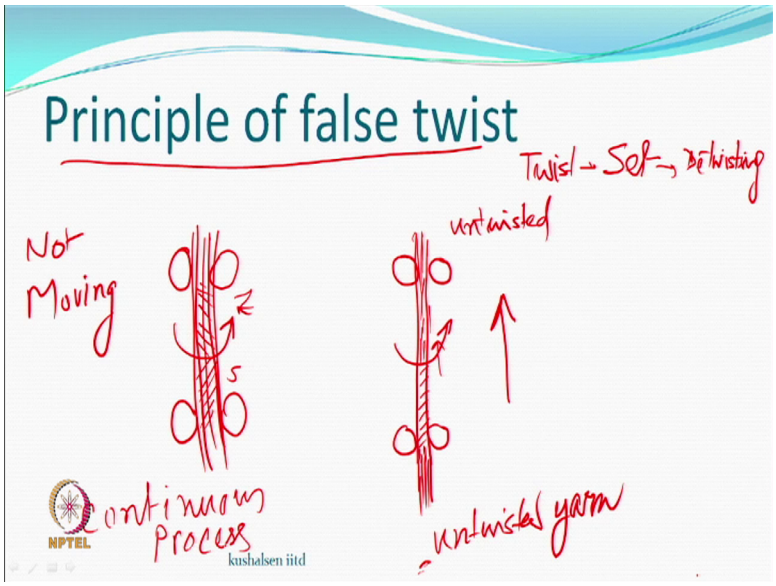

Let us say you have parallel bundle of filaments and they are nipped for example, one at point and the other at this point they are nipped. If they are nipped if they are nipped properly and it is stationary ok, is not moving. If this is not moving and you twist from the middle, what do expect? We expect that on one side the twist will be let us say in one direction, on the other side the twist could be in the let us say first was S then will become Z all right S and Z. So, if do the sum total of this if it is absolutely middle so number of twist above the twisting point and the number of twist below the twisting point are going to be same.

One in plus direction other in minus direction and therefore, there is no twist or a false twist. Does it help in any manner in our texturing process? Unless and until we are smartly do it does not matter does not help. So, what do we get we must do setting, but we must do twisting followed by setting followed by de twisting. So, what we do? We do if suppose we have the same situation like we have a take up role and feed role. And let us say as we may say this is moving upwards. Now it is not stationary actually it is moving, if it is moving and there is nipped here.

This is the parallel bundle of filaments being fed up to the nip and you are trying to do some twisting. So, this portion from here to this point will get twisted the other portion must get equal and opposite twist, like the case which was here all right. But what happens here is because this portion which is just been twisted is moving up. So, it gets

the reverse twist exactly equal and opposite. So, the resultant is that this becomes untwisted. So, in the same movement if we keep doing it you start with the untwisted yarn twist in between and go up which you have again an untwisted yarn. So, you start with an untwisted yarn and finish with an untwisted yarn. This is the principle of the false twist machine.

So, one thing the motivation is you did not you wanted a continuous process continuous process. Because we know that the profit, the speed, the production in a continuous process likely to be higher, the best batch variation which you can see in a situation which is one batches to the other batch the temperature if at all may be changed the levels may be changed. In this case if it is a continuous process then productions could be high, space requirement could different and quality variations may be less.

So, how do we use this principle in the texturing machine or a false twisting machine is that there is a twister here; there is a twister this is the feed role all right this is the take up role in between we are twisting so what do we expect if this is twisting here the material above this would be untwisted the material below this will twisted.

So, the twist is actually flowing from this up to the nip of the feed role, in between what we have done also is there is a primary heater also has been put. The word primary here come because in a next machine we can see there can be a secondary heater also. So, what have you got? You have twist and de twist taking place because of false twisting and when the material is in the twisted condition you are putting a heater there. And so not just the heater, but you also have what I call is the cooling zone. So, setting in a thermoplastic yarn is there is a heating process and there is a stabilisation process which we call probably can come through cooling.

If suppose you did not give this cooling length or did not give the cooling time then false twists will do it is job twist and untwist. But the hot yarn which is pliable to change again will be an twisted while it is still hot. So, you will see whatever setting you want to do can be redone also, it is not only going to be untwisted. But it will also go to the new position which will be flat filament yarn. So, all these thing that a written here call the primary heater is important, cooling zone is important. Twister is going to do the twist the twisting which means the false twist that mean defamation, after the twisting it is a

multifilament yarn which is a parallel bundle and then you can wind it up and that is a textured yarn continuous process is that right.

