**National College of Art and Design**
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# THE DEVELOPMENT AND TECHNOLOGY OF ARTIFICIAL FIBRES

by

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# INTRODUCTION

This dissertation is an examination of the manufacture and role of new textiles today focusing especially on new synthetic fibres. In this decade synthetically manufactured yarns and fabrics have reached a tremendous stage of development. These developments have involved the production of new textiles fibres, the modification of existing fibres, and new ways of making yarns and fabrics. Therefore we must recognise this ongoing scenario of change and respond to it in order to meet the needs of the future.

The main purpose of this thesis is to discuss the positive future of artificial fibres in the fashion field and reveal their rapid development. I have divided this dissertation into three chapters. The first chapter questions the reasons why synthetic fibres became so widely used in the fashion sector in the 90's. Almost every item of clothing we wear is either artificial or an artificial and natural blend. This is a serious phenomenon in the fashion field in comparison with few decades ago. To answer the question as to why artificial fibres are now so commonly used, we have to be aware of how consumers attitudes have changed towards theses fibres, and how they see the fabrics in relation to their life style and living environment.

We also have to look at the artificial fibres' development in relation to social and economic changes. Artificial fibres have become part of our daily necessities. People are using their money to purchase clothes that are comfortable, easy to care for and simple rather than ones requiring a complicated way of living. It is also important to address how fashion designers play a significant role in the revival of artificial fibres in terms of popularity in the 90's.

Today if we look at any labels detailing the fabric content of clothing, it is not surprising to discover the combination of man-made and natural fibres. These fibre mixes are becoming widespread. In chapter 2 I introduce the phenomenon of blended fibres and address their impact on clothing properties. We have to realise that nowadays a large percentage of our clothing is made up of blended fibres which guarantee better performance than just using one type of fibre. However, economic factors are also part of the

reason for textile manufacturers and fashion designers to widely use fibre blends in their design and production.

Chapter three is a study of the latest developments of artificial fibre such as: microfibres, polyester, Gore-Tex, Tactel and Lycra. All these fibres are the result of a continuation and modification of textile development. They are the newest invented man-made fibres. In this chapter, I discuss the technology development, applications, consumption, and marketing of these fabrics as well as their physical and aesthetic qualities.

During my investigation, I found it hard to relate some of the magazine articles, the promotional leaflets and supplements of certain fibres with actual fabric in our daily clothing. Although fashion and textiles periodicals have many articles on the new fibre development they mainly focus on the brand name rather than on the generic. From the detailing on clothes labels it is almost impossible to make a link with the information given in the textiles periodicals. Therefore I feel manufacturers and suppliers have a responsibility to inform the consumer of the detailed content of the fabric rather than just promoting thefibre. Lots of clothes labels say Tactel, Lycra or Gore-Tex for example - but they do not tell us which sub-type of these fabrics the garments are made of.

Due to my interest in artificial fibres. I believe it is important to be aware of the tremendous changes and developments in this area. Researching this thesis has helped me to understand the past and be more aware of the present, it has definitely enhanced the scope of my knowledge in the fashion and textile field.

# Chapter 1

## Artificial Fibre Development in Relation To Social and Economic Changes

Man-made fibres fall into two groups:

1. Regenerated fibres which are those made from naturally occurring polymer materials such as cellulose.

2. Synthetic fibres which are those made from polymers synthesised in a chemical plant from simple raw materials such as coal and oil.

Up to now, two types of fibres have been widely used in society: natural fibres which have existed for over at least 4,000 years and man-made fibres which first appeared about 100 years ago. The invention of man-made fibre was originally an attempt to imitate silk. Due to the beauty, scarcity and expense of silk, the textile industry devoted themselves to the possibility of a man-made substitute which was not just attractive but also potentially rewarding financially.

> Once upon a time there were only
> Natural Fibres, of these, silk was
> the Queen, the only natural fibre
> available as continuous filament
> and the "hatched" cocoon as spun silk
> (H. Peter Vogel, Polyester 50 years, 1993, p. 100).

The first filaments of man-made silk were produced in the late 1880's by Count Chardonnet who studied the silkworm which provided clues to make man-mad fibres. This first regenerated fibre was based on cellulose which was named rayon. In 1904, the British rights of the rayon process were purchased by Courtaulds Ltd., who developed it into the most successful method of rayon manufacturing the world. At the beginning of the century, although constant efforts improved the produce and made it more like silk, high class couturiers still considered it inferior to silk.

The period 1900-40 involved the two World Wars. The radical social changes brought about by the first World War were certainly immense. Many women were in uniform, and those who were not had the option of dressing in tailored suits, easier-fitting dresses and shorter skirts with a tendency towards simplicity. The old social structures were undermined, the working class become aware of their contribution to society and began to demand improvements in their life-style and conditions. Many women broke with convention and participated in social activities outside the home. The pre-occupation of women with children and women with domestic activities was being questioned. Women's emancipation was in part the result brought about by these events during the wars.

> No, its the hero who's waiting for her these days. You see, she has taken his job in the factory when the men went to war the women just naturally went right into men's jobs. When the men came back from the war, the women just naturally stayed right on doing men's jobs

(Dorothy Parker, Vogue History of 20th Century by Jane Mulvagh, 1988, p.49).

New practical apparel was designed for active women. The leading past-war Paris couturiers Chanel, Lanvin and Vionnet captured the spirit of the time and claimed they made clothes for women to live in, breathe in, feel comfortable and look young in. The traditional restrictive corset was eliminated. Women's clothes became loosely-fitted, with the waistline dropped below the hips and straight to the knees. Taffeta and silk were popular for indoor clothes. Practical materials like serges, soft duvetyn, twill and wool in checks or stripes were for outdoor clothes. The day time frock was becoming simpler, often made in cheap cotton which was easily washed.

In the 1930's Rayon was marketed under a variety of brand names and extensively advertised. The production of rayon staple made rapid progress during the period of time. Yet it was considered only a cheap alternative to silk fabric. At the time most of the couturiers experimented with fashion design styles rather than experimented with the new fabrics (Fig. 1).

Fig. 1 Vionnet's blue rayon evening gown, swathed tightly about the hips, hanging in long panels in the 30's.

Paris fashion designer Elsa Schiaparelli however, broke conventional ideas by bringing in man-made materials to create a whole new collection. She also collaborated with Textile manufacturer, Charles Colocombet, who produced unusual rayon designs. One was with fine elastic rayon crepe, the other was a goffered tree bark crepe directoire evening dress with "melodie" design textures (Fig.2). These two designs were used by Schiaparelli in her collection in 1930. Schiaparelli was a very inventive designer, she regarded designing as an art, not a profession. By 1932 she was using upholstery materials and terry cloth for beachwear and zippers on ski ensembles. Her chief fashion contribution was witticism and she was also very important in creating designer clothes in synthetic fabrics.

The real beginning of the synthetic fibre industry was to spark from the work of H. Carothers on polyester and polyamides which led to the fibre we know as Nylon. The DuPont company first produced Nylon in 1935. It was claimed to be "finer than spider thread, stronger than steel and more elegant than silk" (Tatsuya Hongu, New Fibres, 1990, p.1).

> The story of nylon's discovery is a romance of modern scientific research. It is the research of fiction come to life the change discovery, that led to a world-wide industry
> (J. Gordon Cook, Textile Fibres, 1984, p. 195).

During the Second World War nylon was not available for wide-scale production, but was confined to military uses. A small quantity of ladies' stockings were produced for the market which were regarded as gold dust in a woman's wardrobe.

However after the Second World War nylon burst onto the U.S. civilian market and became overwhelmingly popular. Due to the lack of other materials and economic pressure. Consumers demand increased rapidly which pushed the production market upward.

As the social ideals and attitudes changed in the late 40's at least some aspect of the "American Dream" had invaded almost every home in the western world. The post-war booming manufacturing production was aimed at satisfying consumers' demands and promised them a better living. Technology became an icon of the time. It influenced the way people thought. Anything new and technological had the masses strongly interested.

Fig. 2 Schiaparellis black taffeta jacket and Treebark crepe directoire dress and cellophane scarf.

Synthetics were a symbol of being modern. In fact all sort of synthetic products were manufactured in a wide-scale at the time such as radio, television, domestic goods, nylon blankest and carpets. People had their ideas of contemporary lifestyle and these goods embodied them. Certainly, the easycare, resistance to creasing, quick dry synthetic fabrics perfectly matched the image of "modern" life. Synthetic fibres were considered as a product born in the war and bred in peace. Owing to the nature of this "indestructible material" it was connected with a scientific future. In 1951 Alec Guinness shot a film called "The man in the white suit" which was a story of a man who wore a "synthetic material that made his clothes last forever" (David Brunnschweiler, John Hearle, Polyester 50 years, 1993, p. 227).

In Paris 1954, Chanel re-established her fashion label after 15 years absence from the couture market. She witnessed that the market had changed from the privileged few to the thousands of women. Her easy functional clothes and the introduction of synthetic fabric in her collection's such as the none-iron fabric Orlon and nylon seersucker was simply a good way of marketing to the ever-widening fashion-conscious public. DuPont had introduced Orlon for example in 1948.

In the U.S.A. manufactures tended to raise the status of synthetic fibres by linking them with prestigious couturiers. In the early 60's DuPont promoted their new synthetic "Qiana" aimed at the mass market; Geoffrey Beene was one of the international leading designers approached by DuPont. Beene was offered to have his material made up by the factory and he chose Satin Velour decoupe. He commented on the fabric; "working with the material proved to me that synthetics could be perfected, for it was exactly like a pure silk velour, only it did not crease". He also believed that "the future of fashion lay with perfected synthetic". (Mulvagh, 1988, p.300 ). This gave a significant boost to the acceptance of synthetic materials.

In Britain ICI were determined to encourage their market sales and the use of polyester for couture. They launched the new fibre" Crimplene. Crimplene was "textured polyester". ICI produced incredible fashion shows at The Royal Albert Hall in 1964 based on this fibre. ICI also promoted their fibres and sponsored design projects in fashion schools. It was part of their strategy to boost their product status.

In the 60's "mass production", "mass-consumption" and "mass-media" had influenced western society profoundly. Fashion reached mass society through different media like television, magazines and newspapers. The advanced technology for producing clothing certainly targeted a large majority of the population with cheaper, more easy-care and comfortable items. The most successful modern designers in the U.S. were Calvin Klein, Ralph Lauren, Geoffrey Beene. They all worked on ready-to-wear concepts based on mass-production and consumption.

This conspiracy of control was underpinned in the "popular culture" society in the 160's onward. The media, as in newspapers, magazines and the film industry, were aware of the economic boom created through periodical trends and arbitrary categorisations changing fashion directions and design. They communicated what was up-to-date and what was out-dated. Therefore they had huge control over all trends.

> At this time Europe was becoming increasingly involved in the middle-class youth culture. Britain was now entering a new age... The advent of the mass media, changes in the constitution of the family, in organisation of school and work, shifts in the relative status of work and leisure, all served to fragment and polarise the working-class community. The development of youth culture should be seen as just part of this process of polarisation. Specifically, we can cite the relative increase in the spending power of working-class youth, the creation of a market designed to absorb the resulting surplus, and changes in the education system... as factors contributing to the emergence after the War of generational consciousness amongst the young (Dick Hebdige, quoted in Christopher Breward, The Culture of Fashion, 1995, p. 193).

During the 60's the youth market had become an important driving force behind the design ides in Europe. Yves St. Laurant, Courreges, Ungarro and Pierre Cardin were Paris designers who intended to adopt the youth culture and combine it with the art of couture. The new direction towards ready-to-wear clothing was established. Traditional couture concepts were diversified, Design tended to be modern and revolutionary. Dresses became shorter and shorter, design bolder and bolder. A whole new fashion scene was created by breaking the old rules. Technologically-advanced materials were used widely in Haute Couture and the quality became gimmicky and sheer. The whole fashion industry was stimulated by the space-age discovery and a fascination with futuristic notions.

> By the 1960's output of wholly synthetic fibres was growing at a spanking pace and a number of growth areas had emerged; textured yarns were giving jersey knitting a new lease of life, polyester and cotton blends were making deep in roads into wholly cotton products in United States. (Blackburn, 1993, p.238, 24[2]).

Toward the end of the decade, disillusionment with the space-age, tight economic measures, currency devaluation, the protest movement against the Vietnam War and the assassination of Martin Luther King and Robert Kennedy, were among a whole sequence of events which caused huge turmoil and drove away youth culture from futurism and modernism towards pastiche and into "nostalgia mode". A need for escape was born among young people. The dictatorship of Haute Couture was no longer to control a single chic. The philosophy of self-expression and inner freedom became the prevailing one of the youth culture at the time. There were highly diversified fashion streams; street style, subculture movements, green politics, third-world culture, fine art and craft and haute couture. A multi-cultural influence was encapsulated in the fashion scene.

