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

Lecture - 1
Introduction to texturing

All right, so we are meeting for the first time in this class. So, we can begin with actually learning about what is approximately the area that we would be covering in this particular course which is called the Textured Yarn Technology.

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So, in brief if we look at some of the things which we should be doing is principles of texturing and classification. So, the whole course is called textured yarn technology. So, what is texturing at least we should know and what kind of a processes which can be covered under this type of an heading or a whole topic therefore, we will say that some classification also we need to do either to learn the various different processes.

The other in this whole thing is there is one of the interesting technologies which is quite popular called false twist process. And what it means; obviously, is that you actually twist, but finally, there is no twist and therefore, it is called false twist. So, this is one process that we would like to talk about. We will talk about mechanisms related to this texturing in this process and properties structure property co relation process parameters and so on so forth.

Within this category you also have a draw texturing process where the filaments which are supposed to be textured are not fully drawn. And so they are in a way undrawn or partially oriented yarns. And so what to do in such cases is what we call the draw texturing the need the fundamental aspects of these are going to be quite important as far as the learning component is concerned. The next in this line is friction texturing where friction is a very important component in the whole process for twisting purposes. You can twist by many methods, but this is become a popular technology. And so why the friction texturing was needed what developments have taken place within this and also the mechanics of friction texturing is what we would also be talking about. There be many other things here also property correlations on support will come into picture, but mainly we will be talking about friction.

Another process which we believe now is commercially a successful process is called air jet texturing. So, instead of using any other mechanics or mechanism like thermal inputs you will have air as a mechanism of deformation entanglement and so you can use this process to produce product which we called as air jet textured yarns. In this whole thing you also have filament yarns, spun yarns and so on so forth that is what we will also talk.

Related to this topic also is a topic which we called as a air interlacement which is not exactly texturing, but in multifilament processes particularly they started using this as one of the processes because it is an attachment which may be available on various machines and therefore, you may like to learn something about this as well. There is one interesting process which we called as a bulk continuous filament yarn and this process is interesting in the sense that the speed of the whole process is very high it could be in the range of 4000 metres per minute which in normal textile processes you do not see such speeds very high speeds. And so it produces a type of a yarn which is interesting. And this also comes under the whole big umbrella of what we call as texturing.

Then there is a category of yarn called Hi-bulk yarn which are used also in daily life particularly in the winters you get a lot of knitting yarns woollen or other synthetic material which we do which looks like woollen yarn is done through the hi bulk process and so this also we will learn and we will spend some time also on other methods of texturing which we called as using solvent or any other chemical rather than only a dry heat or air jet it is a mechanics. So, this is the course content in brief.

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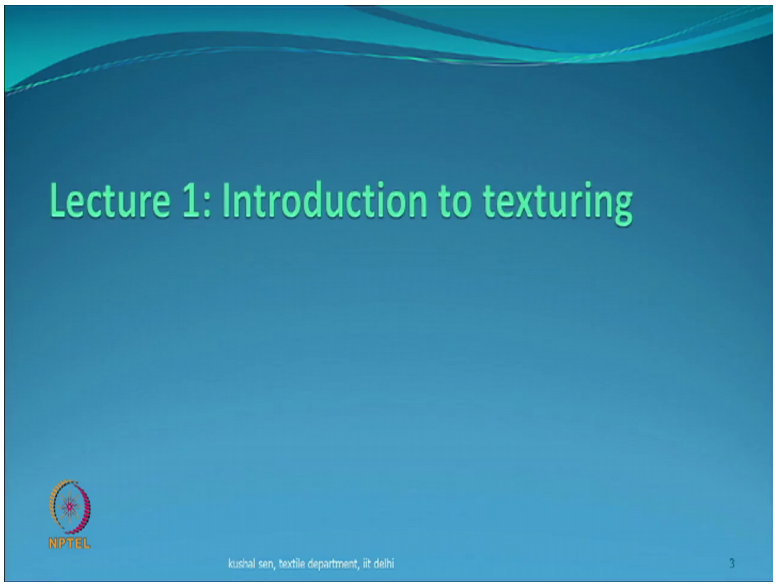

So, the introduction to texturing is the lecture that we are doing today. So, we spend some time to understand whatever it means and later on we will develop on these things.

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So, what we want to learn in this; the terminology as to when we say texturing whatever it means we may learn the definition of a process itself. Why do we do this all this what is need what is the need and that is what we may like to point out. The advantages, applications some of the application that we have. And hopefully we should be able to

finish something called a broad classification of textured yarns from where onwards we will pick up individual processes and work on them.