So, the principle of false twist is clear and the general see scheme of things are also clear the sequence also in which it should happen. You cannot have any other sequence cannot do setting before the twisting and cannot do setting without cooling in case of thermoplastic yarns. If there are other yarn the we will learn about it how they can the set is where. So, what will be the structure of this false twist yarn. We will look at a structure what to do the structure you have to speak little louder so that yeah.

Student: Helical.

Helical.

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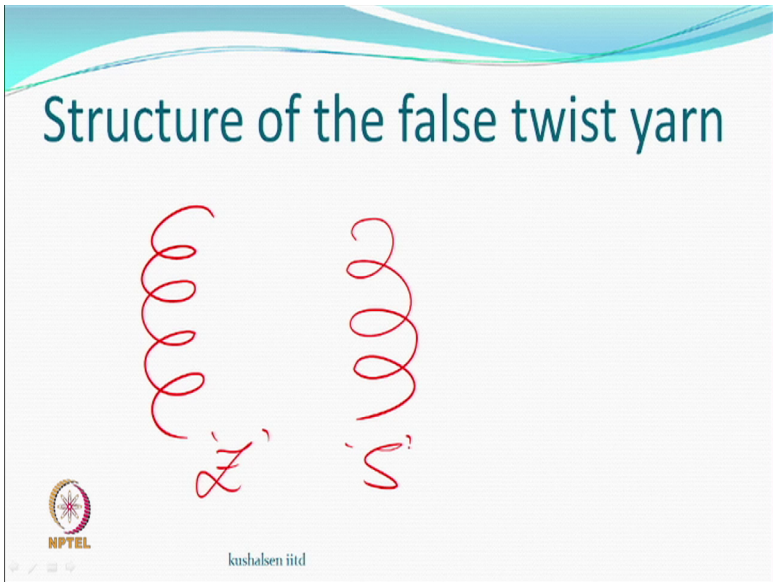

So, the structure of this yarn also will be helical, one can design to make it Z or S up to us. So, if you have large long machine so you will have different spindle some of them maybe running at S some of them maybe running at Z (Refer Time: 19:53) everything can run and S yeah sure. You can run whichever direction you want to run. But when you make a final product people may like to have one S twisted yarn, the next one as a Z twisted yarn and S and Z and S and Z combination; so that whatever little biases can come because yarn has a tendency to get into helical shape.

So, if one of the yarn wants to turn this direction the neighbouring yarn if turns in the other direction then you get a balance, a fabric knitted or otherwise would look balance. So, in a machine you may have both running simultaneously or alternatively. So, that the final product which you make is more balance. So, structured the yarn a false twist also is helical.

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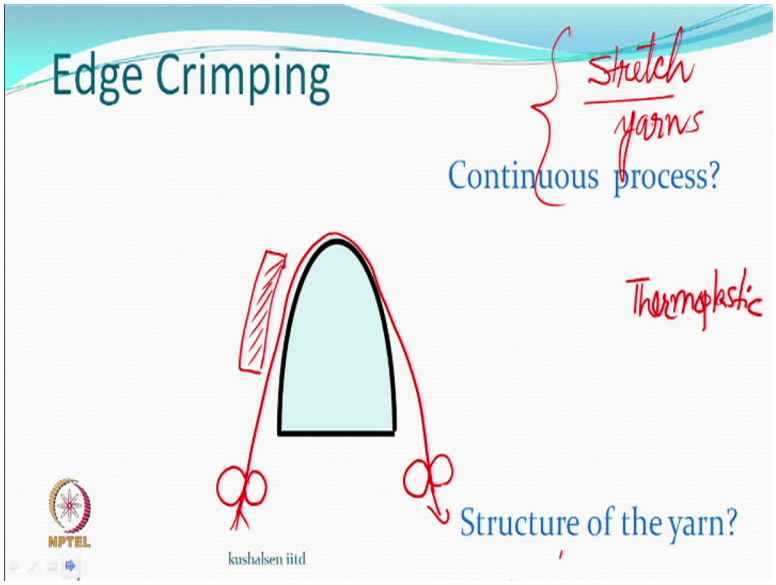

So, another process which is used to produce stretch yarn. Remember we are still talking about stretch yarns; is called edge crimping. And what is edge crimping you take a yarn over a sharp edge, under tension. If you take a yarn over sharp edge under tension and if you want to design something you can let us say it is also easy to understand to begin with, is also thermoplastic yarn. So, you can put a let us say heating device as it moving.