> For one thing, our culture of global mass-media feeds us so much information that a missive cultural eclecticism is the only possible response (Elizabeth Wilson quoted in (Breward, 1995, p.195).

The boom in synthetics declined following the disenchantment when space-age Nylon turned yellow with time. Other man-made materials like acetate, acrylics, polymides and polyester appeared to be uncomfortable, too tacky, too hot and other negative elements emerged. Consumers withdrew from wearing synthetics. At the same time the hippie trend and the prevailing nostalgia combined with sympathies for Far Eastern Cultures were part of the strong influences which detached themselves from the artificial "space-age" and tended to relate to nature, the hand-made and natural materials.
Due to the increasing chemical disasters, people were alerted to the ecological effects and became fed-up with the occurrences and the damages. In addition to the rising cost of raw-materials, people began to detach themselves from derivative products.

In 1973 the oil crisis happened, this further alienated people from purchasing synthetic commodities. Synthetics were only linked with the lower and of the market. High fashion was no longer associated with synthetic trends like in the 60's. Competition was greatly increased when silk and cotton were bought from the Far East and third-world countries at very low prices. This caused synthetic prices to plummet. Producers' profits were low or non-existent and the textile industry was approaching a recession.

To be profitable, U.S. large-scale producers reduced the Unit costs and the manufacturing plants had to operate at near capacity. Low prices remained low for years. This improved the consumption potential of synthetics which helped to pick-up and speed consumers from other fibres to synthetic fibres. Despite the low rewards, U.S. synthetic fibres shipments grew from 1,793 million pounds in 1970 to 4,148 million pounds in 1980. The production was strongly focused on all areas of the market like sports-wear, outdoor wear, daily-wear etc. Focused on a wider market, allowed them to expand the production volumes and capacity.

After the oil crisis disaster, the world economy went into recession. A highly conscious public drove designs towards economic ideas and functionalism. Simplicity and body-consciousness were the key note for the fashion designers. Especially in the Western world, the popularity of physical fitness heightened the interest in sportswear fabric and this rapidly growing market formed a vast capacity for textile manufacturers to invest and develop in the higher quality products in term of function and fashion appeal. A broadened market acceptance beyond sportswear, into fashion, has made significant in roads in countries such as the U.S.A., Japan and Europe.

Approaching the late 20th century, most of the big cities like London, Paris, Tokyo and New York have always had a sophisticated international identity and have served as a magnet for exiles and travellers. These societies could be depicted as cultural melting pots where mass marketing emerged.

Unlike in the past in all developed Industrial countries, the social constraints and the dictates of class no longer have such a strong effect on what we were today. One reason is the influence of different philosophies e.g. the Western culture and Eastern culture and their very different values ; one has always valued the individual and the other puts greater value on the collective.

Yet general trends are common to most developed countries. They often emerge from a rejection of the social environment. Protesting and demonstrating at their own societies values is a way of rebelling and disobeying the social order. This is what led to the emergence in the 70's and 80's of punk and other aggressive groups. Many subcultures are more concerned with looking into their own deeper self, discovering, developing and becoming more self-aware. In this scenario of social development, clothes shift from being imposed to being chosen.

Individualism tends to strive for self-fulfilment rather than for a position in a social class. The search for pleasure is a basic right of the individual. The idea of hedonism has settled in the modern society. People purchase products not because they need items generally but because they want them. This is a major force driving consumer markets today. The pleasures given such as feel, sensuousness, touch and identity are extremely important in terms of impulse buying affecting all products. Consumers are driven by "desire" rather than "necessity" especially in the textile industry.

Clothing acts as an intermediary in the relationship that we have with other people and with society. We experience things not only from an intellectual or visual aspect but are also connected by our five senses. This means our clothes are required not just to look aesthetically pleasing, feel comfortable but also has to be functional and provide interesting new sensations.

In recent years, the marketing focal point has switched from marketing the products to marketing the consumers. Customer's attitudes have changed from being passive to active. "It is time for the industry as a whole to start designing and acting with the mind of a consumer from product initiation all the way down to the moment it is sold" (Textile View, Winter 1996, p. 47).

According to the latest figures in 1995 when the volume of high-street sales grew at the fastest rate since 1989 and most economists seem confident the future will continue to rise at a moderate rate on the next few years. However the majority of consumers are looking for commodities of good quality with competitive prices.

With the assistance of the hi-tech development the creation of new fibres has witnessed enormous progress over the years. Many of the latest fibres have

been created specially with sportswear in mind. With the revival of the spirit of the 60's and 70's spirit, the use of synthetic has become an unavoidable fashion-trend. Technical fabrics like nylon-polyester with shiny surfaces are also forecasted to be the best seller in the coming few years.

Unlike in the 60's when their use was just a whim of fashion today synthetic materials not only imitate natural fibres successfully, but also create a new hand touch and elegance which only synthetic fibres can provide. The qualities shared by the new fabrics include breathability and durability, and they are water resistant, easy-care and comfortable. There has been a tendency for people to wear lighter and fewer items of clothing and synthetic fibres can achieve the lightness and softness required in the fabrics.

From the 1980's to 1990's, the production of synthetic man-made fibres world-wide was increased from 10,150 tons to 14,670 tons. Throughout the 80's product rate growth was over 25%. Synthetics apparently, will continue to share this importance with natural fibres in the future.

# Chapter 2

## Blended Fibres

If you look around most clothes stores, the marked content on the labels are blend orientated and this phenomenon is very noticeable in the market place. This leads us to ask when and why did fabric blends start and how did they come to be part of our daily life?

Tracing back the history it appears that the practice of blending was first established long before man-made fibres were produced; for example wool and cotton were blended with the intention by manufacturers of reducing the cost of the price. So the motivation was mainly for economic reasons. In the Second World War, the USA's domestic wool production was not sufficient to meet the demands of civilian and military requirements. So during this time a wool conservation policy and several test programmes were begun.

In 1951, the newly invented nylon was first adopted as a synthetic blending fibre with wool for military uniforms. A U.S. military specialist discovered the enormous potential of blended fibres coming into the market and realised the contribution blending made to the fabric in terms of appearances , reduction of shrinkage, handling and comfort.

Soon after this, the DuPont company took part in experimentation on the implications of combining synthetic components with natural fibres. For the first time polyester blends were believed to give a better performance in comparison to just natural fibres blended. The character and performance of blended fibres such as Nylon/Wool, Orlon/ Wool and Dacro/Wool, was impressive. The fabric strength increased, abrasion resistance increased and also the crease recovery increased. All dependent on the proportion to the percentage of the synthetic component.

In the past 50 years fabric requirements have changed widely in terms of cost, appearance, handling and performance. Now the manufacturers even have wider range of fibre types and qualities available to suit various markets from high-street market to couture market.

Here it is important to make it clear that there are two ways of combining fibres ; mixtures and blends.

The term mixtures refers to the use of two or three different fibres in a fabric, each fibre being spun into a separate yarn, therefore the fabric is composed of a mixture of yarns made from different fibres. For example a fabric with a cotton warp and a wool weft, is a mixture of wool an cotton.

The term blend refers to a more sophisticated mixing of fibres before or during spinning. Usually high-technology is involved in the procedure of combining two or more different fibres in an individual yearn. For example Polyester and wool blend fabric implies all the year is spun from a blend of polyester staple fibre and wool.

Mainly the reason for blends of wool and mixtures of fibres being so widely available in the market place is for economic purposes, for producing better qualities and performance and better aesthetic and colour effect. Textile manufacturers have done a lot of serious research on the production level in order to benefit both producers and consumers. Firstly by the use of cheaper fibres mixed or blended with a more expensive fibre the profit margin for manufacturers could actually increase the cost of the products for consumers could be reduced.

Secondly Manufacturers could by combine two or more different properties in the fabric; for instance, Nylon and Polyester, have excellent strength and abrasion resistance and they are ideal to strengthen wool fibre. The effect of such blends on the handling of the wool depends on the amount of strengthening fibre used in the fabrics. If over 50% of the content used is synthetic, it will effect the heat-setting process in the manufacture which will result is a different appearance and handling of the fabric.

Thirdly due to the advanced technology development, synthetic fibres can provide textured surfaces, distinctive appearances, lustre and colour which natural fibres cannot obtain. Combining these properties with other man-made or natural fibres can produce unexpected results which cannot be achieved by only one type of fibre.

This use of technology established good qualities by combining synthetic, man-made and natural fibres. This resulted in rapid growth of the market in terms of productivity, cost reduction and quality.

In the early 50's, the post war demand for easy-care clothings was high and drove Marks and Spencer to carry out an experimental programme with Terylene (polyester) blended different types of choice of wool. This not only gave up-grading pleated easy care performance but also acceptable shades of grey. But technically it did not achieve the desirable performances they expected. The discovery of non flammable characteristics in the later year made the fabric appropriate for children, men's and ladies' night wear.

In the 60's and 70's the choice of wool or cotton blended with polyester and nylon were widely sold in big chain stores like Dunnes Stores and Marks and Spencer. The market grew rapidly in a global scale. Brand names like Terylene, Dacron, Trevira are will documented with properties of easy-care, wash and wear qualities which in combination with economic price won the hearts of the majority.

In the past 20 years, blended fibres have been well established on an international scale by different major companies like DuPont and ICI. The introduction of microfibres has brought blended fibres to a higher level with advanced technology and sophisticated engineering. The whole field of textile production can be seen to provide exciting new combinations of fibres. They give whole ranges of fabrics with different prices, qualities, appearances, handling and performance which can be adopted in different fashion market from the mass-production to the couture market.

However, in terms of the couture market Italy still remains to the forefront position in the use of the newly created fabric. Recently Irish Designer Marc O'Neill visited the Italian fashion fairs and gave his comments on the new fabric "elastane and Lycra are being mixed with wool so that suits can be made up with actual stretch in them" (Robert O'Byrne, Irish Times, 8/12/9).

John Rocha also recommended the blends of fibre, he says "in the summer, you can mix linen with a little nylon or viscose and it becomes much easier to use" (Robert O'Byrne, Irish Times, 8/12/96, p. 11). Linen has instant character and with a mix of fibres can reduce its characteristic wrinkle properties. So, blends and mixtures of fibres have been widely used from top couture designers to mass-marketed chain stores. The newly developed blend of fibres do not just offer interesting visual appearance but also add to their overall lightness, easy-care, easy-wear and durability. As a matter of fact if its now unusual to see new fabrics with only one type of component.

# Chapter 3

## MICROFIBRES, POLYESTER, GORE-TEX, TACTEL, LYCRA

### Microfibre

Microfibre is defined as an umbrella term for staple, or yarns with filaments which are produced from a very fine extrusion of polymer filaments such as polyester, acrylic and polyamide. It was first produced in the 1970's by Japanese chemists researching a more realistic artificial silk. It was well established by the late 80's in Europe.

In the natural fibre world, silk is considered as the finest fibre which has a denier of 1.0. The invention of microfibres can provide a fineness even finer than silk. With the technology behind them microfibres can offer textured surfaces and distinctive appearances, lustres and colours which natural fibres cannot obtain. The assistance of microscopic technology, can slit the microfibre with different shaped cross-sections in order to achieve the required handle, visual and auditory effects. Various weaves create a silk or suede touch and fabric can be produced to feel like peach skin or be given a powdery surface.

The biggest demand for microfibres is in fashion and function. In this respect look is as important as technical performance. The peach-finish microfibre was regarded as the real break-through. It has a fluid touch and can feel like silk or suede. Because microfibres can be produced up to ten times finer than human hair (Fig. 3).

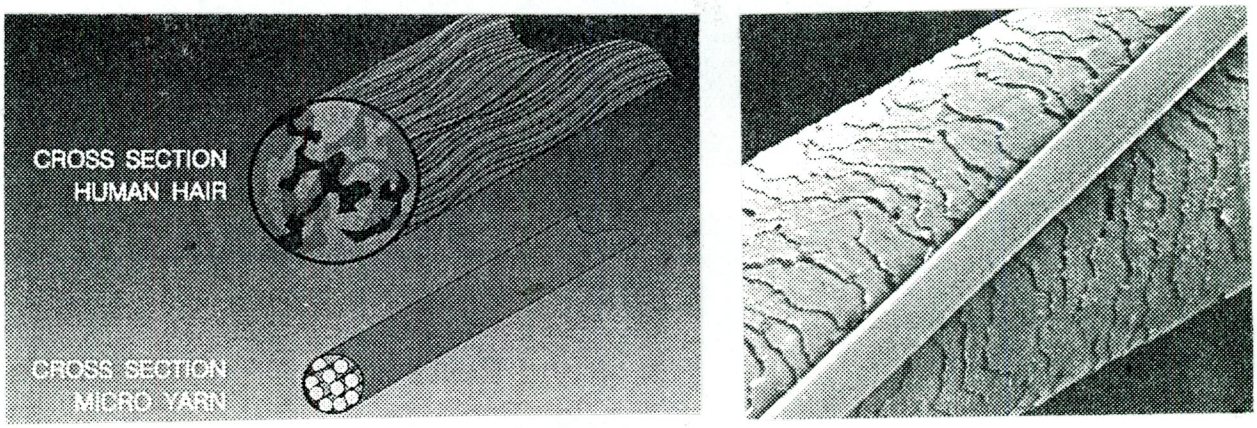



Fig. 3 The fineness of a single filament of microfibres can be produced up to ten times finer than human hair.