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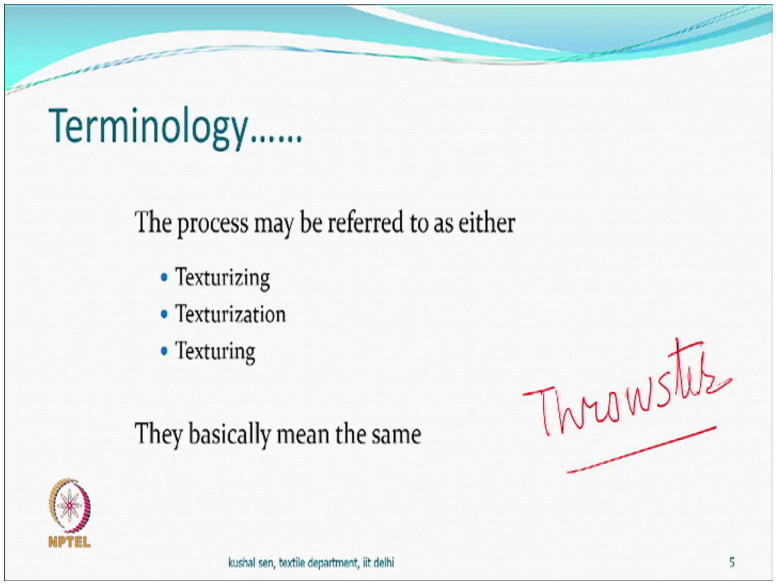

The terminology, different people at different times have been using different words to refer to the same process called texturizing. So, people have been using this word texturizing some people also been using word like texturization and we are in this course calling it texturing all of them means same the same. So, different people can at different time use this term, but you must not get confused that all these terms are similar terms actually same meaning the same process. People who have been working in this industry sometimes are called Throwsters. Throwster was a person who used to do the spinning of silk yarn.Silk worm is the one natural material which is long filament yarns before this the people all other natural fibres are staple short length material, but silk is a long. And then when the manmade fibres are made synthetic fibres are made you had filament yarns. So, the term sometimes we used as throwsters, throwsters it may have the spelling of the kind. But we may not use this word often and texturizer could be one word which may be used texturizing industry or texturing industry could be the industry that we will be talking about.

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So, if you look at a classical definition when in the beginning when first synthetic fibre actually was made and somebody really wanted to see what exactly is happening. They call this is a process, texturing is a process texturing is a process by which luxurious bulk, loft, stretch are introduced in an otherwise flat filament yarn. So, if you know all manmade fibres are generally circular not exactly like some of the things are not really circular, but they are really flat and so the surface characteristics are different synthetic fibre like polyester, nylon are; obviously, based on their hydrophilicity, hydrophobicity they attach some water molecules they attach less water molecules but they are generally flat. And the flat surfaces were considered not so nice particularly in the garment applications apparel applications and when initially these filaments came into the market like the nylon 66 was the first filament to synthetic element to come in the market. While the people were excited about the new material they found that the water absorption capacities, water retention capacities, water sorption capacity is not so good and therefore, they something had to be done and therefore this particular thing which we call as texturing. So, it is a process by which luxurious bulk, loft and stretch are introduced in an otherwise flat filament so filaments are flat and you try to introduce.

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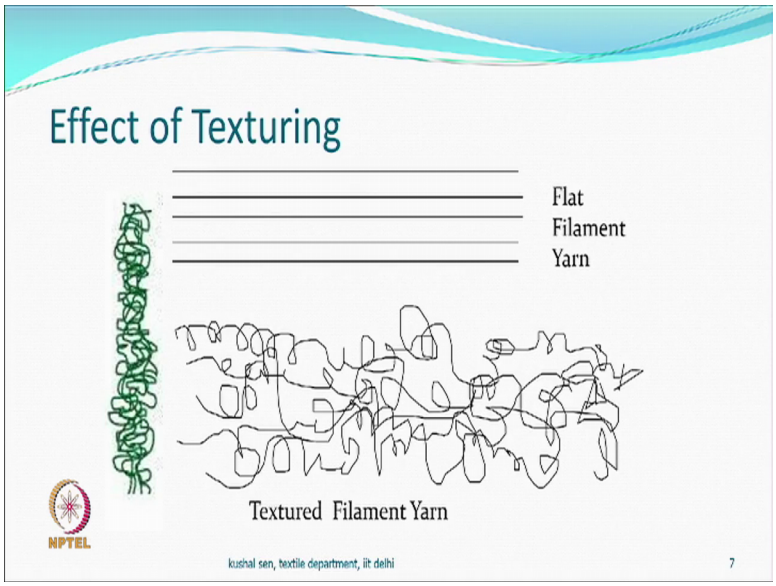

Well roughly, reacting as if they are parallel bundle of filaments called the flat filament yarn and you do something geometrically modify their structures by some means and what would happen therefore, that the structure that you see if you can pull it can be pulled and then you leave it can come back. So, if you go back what we wanted to say is so, you are looking at something called bulk you are looking at something called stretch and what type of a material that you have is flat filament yarn and you want to change the flat filament yarn in some way so that you can get bulk and you can get stretch all right.