Alternately you can heat the edge also, but maybe it is easier to pull a heating device. So, you have a yarn which has been heated to a certain degree which is sufficient for it to respond; goes over the edge and comes out. And you say here we are starting with a yarn which is un textured and here we are coming out with the yarn which is called textured not only textured but I say is it is a stretch yarn. You think it is looks like a good idea or it is a bad idea?

Student: Good idea.

Good idea, the good idea part is that appears to very simple process, we just moving over an edge. So, simple process is always good idea.

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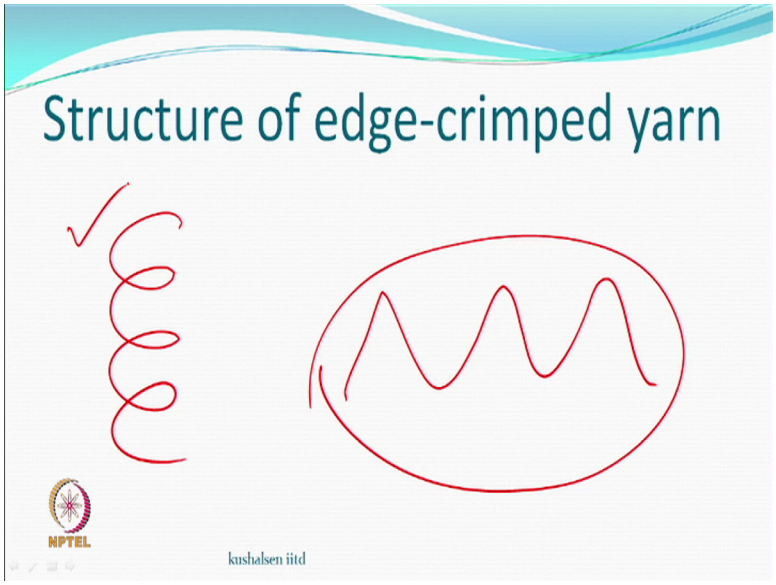

What kind of structures that we likely to get here.

Student: One sided one sided textured.

One sided textured, anyone else would like to respond is to what kind of a structure we will likely to get when you pass a filament yarn over an edge under tension which may be heated. What kind of a structure do we expect? Let us say I say it also will be helical, you think is a good statement or a bad statement or it would be like this, what will be.

Student: Second one.

Second one so you are expecting that the when you pass over edge you are likely to get this type of a structure right convinced, what is wrong? So, what you get (Refer Time: 24:19) is a helical structure, you gone to the florist shop to buy flower buckeyes, that smart guy picks up a ribbon and then moves it over a just edge what kind of structure you see.

Student: Helical.

Oh got that is it; that means, just by passing over an edge you can get a helical structure. And helical structure if you get; that means, you can take this yarn or a filament you can

stretch it will recover will go may be a large man of extension stretch it will show if it is nicely done it will come back. It is quite possible, you take that ribbon of that florist and again stretch like this it may not go back. Because he was not heating it up, he was not cooling it he was just doing it for the time being and why does it happen.

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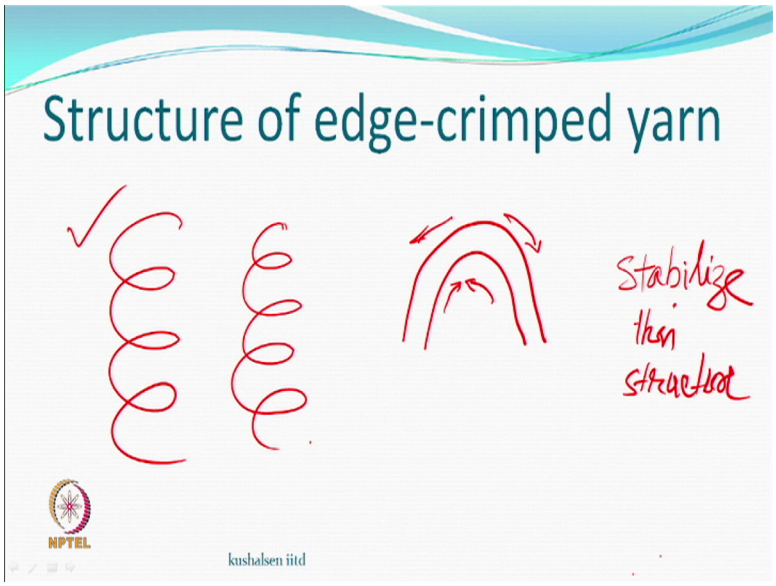

So, when you move or bend any material including the fiber or a filament. So, one side you know is compressed the other side is extended which has to happen because your bending. So, bending resistance is something is do with it if it is very resistant material then it will be difficult to bend.