They can be worn so fine that they do not need further treatment to be rain proof and at the same time they allow the wearer to sweat. The properties of breathability, wind proofing, hard-wearing and easy-care have been proved to be contained in this newly invented fibres. Furthermore, due to the greater surface areas with a large number of smaller filaments. Dye is needed and therefore a high intensity of colour will be obtained and the finished products are marketed as luxury and special materials.

Microfibres are capital intensive products. They appeal particularly to textile manufacturers in developed countries. Japan has greatly increased its production capacity. In 1990, the Economist intelligence unit listed 19 Japanese companies producing microfibre. In Europe, companies have been slow to join in. They started about five years ago; Courtaulds in Britain, Hoechst in Germany and Montelibre in Italy. The high profits generated are what makes microfibres so attractive to manufactures.

Compared to the normal standard of filament it costs an extra 30% to 50% more to produce. Katherine Hamnett, the London Fashion designer admitted "Microfibres are over priced but they feel absolutely wonderful". However the cost of fabric currently a small proportion of the selling price and the clothes produced have still sold well in the shops. Yet it is understandable that the price will drop once product sales grow.

Microfibres production went into decline around 1990. 1990's economy has slowed down and reduced the consumption capacity . Micro labels are being sewn on to more ordinary high street clothes. "Guarantees of quality" were being abused for low quality products. The unit warns "micro" label guarantee of quality is already a casualty in the race to cash in" (By Daniel Green, 6 March 1992).

Despite this, the growth and popularity of microfibre has been maintained and is still associated with high-quality end-use of the fashion line. To be functional and fashionable are the key words for microfibre to maintain its success in the future.

**Polyester**

Polyester was discovered in 1941 by ICI and it was commercially produced in the 1950's The name was promoted as a "miracle fibre". This product is regarded as the most successful fibre in the textile market. Even now polyester has still a significant position among synthetic fibres all over the world. In the past 40 years, brand names such a Terylene, Dacon, Trevine and crimplene have launched various productions and delopement which had made a substantial contribution to the status of polyester.

Due to the oil crisis, in 1973 to 1978 the white synthetic fibre industry went into decline. Most of the advanced countries re-evaluated their strategies to face the problems. Japan was the first leading country to alter its plan and redoubled their efforts to produce fiber finer than silk. Traditionally Japanese demand for silks was higher than in western countries and the need has grown along the same lines as the Japanese economy. Japan's raw materials are limited, its suppliers mainly come from China, the produce is higher and often the stock is quite unreliable. This drove Japan into doubling their efforts in research to find artificial material better than natural alternatives.

Since the late 70's Japan has led the world in making fibre finer than silk. Recently highly value-added products were introduced. They are classified in two categories.

1. The first group is highly functional and are performance fibres.
2. The second group is highly aesthetic fibres.

Functional and performance fibres are mainly used for sportswear, hard-wear and outdoor wear purposes. Fashion conscious consumers require them not just to be comfortable but moisture - permeable, water - absorbent and anti-flammable. Teijin had developed a porous polyester fibre, Super-Microsoft and wellkey which has a hollow centre, with a large number of micropores at the surface.

## (1). Function and Performance Fibres

The first group is separated into two types. One is moisture permeable, the second is water repellent fabrics. Both were developed in response to rapid growth of the sportswear market in the past 10 years.

A moisture permeable fibre "Wellkey" was developed by Teijin . It is a porous polyester fibre with a hollow centre and it could be classified as a lotus root-shaped (porous) fibre which has a large number of micropores at the surface (Fig. 4).

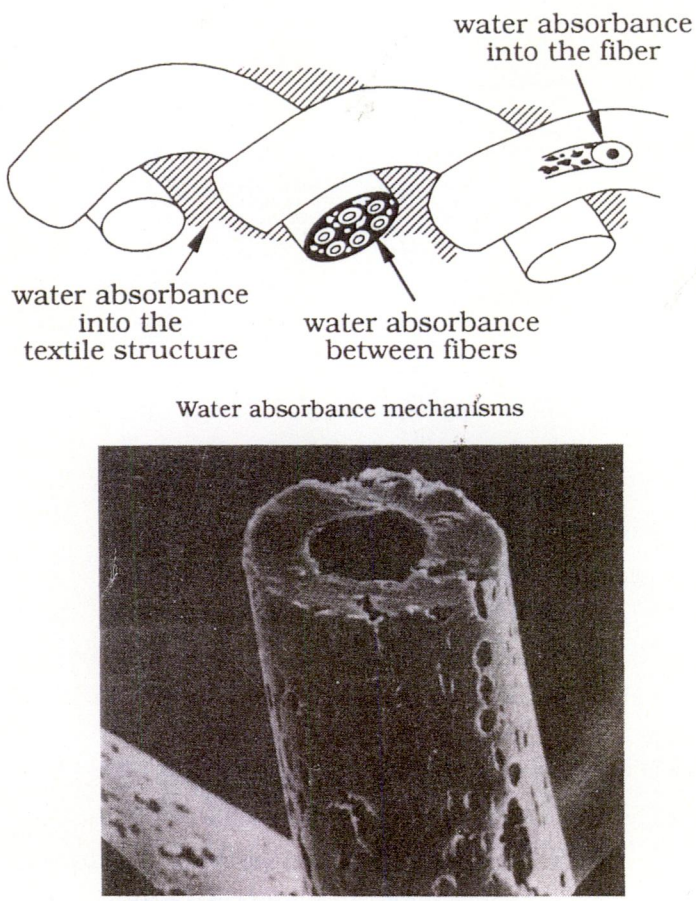



Fig. 4 Water absorbence of the porous polyester fibre (Wellkey Teijin Co., Ltd.)

The micropores of 0.01 to 0.03 diameter are homogeneously distributed and some run right through into the hollow part. This allows water to travel into the inner space and exit quickly keeping the fibre surface dry all the time. sportswear made of WELLKEY causes no chilly sensation on sweating, nor does it stick to the skin and restrict body movement.

This fabric has been widely used on an international scale. All Japan Women's Volleyball Team have used this fabric as their professional uniform.

Water repellent fibre has the similar structural content as moisture permeable fibre. This fibre is made of super fine denier. Because they weave with such fine filaments that a fabric can be waterproof without the need for plastic coating. Yet it has the advantage of being moisture permeable. It was also developed by Teijin and called "Super Microsoft" (Fig. 5).

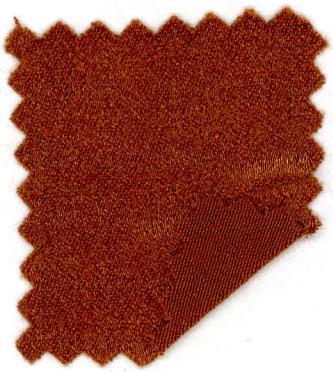

Fig. 5 Microsoft Advertisement, (Teijin Co. Ltd).

## (2) Aesthetic Fibres

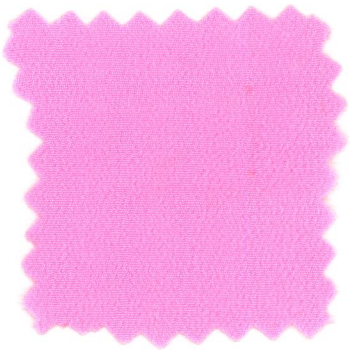
The second group is called "Shingosen" which means ; a highly aesthetic fibre. There are specifically used in women's fashionable garments and only successfully developed in recent years. The group is separated into four types.

(1) New generation silk-like (silky fabrics)
(2) Worsted-like "new worsted" fabrics
(3) Micropile "peach-skin" fabrics
(4) Rayon like "dry touch" fabrics

The first type is a silk-like fabric, "Ajenty® and SIL®" by Teijin (Fig. 6), in which conjugate filaments with different characteristics are used. It consists of self-extending fibres and low shrinking fibres. When the fabric or knitted product of this yarn is heated after the dyeing process, the self-extending fibres extend and relax the low-shrinking fibres. This occurrence creates a result of puffiness and softness on the surface. A new silky hand touch with high density colour is created which is different from natural silk.



SIL®185



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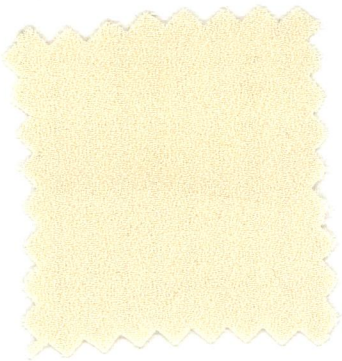
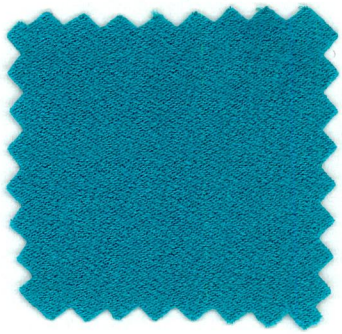
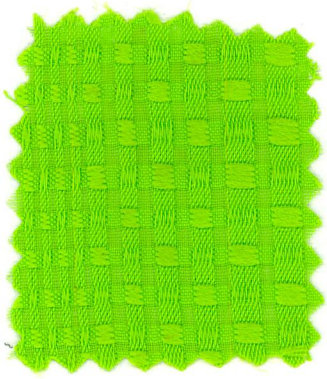


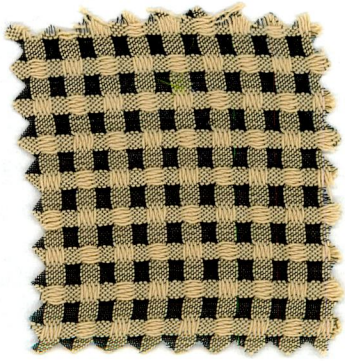


AJ 730 AJ710

Fig. 6 The first type silk-like fabrics, "Ajenty® and SIL® by Teijin.

The second-type is the worsted-like fibre which is made out of two different filaments (Fig.7). Each one has various orientations, shrinkage, dyeability, crimps and thickness. By using mixed-false twisting it can create very uneven and complicated dimensional structure. Mainly these fabrics are adopted for women's suits and dresses.

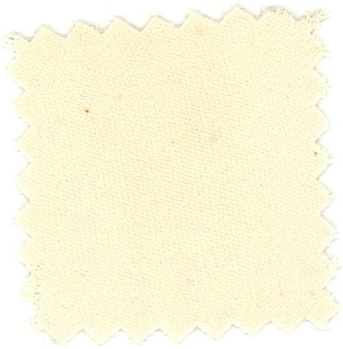




Polyester & Nylon I®III Polyester CF®6180

Fig. 7. The worsted-like fibres by Teijin

The third type, the micropile fabric are mostly applied to the upstanding hair fabrics such as peach skin (Fig.8). It has a very fine and soft pile produced by a pile-raising process. Some of the piles are made of super -fine denier and some others are made in loop-form. Different shrinkage technology is also adopted in the fibres in order to create more outstanding effects on the surface which natural fibres and conventional synthetic fibres cannot display.



MS®481

Fig.8. The micropile (Peach-skin) fibres by Teijin

The fourth one, Rayon type, is made with a principle similar to that above but it gives a cool and dry hand feeling and a high drapeability (Fig.9).



CHO®739 CHO®739

Fig. 9. Rayon type by Teijin with a cool and dry hand feeling

Most of the Shingosen fabric has been widely used in fashionable women's wear. Their unusual and outstanding features; aesthetic as well as the easy-care, drip-dry, non-iron properties attracted the increasing interest of the consumers and the market throughout the world. Teijin have an agency not just in Germany but in London, U.S.A. and Ireland. The representative of the Teijin company in Ireland, Mr. Dermot Kelly, said "every year over fifteen thousand metres of orders and deliveries are made in Ireland. Orders are increasing year by year" and he went on "This is 100% polyester with good-quality and a good price. The average price is from £5.00 to £10.00 per metre. These fabrics are for working women's daily wear such as blouses, dresses and trousers etc." (Interview with Mr. Dermot Kelly Dublin, 25 November 1996).