So, these are the things which we want to introduce and this is our raw material and this is the process. So, if we look at the structure as I said roughly a flat filament yarn and a textured filament yarn maybe looking different. So, stress can be obtained only if you have crank, loops, crinkles which can be easily opened. And you should do something so that they come back also and if they just extend and do not come back is not a good product. So, this is what somebody thought would be interesting as long as we are able to complete the process. So, what kind of thing can we do?

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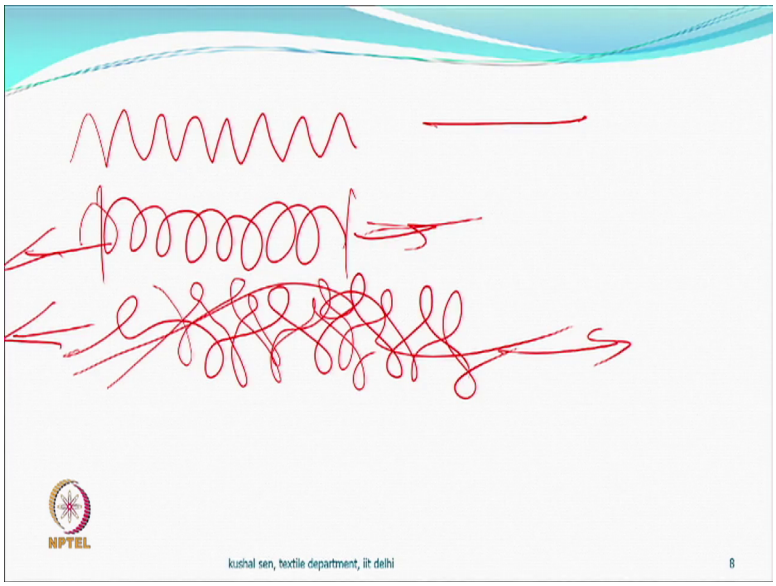

We should be able to, we can do things like this a filament instead of remaining a straight filament you can make it give some kind of crimp you can make structures of this type which are helical in nature and not flat. You may be able to introduce loops of this kind and then if you stretch any one of these they will extend. And when they extend you will feel that the material at a very low stress has become very long.

You can also have situation where these filaments if they are more they may get entangled you may like this there are more filaments they may get entangled. You may not want them to entangle you may want it to be entangled. So, one is that there is a filament and you want to change its character as a final product, either by introducing loops or by introducing helical structure or by some kind of crimps all of them are possible and people are using them.

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If you look at the history like we started when the filament yarns were made and therefore, there is a definition and you want to actually have you know change these structure geometrical structure. But much before the advent of a synthetic yarn like nylons and polyester people have been using something of this type where some bulk could be achieved and stress may be there. And so, the first yarn that we talked about was the yarn which we called as the Lastex.

This is in a way a trade name which was also coined the time which is the rubber cored structures in the centre you have rubber all around you have fibres could be wool, could be cotton and so they were called sheaths core yarns and these yarns are used still today. So, you are making sheaths core yarns even today in all kinds of corset tree applications where the garment has to tightly (Refer Time: 15:11) the body some of these things could be still used. The next one for example, is the Haberlein process this was also in 1930. So, if you remember that these in first synthetic fibre came much later.

So, even in 1930 the viscose multifilament and viscose process were developed. So, you would calling them artificial silk in the beginning and because of this, this particular Haberlein process was designed to give stretch in a viscose multifilament yarn and process was very simple. They would twist the yarn and take it to this for steaming like you make a twisted package take the package in autoclave and a steam for some time

come back untwist it and they found that there is some bulk and stretch gets developed in a viscose filament yarn.

Obviously there were problems when you wetted this type of material you find something it will lost because no permanency was there in the structure, but it was principle was there. If we look at the other process which is cotton; cotton is just like viscose, but is always spun yarn this is not filament yarn, spun yarns also be handled yeah we can handle spun yarn also. But they were using then chemical so whatever they learn from the viscose process they could utilise on the cotton type of yarns and viscose stapled yarn as well.

And use chemistry like cross linking and then you can get a textured yarn which could stretch and come back. And so what I wanted to say is that the modern day texturing which we will be studying had a history that so many process were developed before that also. Although the main industrial use started you know with real effect when you had the synthetic multifilament yarns come into play. So, the modern day texturing uses some of these principles also which they were using.