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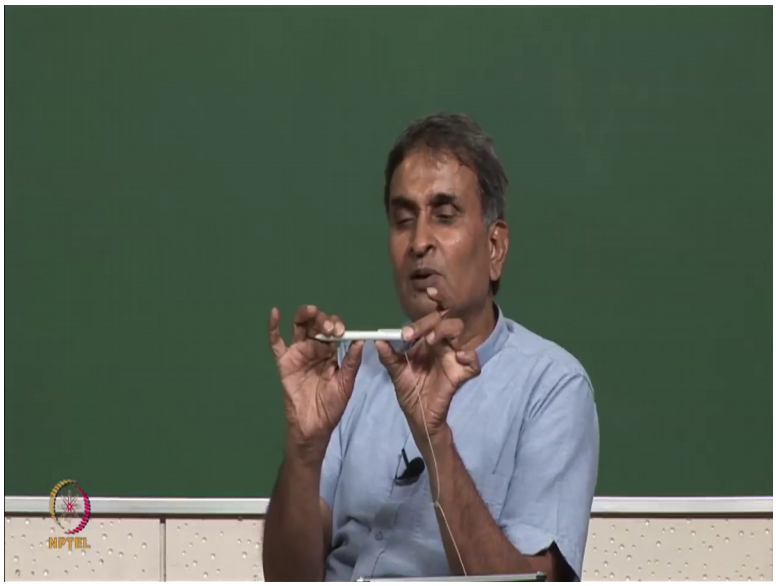

For example this pen is difficult to bend.

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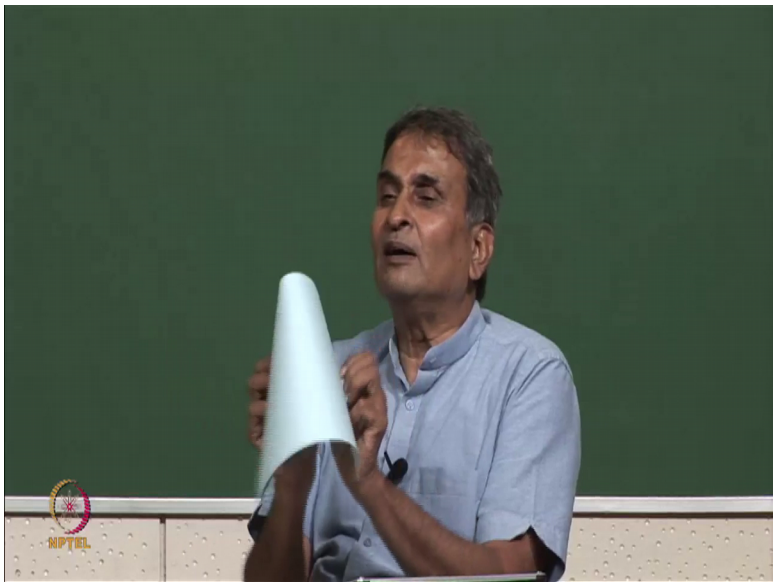

But this material is easy to bend. So, there may be what I call as a possibility of thickness which will be playing the role the diameter of the yarn may be playing a role all that is important right. Now the trick remains can you stabilize this structure? What is this structure? The structure is that when you bend part of it is compressed outside is extended and you keep this as it is, then it will remain in a bend condition.

Like for example, this paper I have bent it I am expecting that inside of this is compressed outside is extended true, but I leave it comes back. I do something like this like this now it does not come back something is happened some change is happen and this change is not allowing it to go back and that is the kind of a change if you do smartly, then the kind of structure that you getting this helical structure will be in some sense permanent. Nothing is permanent in the world is all relative.

So, it is going to stretch it is going to compress it is going to recover, stretch, recover, stretch, recover, this is what will happen. Think of this the one who Attlee postulated must have been a proud man or woman like heroic simple technique you do. So, this is also important to learn in this whole growth of texturing. There is a lot of people have been giving different ideas to ensure different kind of products are generated and so is very interesting so this is a principle.