Overall polyester production has grown rapidly in the past ten years. It has increased 25% since 1970. The introduction of microfibres especially contributed and guaranteed better performance and qualities. This fibre has a huge versatility in terms of price, quality and performance to suit each different market from sportswear, to fashion garment or from mass market to upper market. They are equally popular from the consumption point of view.

## GORE-TEX

Gore-Tex (Fig.11) produced by the American company W.L. Gore in 1958, was a developed version of PTEE (properly called Polytetrafluorothylene). Originally it was used to insulate electric cable, later further research led to the invention of the micro porous Gore-Tex membrane in 1976. It was at first designed for the NASA Space Programme and was later developed to withstand Arctic conditions and to prevent the passage of bacteria. The micro-structure of Gore-Tex makes it highly compatible with the body for vascular grafts and ligament replacement.

In the past ten years Gore-Tex used to be associated with hi-tech sportswear but now it even relates to the fashion market. We wear Gore-Tex in different forms, from the protective material for the street smart in Timberland boot wear to fashion clothing. It has a high versatility.

Gore-Tex contains a micro-porous membrane which has nine billion microscopic pores per square inch. And each of these microscopic pores is 20 thousand times smaller than a droplet of water. Because of the high density on the surface, it prevents water entering but allows water vapour to escape through the membrane. Gore-Tex is totally windproof and waterproof. It allows the body to sweat but also breathe in comfort.

However, in recent years the reason for the fashion markets interest in the Gore-Tex membrane was due to its waterproof laminated properties. This membrane has been developed in oil and water forms which can be bonded to other fabrics. It is like a sheet of film with a light and thin membrane and it can be laminated onto almost any materials. The water vapour passes through by a diffusion coefficient. The face fabric still needs to have a hydrophobic finish for rainproofing but the membrane will stop heavy rain and wind. Gore-Tex made possible clothes that are light and capable of resisting extremes of temperature. Yet it offers a silky soft finish and it can also wash in the machine.


(Fig.11) Cropped Jacket in Schlerrer and Gore-Tex, £270.00) Samantha de Teran ; wool polo-neck, £93.00, Agnes B ; Cotton/Nylon leggings, £195.00, Giorgie Armani ; Neve ; Nylon Snowboard glove-linens, from a selection, Snow and Rock

Gore-Tex Associates currently have about 30 plants spread across the United States, In France, Germany, Britain, India and Japan. The market has gone rapidly from sportswear to fashion clothes. In 1997 Gore-Tex have launched its new double-act collection of swimwear and leisurewear given the new name Gottex for this summer 1997 (Fig. 12). The market is aimed at 16 to 30 year olds. The collection introduced simple, yet dynamic styling to co-ordinate with swimwear and high streetwear. The collection, aims to move from the beach onto the street and into nightclubs effortlessly which gives swimwear a "whole new meaning", has intricate openwork effects such as provocative lace, crochet and macramé. Gore-Tex has successuflly introduced is this diverse and colourful mainline collection and focused on high street fashion which brings the possibility of a wider market and increases the potential profit margins.

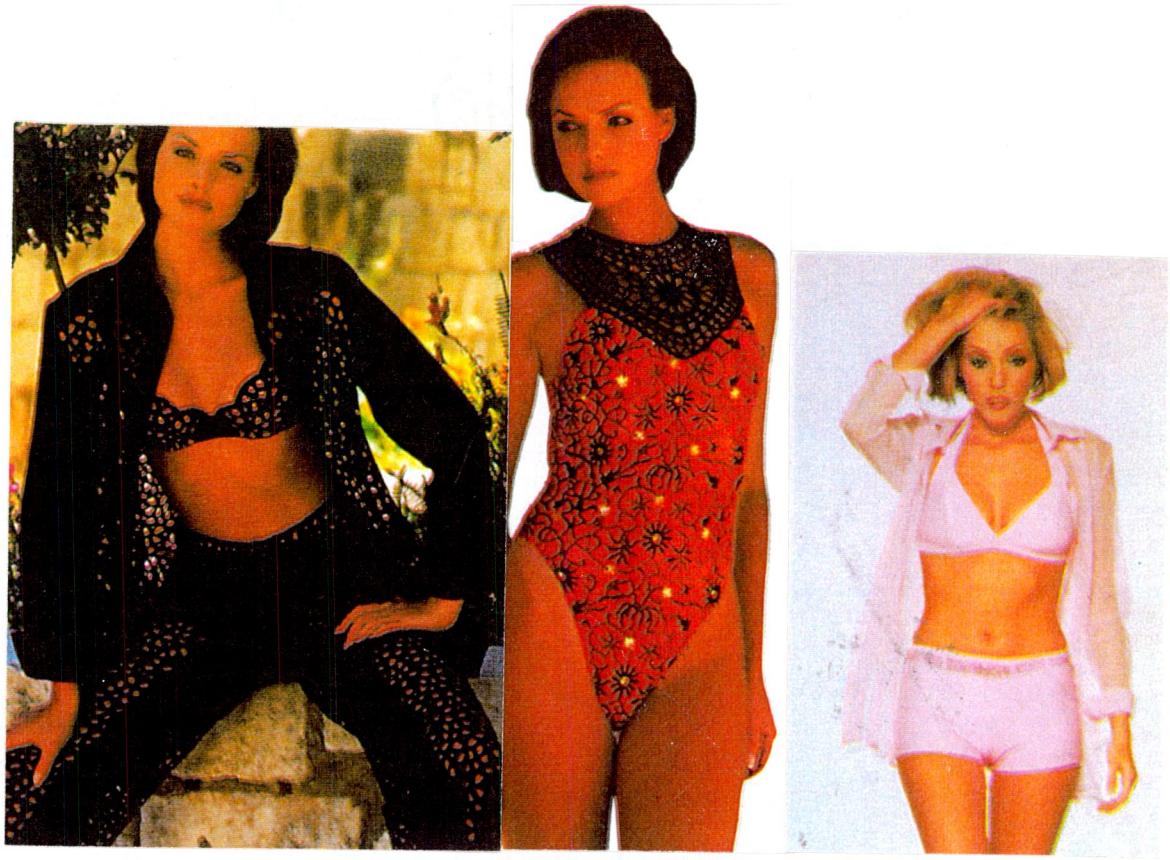


Fig. 12

Erasions of grandeur at Gottex

Web of Intrigue at Gottex

Sugar beat at SIIG by at Gottex

**Tactel**

Nylon was invented by DuPont in 1938. Initially it was used for such unglamorous mundane products as fishing lines, bristles and World War II glider tow-ropes.

Since after the War, Nylon was quickly adopted by other sectors including the clothing and household textiles market, Nylon stockings became one of the most popular items in a lady's wardrobe. Ladies hosiery was the first apparel outlet to be introduced to the new "Wonder" fibre. Monofilament yarn of 20 denier was made into seamed non-stretch stockings. In the 1950's and the early 1960's, the consumer attitude to freedom and the good life was translated by house wives into abandoning chores like ironing and starching Nylon took up this challenge, and so easy-care became a key word for consumers when purchasing garments at the time. Yet as other polyester and acrylic products were developed, the market became over crowded and nylon began to loose its appeal. Soon the disadvantages of nylon were noticed by people such as scratchiness and tackyness and discomfort and that it yellowed with time. These qualities created a distance between Nylon and the customers.

However, after more than three decades, ICI devoted themselves to development and research on this particular fibre. This opened up the potential and opportunities for Nylon to reach a new generation "Man-made" is no longer seen as being second rate.

In 1983, ICI Fibres launched Tactel. In July 1993 DuPont received ICI Fibres Nylon world-wide Nylon business, with the brand name "Tactel". (Fig.13).

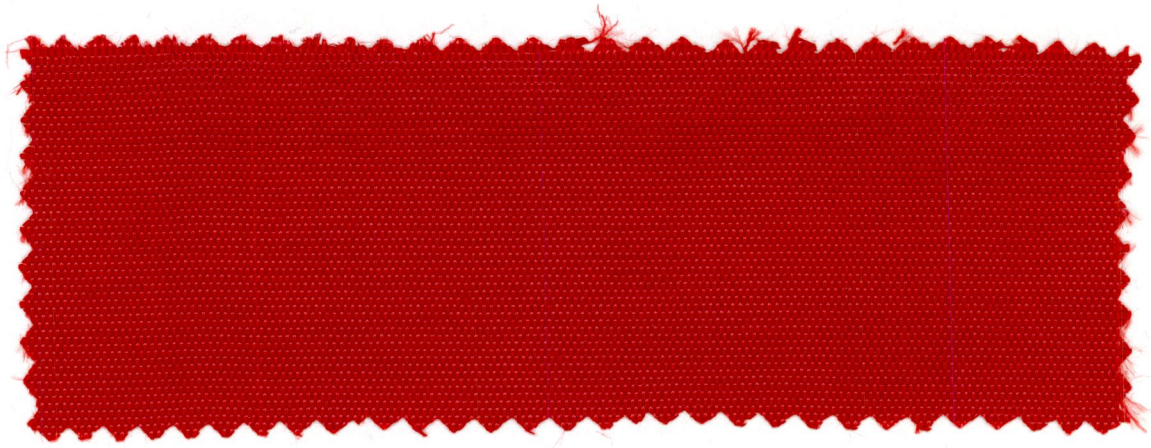


Fig. 13 100% Tactel Water-Repelient

The word Tactel comes from the Latin "Tacto" which means "I touch" (Tactel information pack, 1996). It is a new transformation of polyamide 6.6 yarn. Ongoing research into fabrics was engaged in by the Geneva-based research institute of social change. Results showed that "comfort" was the most important aspect for fashion-conscious consumer's in 1990's. "Tactel" has come to a point which can satisfy the requirement of being soft and lightweight. In comparison to cotton or polyester, it is 30% lighter and has excellent strength and weight ratio compared to other natural and man-made fibres.

To begin with, "Tactel was launched into the ski wear market. Since its high performance properties, combined with its attractive appearance, provided both functional and fashionable clothings. "Tactel" has the properties of being extremely light-weight, robust, waterproof, breathable and easy-care. At the same time, it offers vibrant colours and the possibility of a wide variety of different fabric finishes. It is not surprising that in the ski-wear market it was responsible for 50% of the retail sales within two years.

This initial success led to the development of a whole new range of Tactel yarns suited to different uses, ranging from robust, hard-wearing, outdoor wear to soft, luxurious hosiery and lingerie (Fig.14, 15,16). This versatile fibre is an excellent product which suited manufacturers, who used it on its own or blended with other man-made or natural fibres (Fig. 17).

However, it is difficult to relate the promotional leaflets and supplements of certain fibres such as Tactel® Texturals and Tactel®Diabolo. Therefore, I feel manufacturers and suppliers have a responsibility to inform the consumer of the detailed content of the fabrics.