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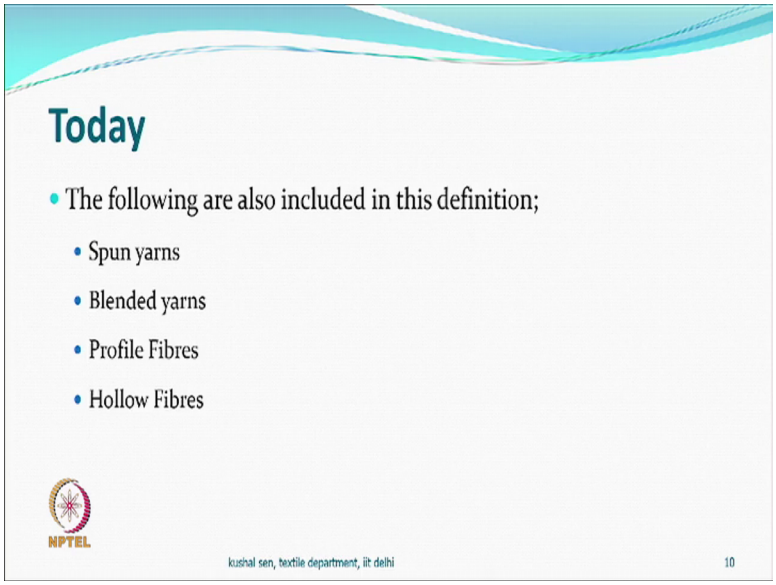

So, what do we have today other than multifilament yarn, you can have monofilament yarns which can also be texturized change the geometrical shape and structure. You can have spun yarns like the cotton viscose spun yarns could be polyester spun yarn also. Why would do why we did not do that will be a question that we will talk about later

whenever we come to that point. And the moment you say there is spun yarns possibility then; obviously, there is a possibility of blend also you can have blended material, that can also be done. And there are some other name that we see the type of fibres called profile fibre; that means, they are not circular they are designed not to be circular or hollow fibre that we know there is some different applications. But what we are looking at the hollow fibre also has more bulk you know specific volume per unit mass specific volume mass of a hollow fibre is also large and so you say bulk is high.

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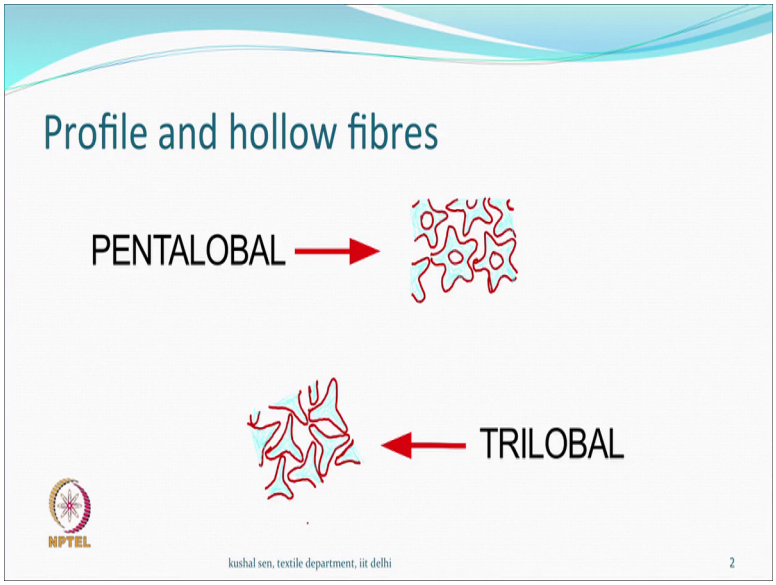

So, a fibre is like this trilobal they are available when you pack them in any manner they take more space. And so they can be bulky and they are called the profile material so you have different profile trilobal, pentalobal or you can have these profiles and you can put the hole through it or you may have simple hollow fibres.

So, that ways people have been working around to keep increasing the specific volume in one way or the other. And so, today the classical definition which we said was introducing loft stretch in an otherwise flat filament may not be applicable as such so.

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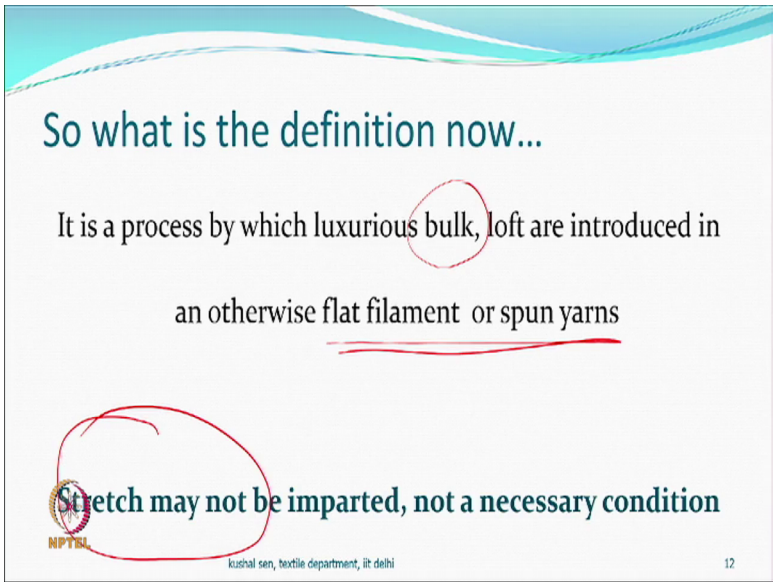

It maybe a process where definitely bulk is going to be increased right. So, bulk will be increased so we talk about bulk. So, bulk is there, but they can be flat filaments or spun yarns and also they may not have stretch. So, you can have applications where a lot of bulk has been developed, but they do not stretch. Let me just give just one small thing, this stretch is different than the elongation of a fibre elongation at break of any fibre or filament.