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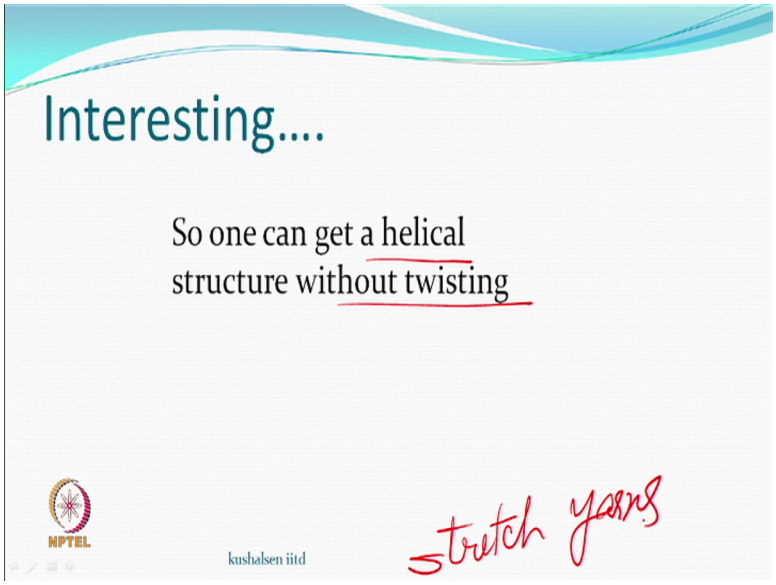

So, interesting part is that you can get a helical structure without twisting and get of course, stretch yarns.

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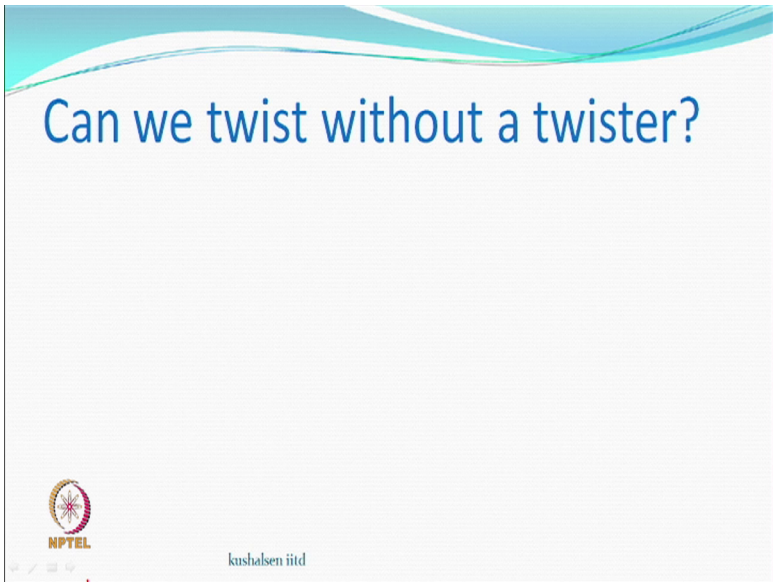

So, this is one part which we thought was interesting that you could make a helical structure without any just passing over a edge helical structure is useful so it is useful. The question that comes is can you twist without a twister? Now twisting we know; obviously, will produce a helical structure, but if it gets twisted it will produce helical structure. But can you think of something where there is no twister and it still get twisted that is you have no twister and it still get twisted.

Once it is twisted then we know what be the best thing to do how will it help anyone for that matter, any guesses? You may like to make or you can also say well this is a absurd question we cannot do things like this. You cannot go to hostel for that matter without walking unless and until hostel can come to you which can happen. But nevertheless there is a question.

Student: (Refer Time: 30:11).

So, you give some tension and then suddenly find it starts getting twisted. Well not a bad thing to Attlee think about it so he is got some idea. I think what will do is that we will give him some assignment to Attlee design a process by which this would happen. So, we would not discard the ide,a ideas are always good right. It can happen also, but let us see what people did.

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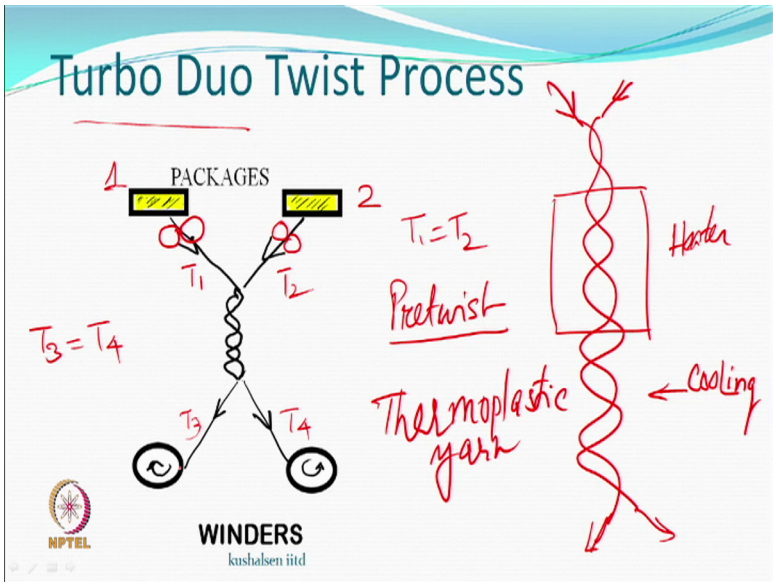