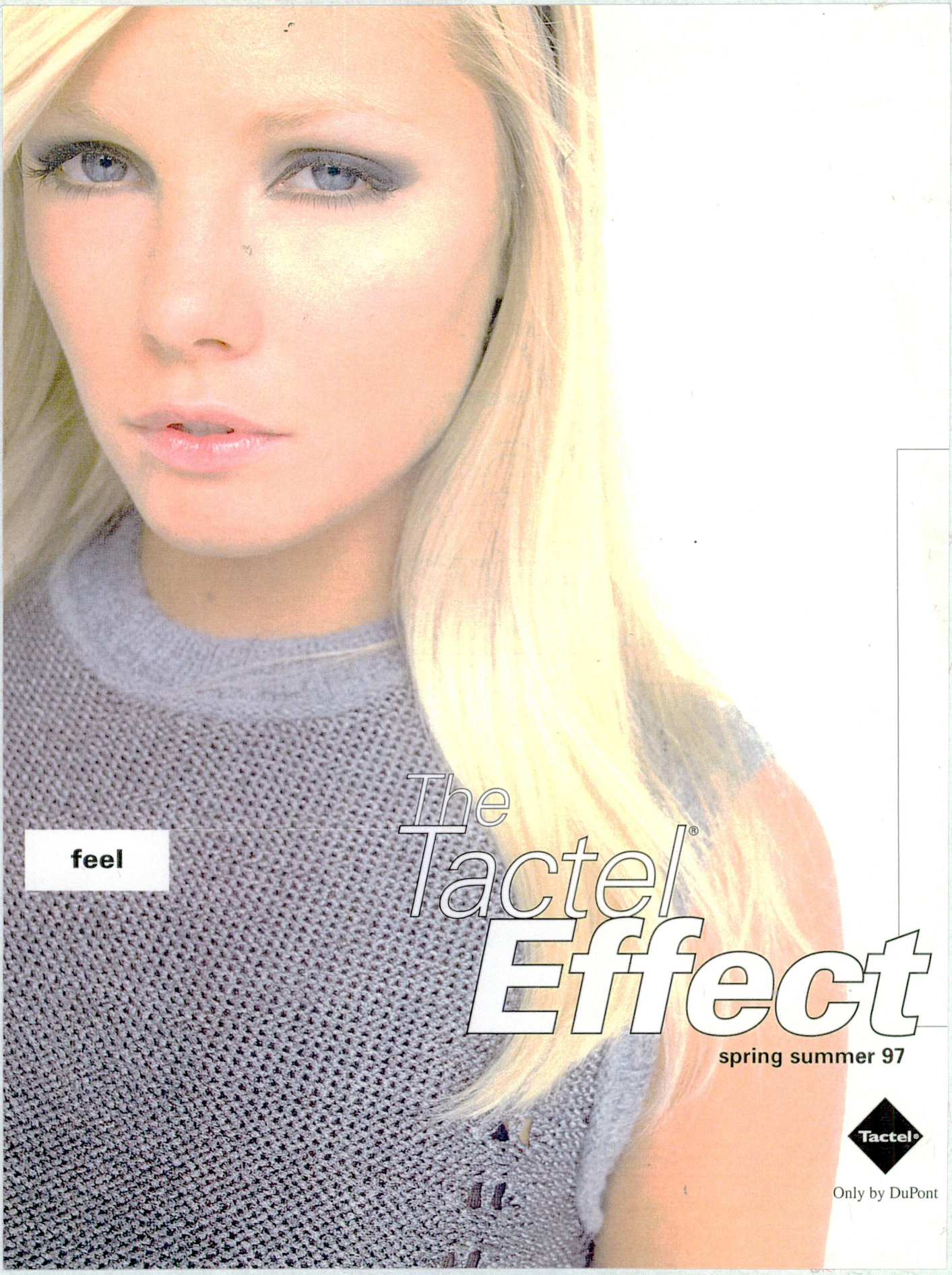



Fig. 14 Tactel's advertisement in 1997

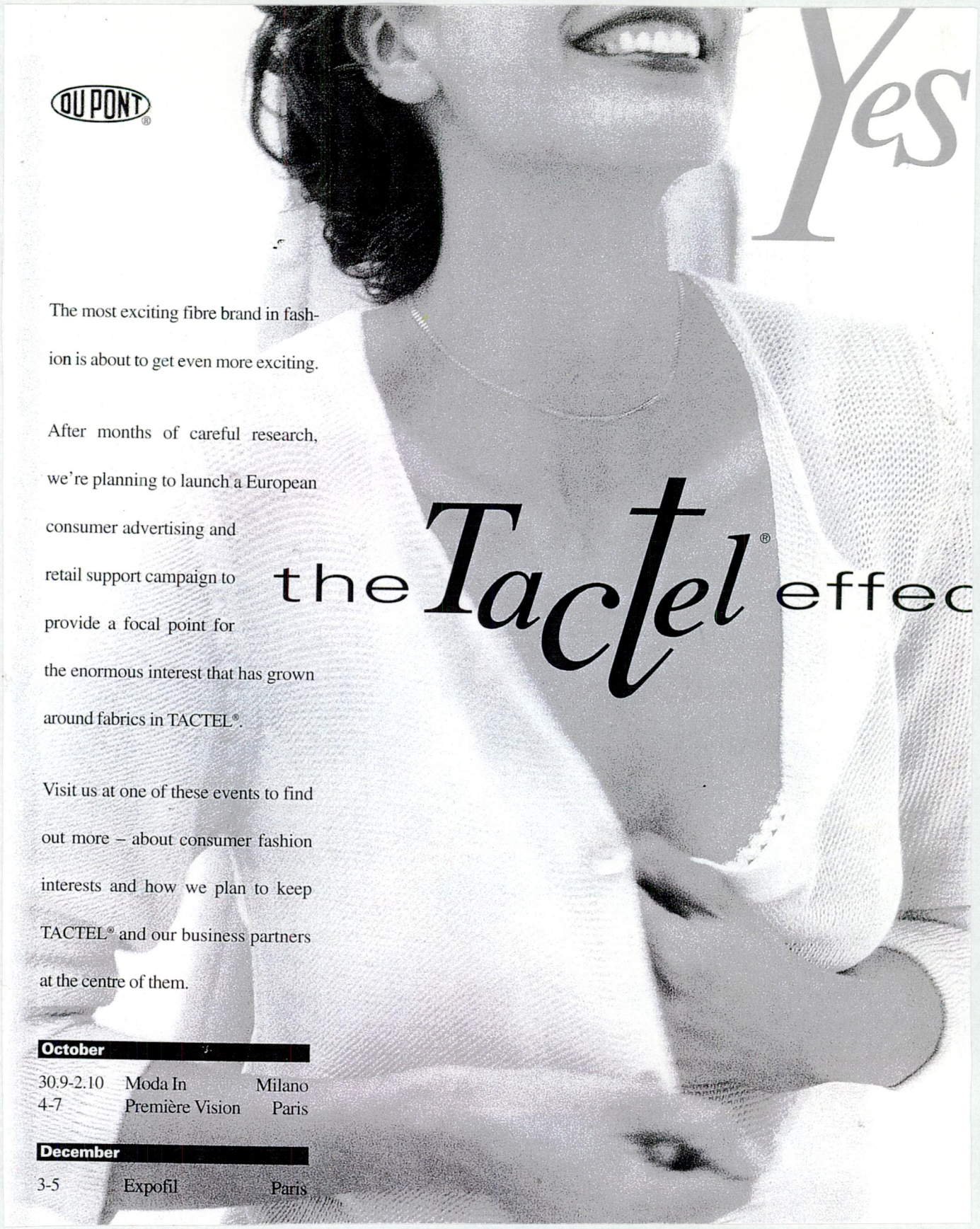



Fig. 15 Tactel's advertisement in 1996


Fig. 16 Tactel lingerie advertisement in 1997


Fig. 17 Nylon-Mix advertisement by Escada Sport

In the following section, different ranges of Tactel yarns will be addressed.

**Tactel® Multisoft** (Fig.18)

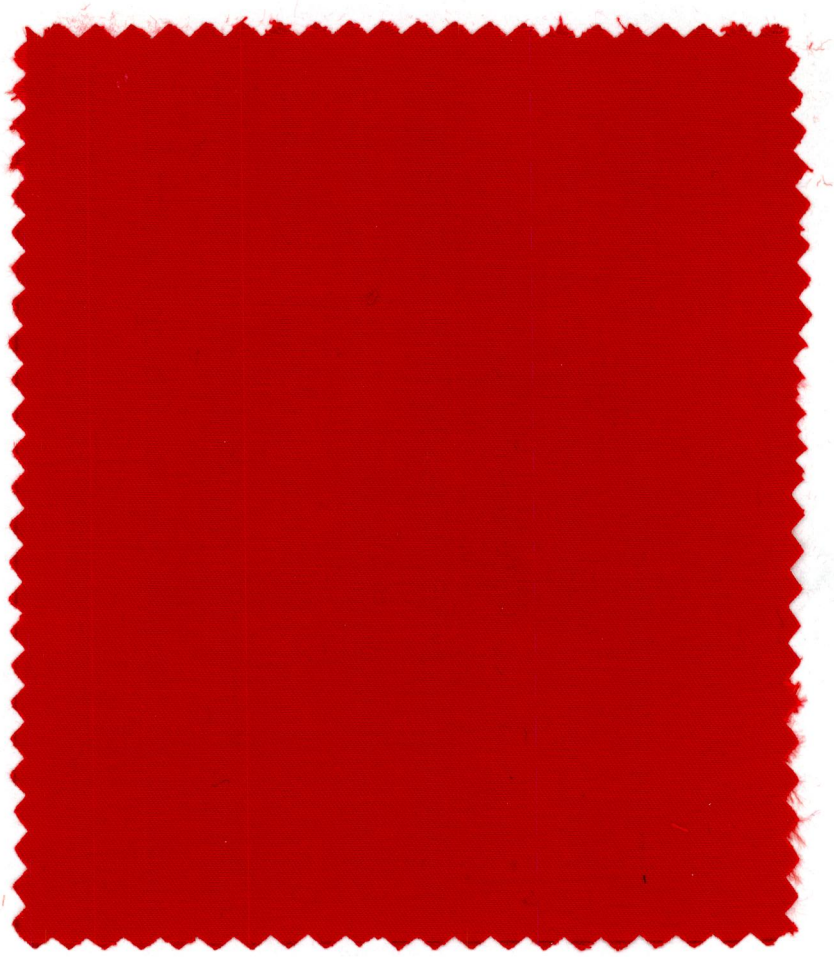


Fig. 18 Tactel/Cotton
Multisoft by DuPont

DuPont's hi-tech polyamide 6.6 polymer and fibre cross-section has been engineered to provide a wide range of subtle lustres. These fine decitex yarns create fabrics with a soft touch, good cover at high weight and in a wide spectrum of lustres.

In hosiery and lace fabric, it can enhance comfort, softness and new matte or sheen effects. In knitted fabrics, it has a different texture of being soft and gentle to the touch in for example swimwear, lingerie and bodywear. Yet all tactel characteristics are in this range.

In woven fabric , it can easily obtain a strong structure and surface effects yet soft, light, durable and easy-care properties are included (Fig. 19).

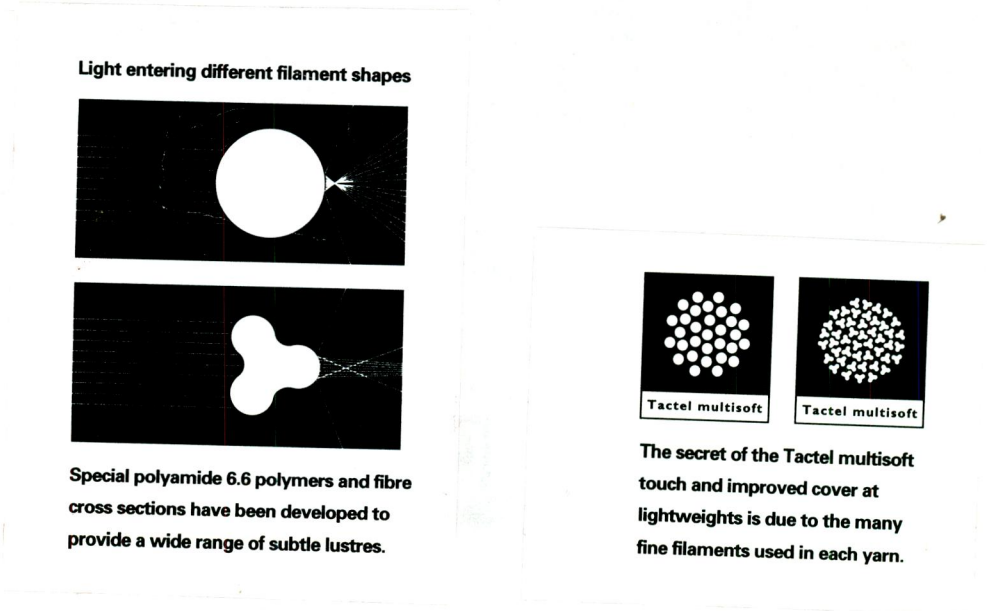



Fig 19 Tactel® Multisoft Cross-Sections

**Tactel® Micro (Fig. 20)**

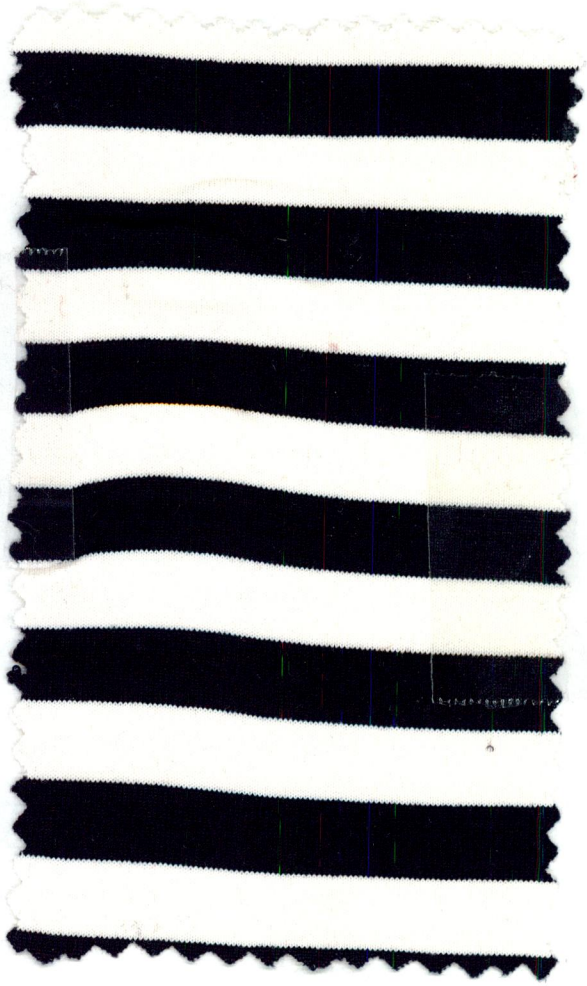


Fig. 20 Autumn/Winter 1996/97

Tactel®Micro
88% Tactel
12% Lycra

Tactel®Micro
93% Tactel
12% Lycra

Tactel micro is one of the brand names for the DuPont range of high technology polyamide 66. yarns launched in 1988 and consisting of many ultrafine filaments. These yarns are produced less than one decitex per filament with extra strength and lightness. These filaments are used to produce fabrics which are weather resistant but breathable with an especially soft feel and luxurious aesthetics for rain wear, street fashion and casualwear and also are strong and abrasion resistant. (Fig.21)