The elongation at break of textile grade fibre filaments is about 25 to 30 percent or 35 percent. But when we talk about stretch we talk about 300 percent 400 percent stretch like you see the elastomeric yarn like rubber or lycra all of them extend quite a lot. So, we may have requirement of a stretch or we may not and therefore, you may have technology which will not give you any stretch as well.

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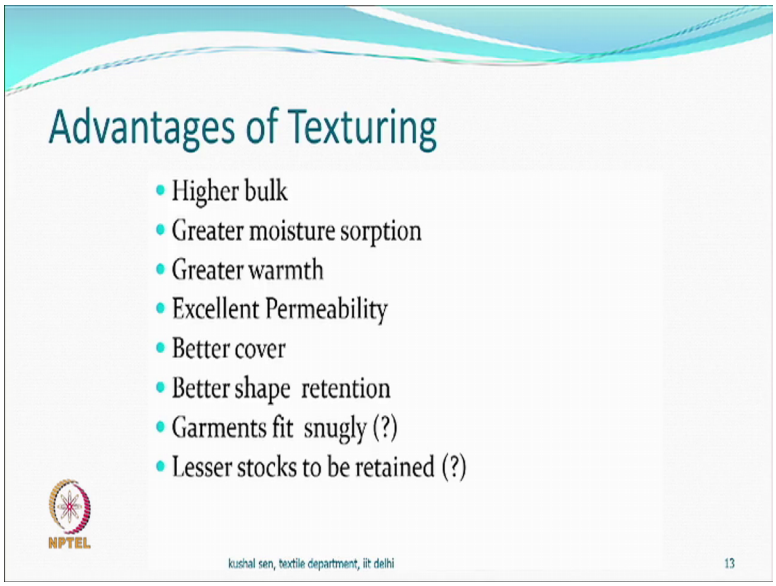

So, why do we do texturing partly we understood that we may not like flat filament and therefore, we want thing because we generally used to spun yarn before that, whose surface is not so smooth always rough surfaces adsorption capacity of the kind of material that we use are different. And so people wanted this may be one of the ways in which you could get a material.

Let us see the advantages higher bulk so like we have seen, so, you have crimps, loops together so the overall space that they occupy is going to be high and so definitely they will have higher bulk. So, wherever we believe higher bulk is a good idea you will definitely like to have these type of material. And so this is one of the properties that we will definitely see that is part of the definition itself.

Greater moisture sorption right and we not talking about absorption we talk about sorption all right. Maybe it is on the surface between the interstices wherever there is a space the water can stay there that is the kind of property which rough surfaces may have you know or porous surfaces may have or surfaces where there are capillaries they may have, but flat filament do not have.

And therefore, if we look at that as a part of a thing then the absorption adsorption of the moisture could become very important. Think of a person where he is sweating and the sweat is dripping down the whole body the type of feel that you have versus it gets absorbed somewhere and does not drip down. So, that is an interesting part. Warmth in

the textile thing that we already know is because of the air entrapped. So thermal conductivity of a fibre is much less to do with the warmth than the air entrapment and so when you make structure which are bulky of this type the; obviously, they entrap lot of air so you will generally have a warmer feeling if everything is all right no no we can always argue, that if wind is flowing at a very fast speed then; obviously, it can penetrate and do the ceiling effect also. But if it is cold as such you may not you may feel little warm like the way you look at any woollen garments. Permeability yes of course, permeability to moisture if as you are you know working talking doing whatever you are producing moisture and heat. So, this will come out so it will be more comfortable.

So, comfort levels always increase when the heat is not retained moisture is not retained. So, that is the microclimate of a garment ensures if these types of a material are there although you feel a little warm everything, but if there is a potential which is higher on the other side it will just pass through because your better cover yeah.

It would appear from the same mass you are covering more because bulkier, thicker type of a material and so you would get this as well. Shape retention in many cases as we have said already that if you do some change we want retraction also after extension. And that means, something you would do to this structure so that it would come back.

And so shape retention is going to be better which anyway whenever you do heat setting would happen in a synthetic material also. So, particularly material which will have good amount of stretch they can hug the body. And if people are interested in type of garments which hug the body then; obviously, material which has some stretch is the one which is going to be preferred.