This process is called turbo duo process. So, what this process is doing is there are two packages; package number 1, and package number 2 which are the packages which are untwisted un textured feed yarn and then you want to texturize them. But before you texturize them you must twist them. So, what they doing is take one yarn from here take the other yarn from here give some pre twist by any method any method, you can just do this and you have a twist. And then whatever length and whatever twist per meter you wanted you give and after that just go away. Just remove the yarn from here and from here and then start binding.

So, what you have is actually you should have a feeding mechanism, you should have a feeding mechanism. Why this feeding mechanism is required? What is important is that if you do this and just keep pulling as long as the yarn is being fed. You will suddenly find this twisted zone just remains there, the new yarn comes in the zone get twisted and as it gets out. It gets out of the zone and that portion where the twist is there just remains stays there may be little bit of vibration based on what you do. So, this is not twisted now, but this also you must have seen in your life some people must have used it doing all kind of things.

But this is something which is possible technically to Attlee do the twisting. This twisting is slightly different than the previous twisting, because now you have two yarns so will be apply twist right. So, two yarns going to be twisted over each other, but that is

ok. So, now, how do we do this smart thing? The smart thing would be that you have this you are pulling, you are feeding, in between when you think you were right space put a heater cooling. So, again we are assuming it is a thermoplastic yarn. So, what is the smart thing that you have been able to twist without a twister and using that zone this zone could be made longer or shorter based on how much twist you are inserted.

If insert more twist then it will spread, but important thing there is a tension in this yarn here there is a tension in the yarn here you can appreciate if both T 1 and T 2 are far away not very close to each other. At fact if they are same that is the best If T 1 is equal to T 2. Then the same amount of yarn is going to be fed. If T 1 is higher, then this whole zone is going to pull towards one side, if T 2 is higher this will be pulled on the other side; and if they are same this point will remain exactly approximately theoretically exactly same practically it may go up here and there because you may have variations.

The kind of this will says as a 0 tension variation if there is no zero tension variation some will be there let us say theoretically want to make T 1 is equal to T 2. And also at the same time you should be able to make T 3 and T 4 also same. If you do these conditions then you can continuously keep feeding the yarn into the twisted zone and continuously keep it drawing from the twisted zone and this so called twisted area or a length will more or less remain stationary at the same point it will appear to be there remaining there smart thing is not it. So, when somebody was saying that I can do this yes that is also smart thing you must do.

So, do not leave that part, but you suggested think as to how will you do it. So, an engineer is supposed to design take a problem and start designing do not say that it cannot be done how it can be done is the more important thing. So, it will be interesting is to if you find some solution other than that. And of course, you wind them and this wind wound yarn should be a textured yarn. Because what have we done? You have twisted you have heated right and also you have cooled. So, it should be meeting all your requirements. Is that a continuous process? The edge crimping was a continuous process, false twist also continuous process. So, you have a continuous process three continuous process is that we have seen one of them is a batch process.

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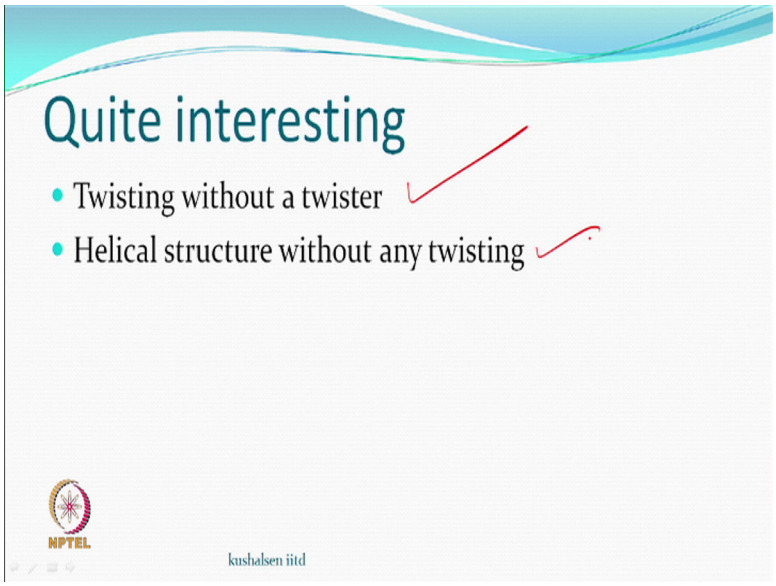

And we have seen this twisting without a twister and also we have seen helical structure without even twisting.