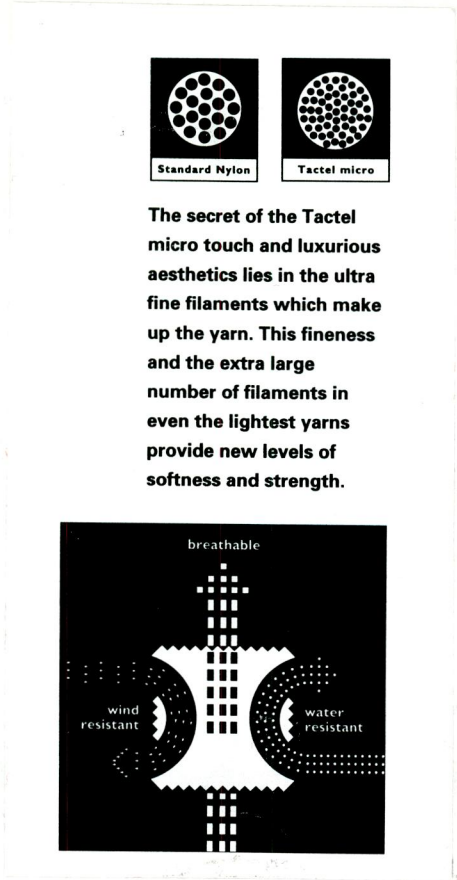


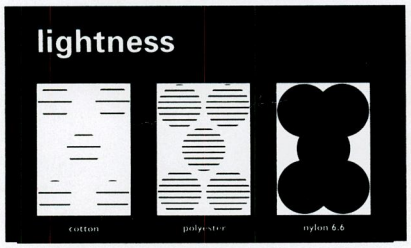


Fig. 21 Tactel®Micro Cross-Sections

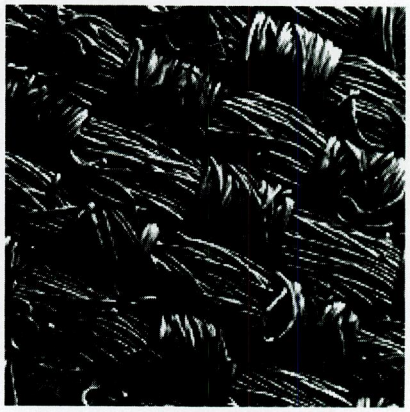
Tactel®Micro has been popular in the hosiery sector especially when combined with DuPont Lycra to provide a beautiful look, a pleasant feel with a good fit. It has successfully made a huge impact in the hosiery market. Leading designer DKNY and Christian Lacroix were quick to bring Tactel®Micro fibre into their collections.

## Tactel® Texturals

Tactel texturals is one of the latest effects to be achieved in woven fabrics by using heavy decitex matt yarns in both warp and weft, for a coarse and rugged structured look with matt aesthetics and a soft handle. These new developed matt polymers gives an additional fashion statement to rugged style. Tactel textural fabrics are ideal for fashion and performances orientated sportswear garments, where improved resistance is obligatory. (Fig.22)




**Nylon 6.6 is a low density fibre, enabling fabrics with adequate cover and strength to be achieved at lighter weights than is possible with other fibre types.**



**Tactel yarn characteristics and fabric construction create the texturals effect.**

Fig. 22 Tactel®Texturals Cross-Sections

## Tactel® diabolo

Tactel® diabolo is made from an unmixed polymer that guarantees a good light convenient fabric with high reflection. The unique yarn cross section creates new lustre, effects and colour vibrancy. The characteristics of this yarn contain unique lustre, excellent fluid drape, smooth handling, high colour density and it is light weight yet strong and durable. When it blends with Lycra®, it provides decent and it is fit and comfort. The special lustre makes them ideal for sophisticated evening wear, elegant lingerie, fashion kits or hosiery (Fig23).

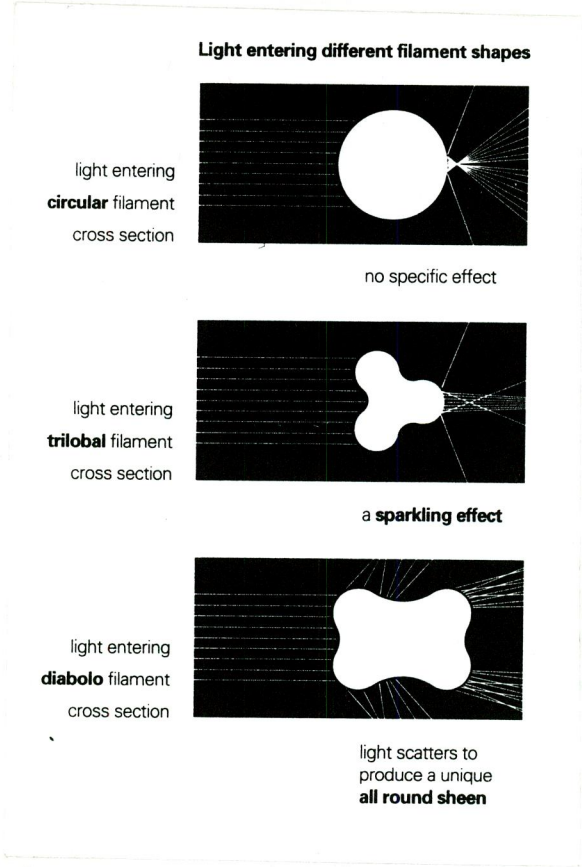



Fig.23 Tactel®Diabolo Cross-Sections

The company Aristol are using Tactel® diabolo for its new hosiery range Ultra Pearl Spring 1997 collection which was first launched last season. According to Brand Director Sue Clegg it was claimed that "this was their most successful product launch ever" (Tactel Information Pack 1996).

**Tactel® Aguator** Fig.24

Tactel aguator is a unique two-sided fabric. It is designed to draw moisture away from the skin. This efficient mixture transportation reduces chill factor and improves comfort. The inner layer of Tactel draws moisture to the outer cotton layer and disperses it over a large surface area, where it evaporates, helping to keep the body dry during leisure or sport activities. This yarn is ideal for knitted sports shirts, gymwear, sports underwear and even casual fashion tops. (Fig.25)

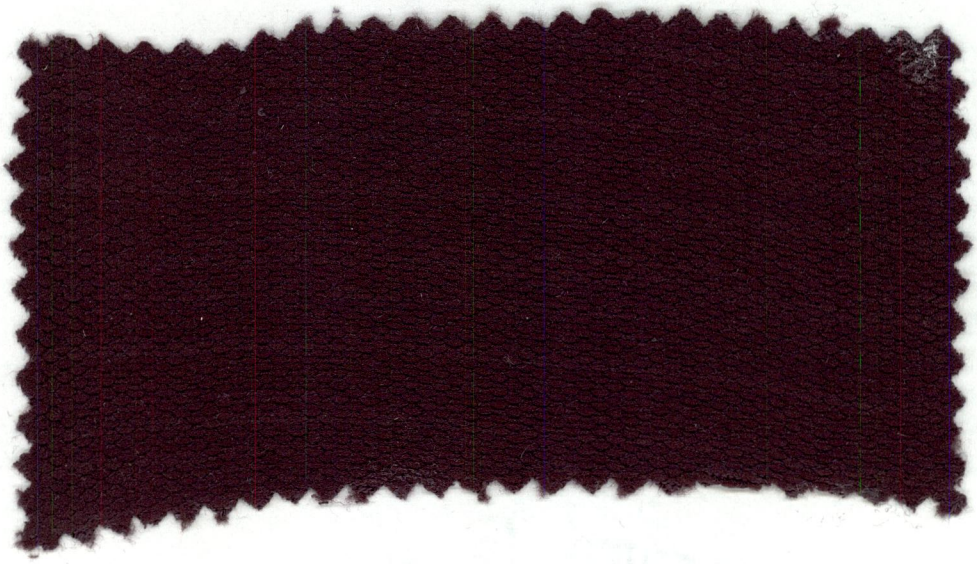
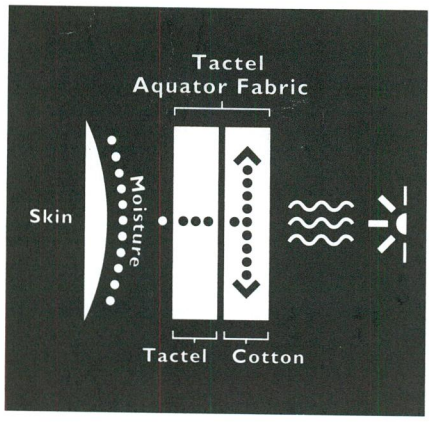
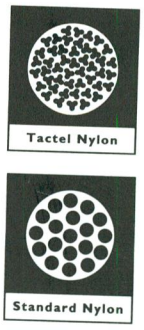


Fig. 24 Tactel®Aguator
Tactel/Cotton




Tactel yarns are extremely strong and bring improved tear strength to lightweight Tactel aquator fabrics.




Tactel yarns are made of many fine filaments. A special cross section, developed for Tactel aquator, helps the wicking activity in the fabric.

Fig. 25 Tactel®Aguator
Cross-Section

**Tactel's Market and its Future**

These Tactel brand micro fibres are sixty times finer than a human hair but six times stronger than silk which makes garments offer, more comfort with better performance. Originally ski wear was a target area. But it was in the hosiery market that it created the biggest impact. Many designers have expanded their interest from hosiery to wider possibilities. Trend-setters such as Paul Smith, Helen Storey, Jean Paul Gaultier and Issay Miyake have all experimented with "Tactel" and it made a welcome alternative to the traditional and often limited natural fibres. Good cut in garments was no longer enough. Inventive and sophisticated fabrics are increasingly important in the fashion scene.

In 1994, Marks and Spencer introduced "Tactel" in their lingerie ranges. In the beginning, their plan was to only sell it in six stores in the U.K. This soon spread out to 30 stores in Britain, 3 in France and one in Spain. Peter Hetherington, specialist manager in the lingerie technology group of Marks and Spencer, says of the fabric. "It has all the requirements of modern lingerie fabric. Indeed, fabrics made of "Tactel" are ideally suited to modern lifestyle in that, whilst they give the impression of luxury, they are easy to care for, can be machine washed, dry quickly and are resistant to creasing" (Tactel Information Pack '96).

The Marks and Spencer range emphasises the versatility of this yarn in that it includes both fitted and fluid garments, form figure-hugging French knickers and camisole tops to elegant flowing slip dresses in a variety of colours. When asked about future ranges in "Tactel", Hetherington replied "We think it fantastic and, at the moment, we have only scratched the surface of its potential (Tactel Information Pack '96).

However, DuPont has changed the strategy from marketing focused on the produce to marketing focused on the consumer. DuPont believes to be successful that they have to work closely with the consumers' demands and requirements. Yet trends are changing constantly in the fashion industry. Companies must be able to react quickly. DuPont Nylon's Textile Centre in Gloucester, U.K., is constantly researching and developing new ideas. The beauty of "The Tactel Effect" is that it can be adapted to these changing needs.

**Lycra (Fig. 26)**

Lycra first was launched by DuPont in 1959. This man-made fibre revolutionised the corsetry industry and is gradually infiltrating and changing all other areas of fashion and fabrics. In no small part the DuPont company has been continuing to research, modify and improve the chemical make-up of Lycra and to produce different types for different uses.

Lycra is a sub-group of polyurethanes which belong to the elastane family of man-made fibres. Its remarkable properties of stretchiness can be under tension four to seven times its initial length when tension is relaxed. In comparison with rubber, Lycra can resist both sun and salt water and is stronger and more restraining. It also possess two to three times more test raining power with one-third less weight. Therefore Lycra enhances various types of fabric with new dimensions of fit, comfort and drape to clothing.