Whether the active wear in a sports or otherwise underwear undergarments and so and so forth. You socks for that matter you would like the material to stretch and come and hold the body controversial and therefore, you would require. So, in such cases you may require stretch as well. So, your definition does not say that it should not there is the stretch garments or not or stretch yarn is not part of the texturing it is part.

But it is not necessarily it must be there that is the only thing, but if you want such type of material you will have to have stretchability introduced also. This also is the an interesting thing because they are readymade garments all the time readymade systems

all the time any material which stretches easily and comes back to the position you know size is called free size.

If you have a trouser, which is woven then you have you know 28, 30, 32, 34, 36 sizes everywhere you got a stock all of them the lengths also. But things which actually stretch in snugly fit or otherwise attractive say well we do not have to so many sizes to be stocked for (Refer Time: 26:35). Well this some people may consider advantage some they say it is hardly does not matter. So, these type of materials are going to provide this also.

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So, where would you like to use them, if you already know that the knitting knitted garments have more flexibility compare to woven. So, that anyway is there so these textured yarns which could be made from any process it could be sheath core type of a process, it could be false just as we have described sometimes where you can generate some texture in each filament yarn or you can have a process where entanglement has been done by some air jet texturing mechanisms or nozzles.

And so all of them can be used for knitted garments like your socks for that matter or blouses for that matter all material which; obviously, you want them to fit snugly you may want that knitted knitting process be used and you get undergarments, tights, slacks , socks, sportswear outer wear. They will be generally knitted and also would have

maybe textured yarn also. So, that is the kind of application which we generally we would be looking at.

Weaving methods like also are used like shirt you may want that it also is bulky and more comfortable, but it may not be fitting snugly to the body we want certain shape to be given you want certain drape to be obtained which is different than a knitted garment. So, you may like to have woven processes as well and when you have woven processes then they do help in quite a lot for that matter you can have a dress material made shirts, trousers, any other dress material suitings, shirtings like you would be this type of material you do not want it to be you know hugging the body, but it will still have bulk retention. Tapes, ribbons and so on so forth these kind of things also can be there and made from the textured yarn.

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Some of the other processes of products which the textured yarn may be useful rugs and carpets you see the carpet has a pile right and the piles most important thing is that it compresses so you feel comfort when you walk away the pile must come back to it is own position. So, this pile yarn could be made from a textured yarn earlier you said you had you may have seen people selling carpets made from wool or carpets made from silk.

If you have seen carpets made from silk they are there because you just like the silk and may be the design which has been there, but they do not have pile and they do not give

the kind of feeling of resilient or resiliency of the fibre. So, if you are looking for resilient fibres then, you would need a pile which can get easily compressed and which can recover from there. So, woollen carpets were there because of the structured the wool fibres had we have a natural crimp in the wool fibre and therefore, although we are not looking it is stretched, but it has compressibility which is useful and then it can recover after compression. So, these days you can have nylon carpet for example, they may be made from textured yarn. You may have polypropylene carpets this maybe from textured yarn one can make from polyester as well.

So, there is interesting process which we have not studied, but we did talk about in the bulk continuous filament as a one of the methods these type of this process particularly is good for making pile yarn for rugs and carpets. So, depending upon and it is of it is a very fast process therefore, it is cheap and it is well.

So, finally, it comes filter fabrics because you can actually create structures which can trap particles. So, if you have only woven or knitted so if you have a hole very right in front, but if fibres are moving all around so, it gives you resistance to the transfer. So, if you are filtering something one side to the other and if there are particles dust particles or other things. So, as they move if get they strike something they have a tendency not to pass through, but stay there and then if you understand the whole filtration process the particles keep attaching to the surfaces and then a cake formation may take place and then the efficiency of filtration also increase.

But initially the particles do strike and if you have structures which in a way give you the obstruction to the direct motion versus you have squares where there is a hole in front. So, there is obstruction the particles can stay. So, various method can be used for textured fabric filter fabric can also be around. Then we have other special application medical hygiene products, ever dry napkin, shoe upper you know. So, some of the concepts changed as we develop these products.

Earlier we always felt what is the garment next to our body, the next to the body the garment is called hydrophilic material generally cotton. But that was because it was able to sop and absorb moisture. But today we do not feel that today we do not think that is the best idea. The better idea for a comfort is that the moisture does not get absorbed or

material which is next to skin does not absorb the moisture it transmits the moisture. And therefore, hydrophilic material are not necessarily the best material for comfort.

You can think of somebody like a marathon runner, running for 42 kilometres the kind of moisture that he loses in that period time from all over the body including the shoes that you wear. And if the shoes were not breathing you could actually be you could be running almost in a puddle so much moisture would get collected. So, these materials transmission of moisture becomes more important rather the absorption. So, the more you transmit the more comfort levels we have. So, some of the products which we were talking about like the ever dry nappies, hygiene products, shoe uppers actually use this type of a principle is well.