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So, let us have a summarize stretch yarns, Helenca multi step process it also gives you a helical structure, but it is a batch process. False twist texturing is a continuous process it also gives helical structure. Edge crimping also gives helical structure as a continuous process and turbo duo we just finished also is helical process, it gives you helical structure. Why? Because the common factor is twit no it is not common factor is that in

some way we are actually making helical structure that is the common. In one case we are not twisting at all, but you getting helical. So, what do we learn? What is what we learn?

We learn is that if you want to make a stretch yarn you make helical structure. Why? Because they will extend the maximum, you can get any structure it does not matter you disturb the yarn in one way or the other you will get some structure alright, not a issue. But you will not be able to get that much of a stretch which we are setting 300 to 400 percent. Now how much stretch it will depend on how many helisis you are putting per unit length. Larger is the number of helisis more will be the stretch. Of course, this will be related later with the denier of the filament, the diameter of the yarn, etcetera.

They will be responsible, but definitely you can take away, it must be helical and all of them produce helical. So, what it also means is if you have another process continuous process or any other process which can give you helical structure you will be able to produce a stretch yarn.

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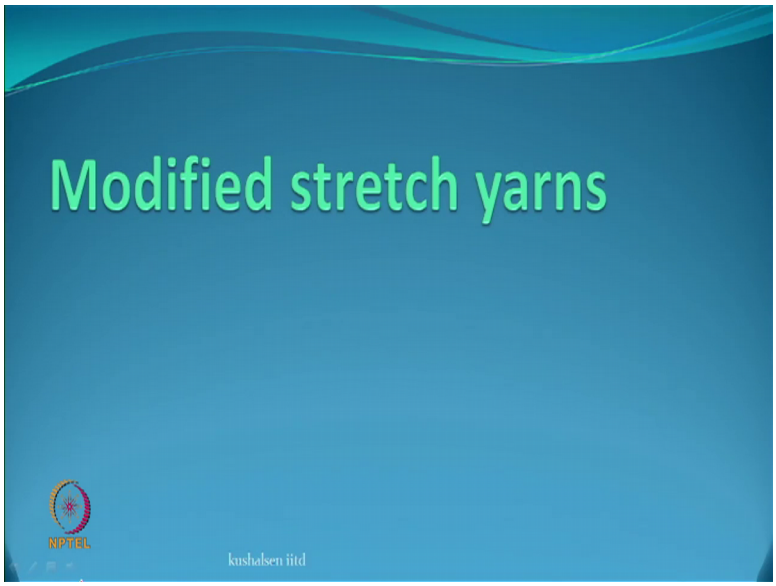

We go to the next step which we called as a modified stretch yarns. Now you remember why did you call it modified?

Student: (Refer Time: 40:23).

Right so you want to reduce the stretch; that means, you first make a stretch yarn and reduce the stretch and therefore, you are modifying the process therefore, the term has just stayed. What actually it means is the yarn characteristic basic characteristics it is a it will still have bulk. But it would have less stretch ok. Maybe 100 250 or so right.

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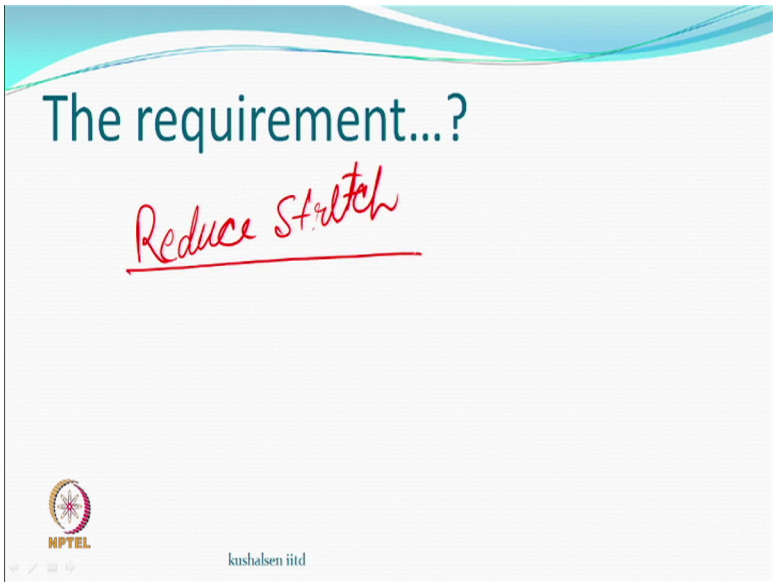

So, smartness will be how to reduce the stretch? Principally we have understood we can make stretch yarn by using different principles. So, which is modified; that means, you have to go to that step initially first you make a stretch yarn ok. So, let us see if the same processes can be used to do the modification.