Lycra is used in combination with other fibres whether man-made or natural fibre. It is never a 100% the content of the fabric. Lycra is sometimes used bare, primarily in circular knits for underwear, sock tops, ribbed cuffs for bodywear and swimwear, but also used covered. As little as 2% of Lycra is enough to improve fabric quality, contribution liveliness, drape and better shape retention. Where body hugging fit and high performance elasticity is required as in swimwear, underwear or active sportswear fabrics still only contain from 14% up to a minimum of 4% of Lycra. Therefore it is always the companion yarn which gives the fabric its main fibrous appearance.

In the 60's Lycra was used to blend with Nylon. It was so popular that it became the all-in-one alternative to stockings for women. It was a revolution in women's underwear at the time. In the 70's Lycra began to be included in the swimwear market. As the tendency towards comfort and body consciousness became apparent in the fashion scene top American designer Calvin Klein and French designer Azzedine Alaia launched a whole collection of tight, body-hugging silhouette casual wear to reveal the raw line of the female body.

> This was also a decided advantage when Madonna broke a taboo, turning underwear into outerwear, rewriting the rules about which garments were fit to be seen in public. Support undergarments were back in Vogue, but this time around Lycra makes them a more comfortable proposition (ELLE (supplement) October 1993, p. 6).

## WHAT IS LYCRA*?

LYCRA is a man-made fibre invented and produced by Du Pont, which has an amazing ability to snap back after it has been stretched. This recovery enhances any type of fabric, adding new dimensions of fit, comfort and drape to clothing.

Lingerie and swimsuits owe their gentle, lasting and figure-flattering fit to LYCRA. Hosiery is smoother, softer and wrinkle-free thanks to a little LYCRA in the leg. LYCRA in leisure and fashion wear improves drape and shape retention, and hastens recovery from wrinkles.

## HOW IS LYCRA* USED?

A fabric will never be made of 100% LYCRA. LYCRA is used in small quantities and always combined with another fibre. You can find garments blending LYCRA with wool or cotton, linen or silk, just to mention a few.

Whatever the blend, a fabric enhanced with LYCRA will always retain the natural appearance and feel of its primary fibre. Whether knitted or woven, a fabric with LYCRA will become more lively, supple and drapeable, and garments will feel more comfortable.

## WHY IS LYCRA MORE THAN JUST A FIBRE?

LYCRA is Du Pont's registered trademark. Besides guaranteeing the top quality of LYCRA, Du Pont monitor very carefully how their fibre is processed, in which type of garments it is used, and how it is sold to consumers.

More than just ''stretch'', the LYCRA label is a guarantee of lasting fabric performance and of superior garment quality.

*Du Pont's Registered Trademark.

LYCRA®
ONLY BY DUPONT

- The above is only one example of over a hundred products ranging from 8 dtex to 2500 dtex.
- Numerous end uses include: Lingerie, hosiery, swimwear, sportswear, outerwear foundation garments and diapers.

Fig. 26 Lycra Promotional Leaflet

However Lycra has been used in hosiery for many years. As these became more sheer and were produced in more fashionable colours so they began to be appreciated by a wider consumer base. From underwear to outerwear, in the 90's its popularity is still increasing and their adoption is wide and various in the different fashion markets.

**Technology of Lycra in the 90's.**

Lycra has the capacity of dye ability and the other processing and finishing characteristics of a man-made textile fibre therefore it can combine many fabric constituents in its bare state.

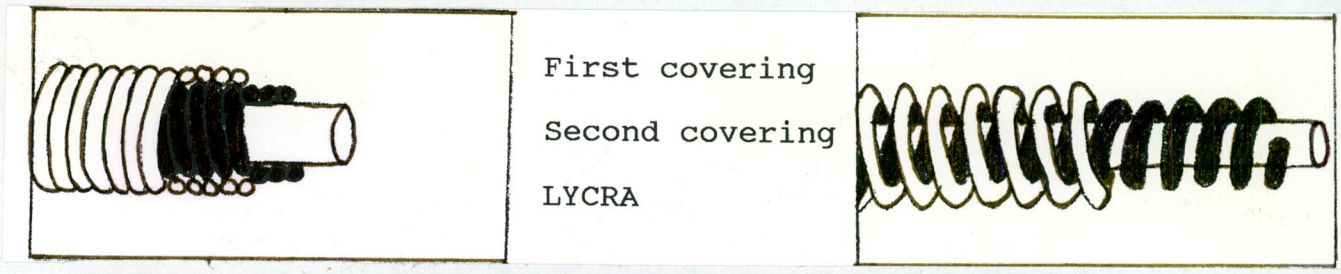
In hosiery fabric, when Lycra is stretched it becomes finer which increases its attraction for sheer hosiery.

In lingerie a small percentage of Lycra can be used in a fine, soft, smooth lace fabric etc., which will not alter the aesthetic but will be more comfortable and that little bit of stretch will protect the seams, so vulnerable in this type of fabric.

In tailoring fabrics, as little as 2% Lycra will help a fabric hold its shape, prevent it bagging and sagging, seam splitting and will increase wrinkle resistance. Sportswear blends can contain up to 40% which gives extra comfort and stretch when in use.

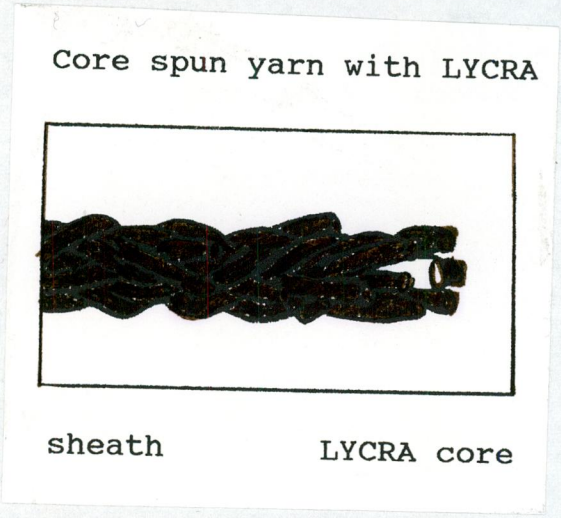
A cotton gabardine feels like cotton. A wool flannel feels woolly. And preserves these visual and tactile characteristics completely when Lycra is added, it needs to be wrapped in another yarn or fibre that matches those features. Technical reasons are the requirements for covering up the Lycra. It is because certain weaving or knitting techniques cannot cope with the highly elasticised yarns. By stabilising Lycra with other yarns for fibres in the process, it can actually restore the full elasticity. These sheathing techniques are divided up into three methods (1) Single and Double Covering
(2) Core-spinning
(3) Interlacing

(1) Single and Double Covering (Fig 27)



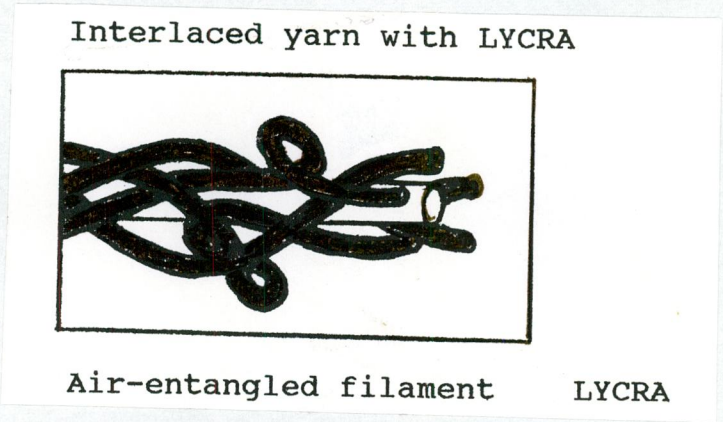

Lycra is surrounded by a strand of non-elastic filament sometime two strands are used for maximum quality, wound in opposite directions (described as S & Z).

(2) Core-spun Fig.28




Natural or man-made non-elastic fibre is spun around stretched Lycra.

(3) Interlacing (Fig 29)




A non-elastic multi-filament yarn is fed through an air jet together with stretched Lycra.

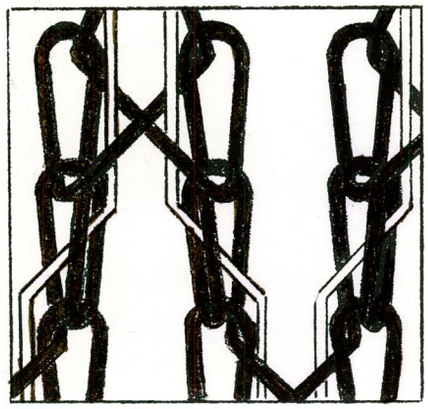
Lycra will contribute elasticity to any fabric. The direction and amount of stretch depends on the percentage of Lycra and how it is knitted or woven in.

**Knitted Fabrics**

Lycra can be incorporated into a knitted fabric where the stretch runs essentially across the fabric. Warp knitting is where the stretch direction runs either length wise in the fabric, or evenly in all directions as in a tricot.

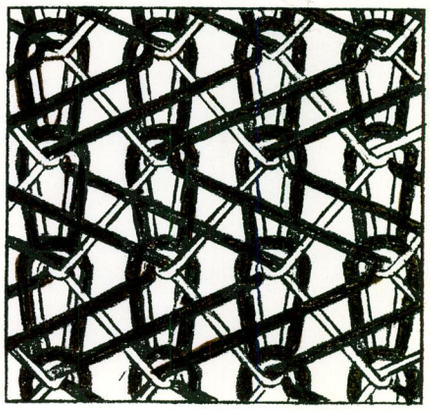
**Weft Knits (Fig. 30)**

In weft-knitting, Lycra is used in its bare form covered according to production equipment and end-use.



LYCRA

Other Yarn



Raschel with LYCRA

Tricot with LYCRA

Fig. 30 Weft Knits

bare Lycra is used in lightweight jersey for daywear, dresses and sportswear. Covered Lycra goes into hosiery and sweater cuffs and welts. Core-spun Lycra is a frequent choice for sweater knits and lightweight jerseys for underwear. Interlaced Lycra is often on high speed hosiery machines and rib machines for cuffs. (Fig.31).




Fig. 31

Rib construction with Lycra

Single jersey plaited with Lycra

(2) Warp Knits

Raschel knits containing Lycra have maximum elasticity in the warp direction and limited stretch in one direction and durable support in the other.

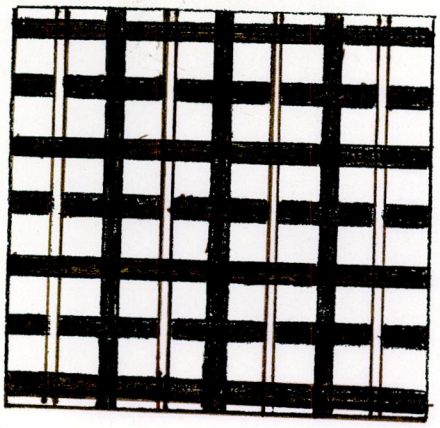
Tricot fabrics with Lycra, on the other hand, stretch in all directions which makes them eminently suitable and comfortable as swimwear, body wear and active sportswear.

Woven Fabrics (Fig. 32)

Covered and Core-spun Lycra impart comfort and freedom of movement to broad-woven fabrics of all kinds, from sporty cotton denims and corduroys to fine wool gabardine; from sturdy canvasses to gossamer silk crepe de chines.

If Lycra is used in the warp, the fabric will stretch length wise. If Lycra is used in the weft the fabric will be elastic in the width direction. Lycra can be used in both warp and weft making the weave bi-elastic.

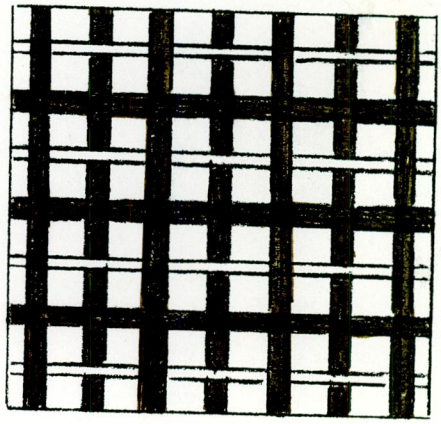
Warp-stretch weave



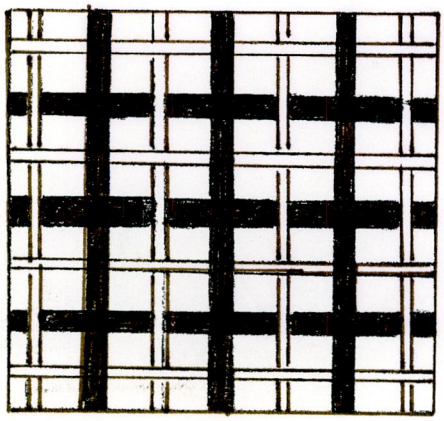
LYCRA

Rigid yarns

Weft-stretch weave



Bi-elastic weave



LYCRA

Rigid weft yarn

LYCRA

Rigid warp yarn

Fig. 32 Woven Fabrics

**New Category of Lycra and its Future**

In 1994 DuPont launched new Lycra 3D on the European market. (Fig.33) This new development introduced a new sheer yet lighter than standard Lyrca 3D. This hosiery is knitted from 20 decitex Lycra type 178C yarn, which gives an extremely fine, uniform appearance on the leg. It has been making important positive gains with the arena of hosiery with Lycra. Marks and Spencer, Dunnes Stores and Knicker box etc., sell hosiery with Lycra 3D and the sales margin has been increased rapidly.