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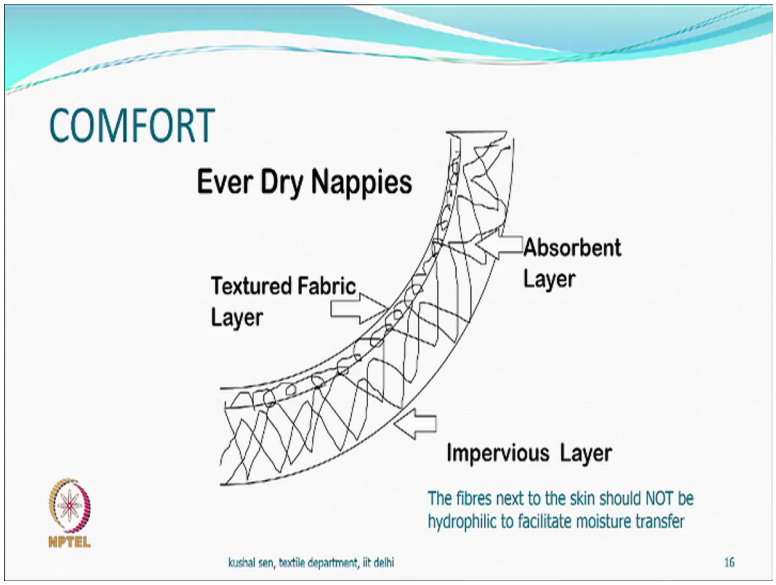

So, generally for comfort point of view and the hygiene point of view a product which we call as an ever dry nappy material which is next to skin is absolutely hydrophobic. And you could actually have polypropylene textured material as a fabric. Fabric made from polypropylene textured material I said polypropylene because supposed to have zero moisture regain.

So, and you still may feel more comfortable because this would transmit does like water moisture will transmit as quickly as possible depending upon the potential difference. So, it will immediately transfer the moment it transfers. Then you design the product which can absorb the moisture and also you can have the final layer which is impervious layer

so that does not go out. So, you have three layered structure generally in which one of the layer is next to skin which would immediately transfer the moisture then you would have a material which will be able to absorb the moisture then you can have impermeable impervious layer which would not permit it all. So, keep it there and then till a change takes place. So, the concept of comfort has changed.

Now you see this sports people in the humid conditions none of them are wearing a cotton t shirt. It is a stretchable garment which is could be polyester which does not like the moisture. So, much transmits out so you actually feel more dry as you are doing lot of athletic exercises. So, textured yarn therefore, has good amount of application in such type of materials is well. The so, which type of a textured yarn that will depend on what kind of product that you want to mean.

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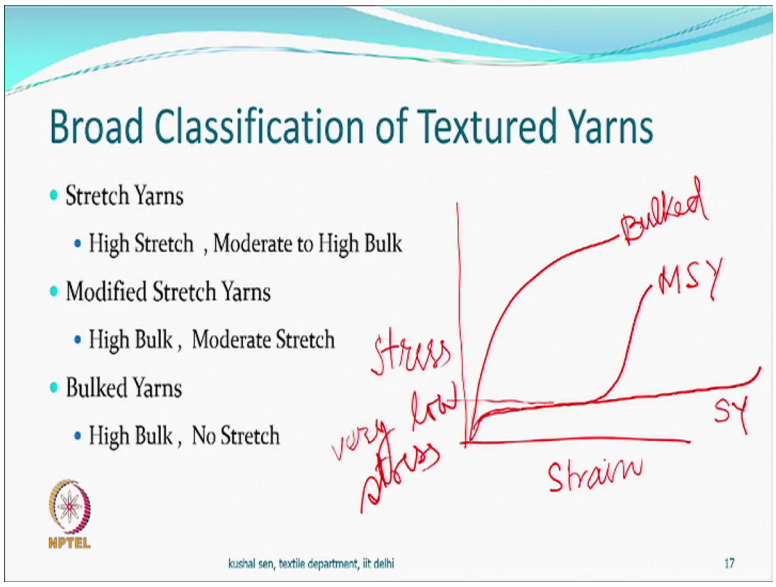

So, if you look at some of the things we say we have textured yarn without saying how they have been made they have just been divided into three broad categories. And these three broad categories as you can see are stretch yarns so; obviously, the name suggests they stretch this stretch quite a lot. They can stretch 300 to 400 percent. So, what happens you know what you get out of this. What we get out of this is let me make it here itself.

So, you have stress strain curve if you want to draw, in normal textile fibre may look like this. So, the moment you put any stress it extends, but you see this region where the

stress develops right. The stress develops here the stress develops, but if you look at the stretch yarn and do the same kind of an exercise in that that may keep extending my space is gone. But what it means is well keep extending at what very low stress value, very low stress what means if your normal fibre breaks at something like 3 to 4 grams per denier kind of it is tenacity.