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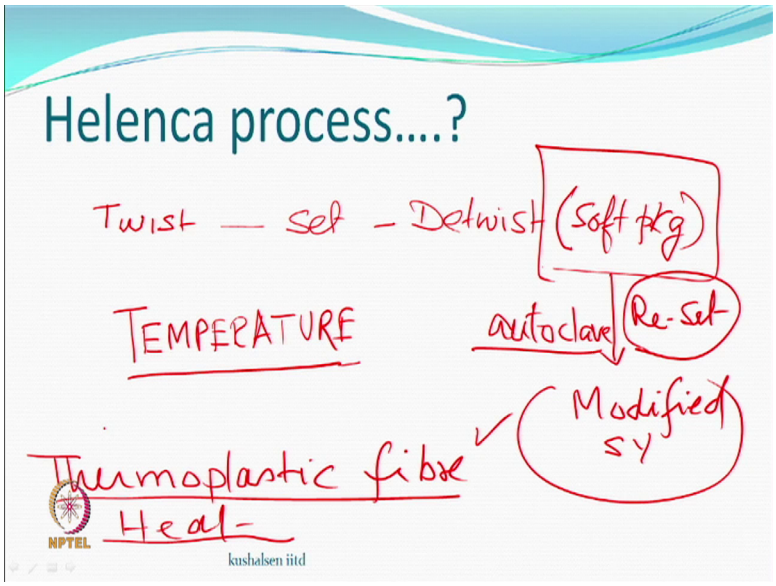

So, we do have this process right, call the Helenca process. So, what was the Helenca process set no twist set de twist we got a textured yarn which was called the stretch yarn. Now you have to go further from there and what you do after this de twisting we have made a package here a term which has been used is soft package. What is soft package? That is the tension winding tension was less and therefore, the yarn or the filament within the yarn have some scope to manoeuvre right.

After that you do re setting, put it back put it back into the autoclave again. If again remember thermoplastic if it is a thermoplastic fiber then you use the heat; that means, again an autoclave. So, package twisted somewhere putting the autoclave take it out; obviously, cool after cooling take it to the de twisting zone machine de twist softer package. And then after making a soft package again put it back to and again an autoclave and do not do anything after that, cool it and this is your modified stretch yarns. So, the question is what have we done we just taken and it put it somewhere and then suddenly it become modified stretch yarn.

So, what are the tricks say what is the principle trick? What is the principle trick? Can you guess what have we done. Take the package again and put it somewhere else re heating the same thing we have to cooled untwisted again re heating. So, the heating re heating make sense. So, does it somehow satisfy your inquisitiveness that you take

something heat it once then cool it again re heat it is going to keep changing the property. And the property the way we want to change the property you mean it is not that.

Student: (Refer Time: 44:26).

Good. So, one part that he just said is the temperature could be different. Temperature of resetting could be different alright. So, should be high or should be low high or low?

Student: (Refer Time: 44:57).

Low so; that means, the second heating system or a cycle would have a lower temperature than the primary or the first heating cycle right. So, if you remember your thermoplastic yarns polyester etcetera you iron you put a crease right. So, you wash it the crease stays there, but if you want to remove the crease then you go to the temperature which is equal to the previous temperature or above. Then you can remove the crease, but if you remain below can you remove the crease.

But you cannot say nothing is happening. You see it is a polymer, there is something called a glass transition temperature. If you are above the glass transition temperature something will definitely happen you know some change, but the change would be limited change. It will not completely change that now somebody ask you; you are already in helical thing yarn has been texturized and your reheating again just to the lower temperature is it going to be in your benefit, who is it is benefit you know ok, lower temperature some change, but it is a helical.

So, how it is going to help you to reduce the stretch, good question. So, what we are going to do is we will stop here and continue in the next class; starting with this is question itself as to ‘how is it going to help you to reduce the stretch’? Like you have the crease on a shirt at a lower temperature of ironing you take the same crease and put your iron will the crease go? If it does not then how is helping, right. So, we leave you here with this question. And well we stop here.