In 1995, DuPont strongly renewed the ideas of Lycra and Lace (Fig.34). Although stretch laces with Lycra are not a new fabric concept, fibre manufacturers have been working with innovative new laces which combine all of the latest machine and yarn technology. A special brand name "lace with Lycra" logo has been used on lingerie and outerwear swing tickets. It has successfully renewed the popularity of lace in outerwear. DuPont's own market research has confined that "Women of all ages love lace which is hardly surprising since this ornamental (open-work fabric which derived its name from the French word, 'lacerér', meaning "to entice"), has always had an air of sensual invitation" (Textile View, Summer 1996, p. 107).

With increasing use of Lycra in all aspects of clothes such as lingerie (Fig.35) , outerwear, sportswear and evening-wear. The application of Lycra has a huge diversity. A bit of Lycra helps fabric hold its shape, prevents bagging and sagging etc.. Fashion and textile designers alike are increasingly interested in the hidden properties which Lycra possesses. Today, comfort, softness and easy-care are the main concerns for consumers. DuPont says "Lycra ... combines fashion with function and the performance values needed for a modern lifestyle" (Textile View, Summer 1996, p. 107).

Lycra absolutely matches the lifestyle of modern living. This is where Lycra comes into its own because a little Lycra used in fabric such as wool, cotton, linen and silk means that they can now retain their aesthetic appeal yet provide added quality in the garments.


Marks and Spencer Opaque 60
Lycra®3D
Tactel®Micro

Fig.33

Fig. 34

Lycra and Lace, Guardian Weekend, December 7th 1996

**Pale fire: Peach silk satin robe with lace collar and cuffs (main picture), £95, by Charnos, from major department stores, enquiries 01159 322191. Flesh stretch lace girdle with suspenders, £90, flesh padded bra, £60, both by Christian Dior, pink diamanté waist chain, £65, all from Agent Provocateur, 6 Broadwick Street, London W1, 0171-439 0229, and mail order. Satin Touch Stay-ups, £18, by Wolford, 3 South Molton Street, London, W1, 0171-499 2549, and 11 Eldon Gardens, Percy Street, Newcastle, 0191-232 2288.**



Fig. 35 Lycra Lingerie from Marks & Spencer

Irish knitwear designed by Lainey Keogh (Fig. 36) is typical in its blend: 92% cashmere with 4% of Nylon and Lycra. "We like to put a lot of depth in our Textiles". The 90's is intensively body-conscious. Lycra came to the fore in the late 1980s allowing a stretch and cling previously unavailable to clothes. Lainey Keogh also said "It is stretch everything right now". (Irish Times, Robert O'Byrne, August 19, 1996).

Margaret Howell, British fashion designer, made the remark "A natural fibre to give it 'life' but may be mixed with Nylon or Lycra to give it modernity" (Lycra Information Pack, 1996).

In the 90's styles with Lycra account for more than 50% of many retailer ranges. Lycra has been used by almost every chainstores in the International scene. Its impact on the clothing industry is tremendous. Many of the main shops adopt Lycra in their collection ranges such as Knicker Box (Fig 37), Mark & Spencer, Dunnes Stores, Adidas, Nike, Next and Oasis etc.. It is hard to see a shop without the DuPont Lycra tag or label on the particular clothing ranges.

Fig. 36 Black stretch cashmere skirt £490.00 and matching sweater £465.00 by Lainey Keogh available from Brown Thomas, Dublin and Havana, Donnybrook or order direct. Photographs by Frank Miller, The Irish Times, 19 September 1996, p. 311.

Fig.37 Knicker Box promotion leaflet

## Conclusion

Now, approaching the 21st century, man-made fibres have reached an incredible standard and a hi-tech level with the assistance of advanced technology and on-going research. Man-made fibres have become an even better alternative to natural fibres. No doubt, the public has benefited greatly from the new innovations like micro-fibres. High function performance, comfort, easy-care are all the main basic ingredients in fashion fabrics today. The popularity of man-made fibres is its comprehensive versatility. Unlimited effects can be created and colour intensity can be adjusted in order to match the ever changing fashion trends.

Nowadays man-made fibres are not just a whim of fashion chic, although the revival of space age has been a huge boost to the synthetics. The 60s and the 70's generation had bad experiences with synthetics and were turned off by the negative effects of the fabric. After over twenty five years continuous modifications and exploration of man-made fibres, people have built up their confidence in synthetics. Teenagers and young adults are the market motivators who are growing up with this new generation of man-made fibres. Companies like DuPont and ICI have successfully promoted their products with a new identity and given new quality guarantees to the brands like Coolmax and Tactel. Their strategies have switched from concentrating on marketing products to marketing consumers. In a 1996 Lycra® Speech by Associate Director of Cofremca France, he outlined that the current trends in social evolution and their impact on the present and future behaviour of clothing consumers include : the rise of autonomy and personal expression; hedonism ; multi-sensuality ; increasing sensitivity to nature and the environment; and the need for meaning and sensitivity (Textile View, Spring1996, p. 276).

In the past years too many manufacturers were still busy with producing products they thought the consumer wanted. 21st century consumers can no longer just be manipulated by a conspicuous consumption system. They now seek to experience fabrics that not only simply look good aesthetically but are also intelligent and feel naturally soft. These are the essential marketing aspects in regard to the future of Fashion and Textiles.

If we look at the global man-made fibres market, Europe and the U.S.A. have reached a very high level. Most economists expect the growth in demand will be low, product and service will be the key to survival. In contrast Asia will experience huge population growth, rising from three billion in 1995 to six billion in 2020 together with nearly double digit growth in many of the regions' economics. These forces will make Asia one of the most attractive regions for companies seeking to increase revenue. "Between 1995 and 2020 Asia will create more than 300 million middle-class consumers, earning an average more than $30,000 per year" (Textile its Leader, Autumn 1996, p. 64). From that one can expect that the dominant economic force will shift from European countries to Asia and it will create huge consumption demand which will push the market capacity upward.

Man-made materials will have a tendency to grow rapidly in this economic atmosphere. Statistics suggests that the textile industry is facing an optimistic future. The gradual removal of barriers to trade and the decreasing cost of communications will open the world's market to even better opportunities. Especially the GATT (General Agreement in Tariffs and Trade) which 168 signatory countries approved in 1994 during the Uruguay round of trade talk, substantially reduces obstacles to global industry trading.

However, one of the most crucial points in the man-made fibre industry is its impact on the environment. It has become a major issue in the U.S.A. and European countries. The Green Movement has been making inroads into all aspects of the business and that of course includes the clothing on our backs. Environmentally favourable textiles do not necessarily have to be made from natural fibres cotton, linen, silk etc.. Yet man-made materials can include recycling which creates less destruction in the manufacturing processes and final state. There has been increasingly stringent regulation in end user countries. Manufacturers have adopted new facilities in order to reduce effects on the environment. For example Nylon, Polyester and other synthetic fibres are produced from chemicals derived from oil. Oil is a none renewable resource unfortunately. But the entire production of chemicals required to make Nylon for example accounts for less than 1% of global oil production each year. DuPont are also investing a large amount of money in changes to the types and sources of intermediates used in the manufacturing process.

The most notable of these is in the case of Nylon where Nitrous Oxide is produced during the manufacture of Nylon chemicals. DuPont has made a commitment to eliminate the release of Nitrous Oxide from its Nylon production by the year 2,000.

The majority of garments manufactured today are made of not one fibre but of a mix or blend of many. DuPont claimed that they are now looking to work with customers to explore future routes for the recycling of synthetic fibres. In the future the DuPont vision for man-made fibre re-cycling involves the reclaiming of fibre and polymer and its depolymerization to produce chemical building blocks which can be returned to the manufacturing process right at the start.

Afterall, all types of fibres have both upsides and downsides in terms of their environmental performance. Therefore if manufacturers carefully consider and use new facilities to reduce the dangers to the environment it does benefit human kind as a whole.

In this dissertation, I outline how man-made fibres are not just a substitute to natural fires. They have their existence in new values which can benefit that the Fashion and Textile industry, in terms of their function, performance aesthetics and versatility. Due to the large population growth the coming decades, it will certainly lead synthetics to new prospects and obviously they will play a major role in the future of the Fashion and Textile industry.

## Bibliography

### Books


Breward, Christopher
The Culture of Fashion
Manchester University Press
Manchester
1995

Brunnschweiler, David & Hearle, John
Tomorrow's ideas and profits Polyester 50 years of achievement
Stanley Press
Dewsbury
1993

Colcheser, Chloe
New Textiles, Trends and Traditions
Thames and Hudson
London
1991

Cook J., Gordon
Handbook of Textile Fibres
Merrow
Durham
1984

Hongu, Tatsuya
New Fibres
Ellis Horwood
West Sussex
1993

Miller, Edward
Textiles
Batsford Ltd.
London
1995

Mulvagh, Jane
Vogue History of 20th Century Fashion
Penguin Group
London
1988

Nunn, Joan
Fashion in Costume 1200-1980
The Herbert Press
London
1984

Schoeser, Mary
French Textiles : from 1760 to the present
Laurence King
London
1991

Steele, Valerie
Fetish: Fashion, Sex and Power
Oxford University Press
London
1996

**Articles**


Jim Sage, "The Science of Textiles", New Designer, London, January 1996.

Lynton McLain, "Alternatives to 'cut spaghetti'", Irish Times, 25 may 1990.

Daniel Green, "High-tech fibre mimic silk", Irish Times, 11 April 1992

Robert O'Byrne, "The Fabulousness of New Fabric Technology", Irish Times, 19 August 1996.

Damien Foxe, "The Fibres", Irish Times, 19 August, 1996

Daniel Green, "Spinning a yarn to its limit", Irish Times, 14 January 1992.

Nancy Dunne, "U.S. Sweatermakers elated by anti-dumping, Irish Times, 7 September 1990.

Ann William "Green Textiles of Many Colours", Hong Kong, Fabrics & Accessories, May 1996

Colchester-Chloe "High-Tech and Textures", Crafts, London, England. V. No. 112, Sept/Oct 1991, p.30-31.
Colchester-Chloe, "High-Tech Styles", Crafts, London, England. No. 132 Jan/Feb 1995, p. 20-3.

Coatls, Margot "New direction in textiles and fashion from the Royal College of Art and Living, Stone. Studio". Craft, London, England, No. 139, Mar/Apr 1996, p. 57-8.

Rudge-Geralding, "Rising Earley", Craft, London, England. No. 139 Mar/Apr 1996, p. 26-9.

Znamierowski-Nell. "Frontiers in textile", American Craft, V. 54. Feb/Mar 1994, p.44-45

Polan-Brenda, "Maximum effect", Craft-London, England. V. No. 75, July/Aug 1985, p. 40-1

Lott-Janr "Synthetic Style", Design-London-England. V. NO. 433 January 1985, p. 30-3

Christophe Jouany. "Alpireaction", Marie Claire, Nov. 96, p. 212

"Lace with Stretch", Textile View, Summer 1996, p. 107.

"Social Evolution, Clothing Consumer", Textile View, Spring 1996, p. 274.

"Cultural Diversions", Textile Views ; Winter 1996, p. 47.

"John Rocha", International Textiles, No. 778, November 1996, XLV.

John A, Blackburn, "The British Cotton Textile Industry Since World War II; the search for a strategy "Textile History, 1993 24 (2) 235-258.

Peters Glen, "The Hard Rules of Global Business". Its Textile Leader, Autumn 1996, p. 62-75

## Interviews

Interviews with Dermot Kelly (Japanese Fabric Agents Trading Manager), Dublin, 25th November 1996.

## Promotional Supplements and Periodicals.

DuPont/Lycra, Lycra 3D, London, 1996.

DuPont/Lycra, Lycra Information Pack, London, 1996

DuPont/Tactel, Tactel Information Pack, London, 1996

DuPont/Nylon "Securing the Future for Nylon" by Les Jacques, JSDC Volume 109 October 1993.

ELLE, (Supplement), October 1993, p. 6