So, we are talking about 0.1 gram 0.1 gram if you put as a tenacity grams per denier will be extended to 300 percent 400 percent. So, when we talk about comfort this becomes an important part. So, somebody is jumping somebody is running, how much extension at the knee you have let us say 40 percent 50 percent extension when you bend if you do this is there is an extension here. So, if this material extends the way you extend and it can go 300 400 percent, then the stress develop for a 50 percent or 60 percent extension we hardly anything. That means, you will not even feel that there is there is a fabric which is trying to resist the motion. So, this is what was the important thing is for the stretched yarn they concerned. So, when you talk about stretch yarn so all type of garment that you would like to make where you want the it should stretch along the stretch in the body that is snugly fitting then you will like to make use of stretch yarns.

So, all such yarns which will be actually extending to such extends are going to be in the category of stretch yarns. So, there will be some methods by which we can produce a stretch yarn. So, definitely they will also have bulk. So, people say well yes it is not just the stretch there is bulk also. So, bulk will also be increasing, but when you stretch; obviously, bulk will go down. After let us say this is the kind of a area cross sectional area and with large number of fibre filaments are there which has occupying this space you pull they will become thin but you leave them they will have to come.

So, depending upon the construction of the material this whole process of extension and recovery you will have to design. So, knitting these type of material also is difficult. Difficult in the sense that, when you weave there is a tension, when you net there is a tension. So, you should know how to control the tension during preparation of the fabrics and garment. Because if you put any amount of a tension with different from one yarn to the other you can generate a fault.

Because some of them have extended more the other have extended less. So, you have to make sure that all of them are extended to the same extent that the tension level controls

observe. So therefore, preparation making garments is going to be making fabrics is going to be more challenging when you use a textured material. But after you have made the comfort level that is are going to be high.

The next one before I do the next one let us see last one last one is a category called bulked yarns. So, they have enough bulk very high bulk compared to if we are not done this process. So, they have high bulk, but they do not stretch. So, where you make them, but all such application where we do not require too much of a stretch or we do not require any stretch then, you look at for example, some of the yarns even cotton spun yarn for example, is used for knitted garments.

It is this still look good right so you say given I will increase the bulk by any other method and I do not have to use because my final technology for the garment manufacturing let us say is knitting. So, I do not need this type of a material or any other product I can make. For example, a car upholstery it require when you have upholstery which has bulk it can stop moisture it can transmit air from I can sit in for 1 hour half an hour 15 minutes like this you would want transfer of heat and moisture. So, this type of material we love it does not have to stretch at all.

Once you made whatever you have made it stays there you do not require stretch. So, all such application where we require lot of bulk, but you do not requires stretch you will have bulked yarns. So, if I look at this then, the bulked yarn may actually look like this, while this may be a stretched yarn. Now so there are application which do not require any stretch so you use such type of processes applications required large amount of stretch you use the stretched yarns in between there is something which is come we called it modified stretch yarn.

So, the modified stretch yarn; obviously, has less stretch. So, because the process processes that have been used to produce this type of a yarn actually first makes a stretch yarn and modifies the process later or the yarn later and therefore, I have to reduce this stretch and so the term the classification has come as a modified stretch yarn. But there is a possibility that you can produce this type of product without first making a stretch yarn and then modifying it. So, you can make a product without doing this process directly some other technology can be used to make a process product which will have less stretch right. .

Why do we require less stretch well for example, my shirt I do not want every time somebody pulls and I have got 300 percent, but I may be interested in bulk, it gives me all those advantages which the bulk material should give, but I do not want stretch. So, such type of an application you may require the bulk which could be high or moderate. But stretch is reduced how much it reduced if that one is going about 300 to 400 percent this may be may be 100 to 150 percent it may stretch. So, it is not 0 stretch it is a reduced stretch if you look at that then maybe the modified stretch yarn also may behave like this, but has less stretch.

So, I have all the three types can be represented approximately by a stress strain curve and based on your own requirement you may use any of the technology and make a product and be happy. One thing which I can say roughly any garment that we make out of multifilament yarns most of them most of those are from textured yarns. You would not really find a shirt from multifilament yarn which is not being texturized or a knitted product made from multifilament polyester which is flat yarn.

So, because the comfort levels; that means, the this particular technology has become such an important part that all such products will go through this before they are used right. It is just like when you make a synthetic yarn you must draw if you make a synthetic yarn and use for a new product you must heats it. But if you want to have a synthetic yarn and also want to make garments out of it so you should texturize also. So, texturizing therefore, had become an interesting important technology which must be used to make a useful product. So, we have seen some other application which could be through the woven root or a knitting root, but definitely it is a interesting technology which we will be dwelling upon for more time later.

So, what have we learnt today? We have learnt that there is some kind of a classification broad classification. We know the definition of the material we also know what can come and the umbrella of the thing called textured yarn all right. So, as were as we are concerned for today we are done. Next time when we meet we will pick up all these topics and so all the best see you.