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Manufacturing and properties of microfibers

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Abstract

Synthetic fiber industry has been enforced to make developments due to the increasing performance demand from textile products. One of the most important developments in synthetic fiber industry, is absolutely producing extremely fine fibers which are named as microfibers. Microfibers provide light weight, softness, good drapability, high water absorbency, quick dry and many distinguishing properties for different end uses such as apparel, sportswear and home furnishing. Microfibers can be woven or knitted into a variety of fabrics structures. This literature review microfibres, including their general proprties, classification, manufacturing processes, numerous forms of the fiber, and applications.

Keywords: microfibre, manufacturing methods, fiber cross-section.

Introduction

The first 'micro-denier' products were introduced by Japanese fiber manufacturing companies during the 1970s. [1] The production of microfibers followed in Europe during the 1980s and since the 1990s by American manufacturers. Toray was the first company in the world to introduce microfibers, followed by Teijin, Hoechst, ICI, DuPont, and others. Recently Toray has introduced an ultra-fine polyester microfiber with a linear density of filament of about 0.05 dtex. This may be called the finest synthetic fiber so far produced commercially. At present, polyester and nylon are generally used for manufacturing microfibers. However, 'micro-denier' versions of rayon and acrylic products are on the horizon. [2-4]

Microfibers can be woven or knitted into a variety of fabrics structures such as Plain, Twill, Jersey, Rib and Interlock.Three conventional spinning methods, i.e. melt spinning, dry spinning, and wet spinning can be used to manufacture microfibers. However for producing microfibers by these methods, the polymerization process, polymer spinning and drawing conditions have to be selected and executed very carefully. The technology involved in the extrusion of microfibers is more sophisticated and costly than that of conventional deniers as microfibers are delicate products that require great attention in handling during textile mill processing. [5-16]

The most common types of microfibers are made from polyesters, polyamides (e.g. nylon, kevlar, nomex, trogamide), rayon and most recently acrylic or a conjugation of polyester and polyamide to obtain specific properties including: softness, durability, absorption, wicking abilities, water repellency, electrodynamics, and filtering capabilities. They also can be blended with other fibers including cotton, linen, wool, rayon and lycra or spandex. Blends enhance the appearance, hand, drape and performance properties of the fabric.

Microfiber yarns

Microfiber is defined as a staple fiber or filaments of linear density approximately 1 dtex or less, and above 0.3 dtex. Although acrylic, viscose and polypropylene are available for the production of microfibers, polyester and polyamide are the main source. The fabrics made from them can be 100% microfiber or in blends with wool, cotton or viscose. Microfibers are half the diameter of a fine silk fiber, one-third the diameter of cotton, one-quarter the diameter of fine wool, and one hundred

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times finer than human hair. In order to be classified as a microfiber, the fiber must be less than 1 dtex in width.

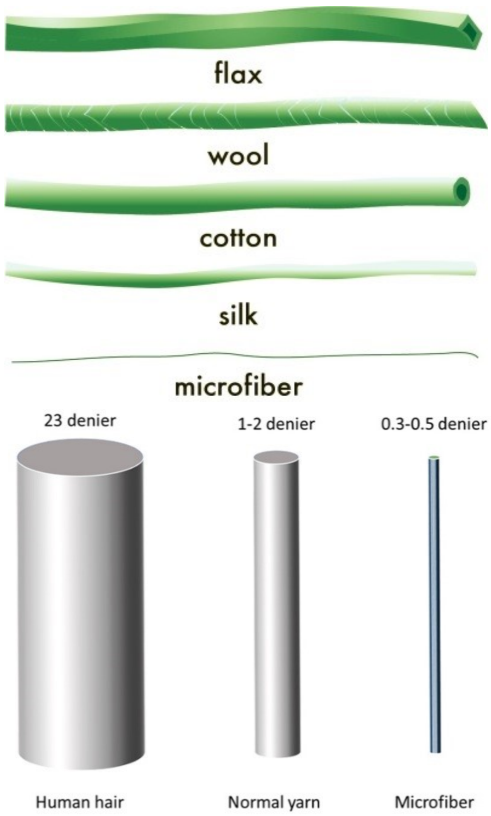

Figure 1: Microfibers Vs other fibers

Even finer fibres are produced, of 0.3 dtex or less, but these are commonly referred to as super-microfibres.

Table 1: the relationship between fibre linear and classification

Fibre count, dtex/f	Fibre classification
> 7.0	coarse
7.0-2.4	medium fine
2.4-1.0	fine
1.0-0.3	micro
< 0.3	super-microfibres including nanofibres when their cross-sectional dimmentions are within a range of nm, that is of <0.1dtex or <1μm

Polyester Microfiber

There has been a trend to produce finer synthetic filament fibers, and consequently various microfibers have been developed with new fiber spinning techniques to reduce thickness and alter the cross section shape. Microfiber fabrics have enhanced drapeability, luster, softness, bulkiness, and smoothness, and also high tactile aesthetics and high water absorption and chemical adsorption properties. [17, 18]

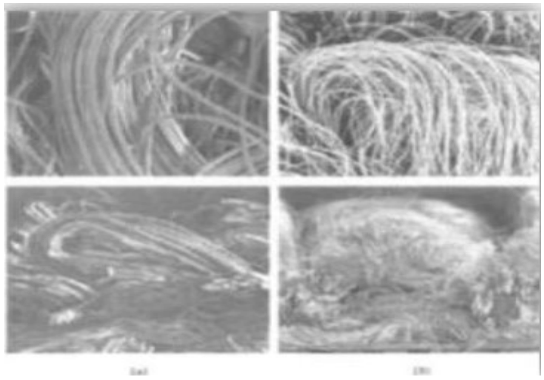

Figure 2: SEM images of(a) original polyester fabrics Vs (b) polyester microfiber

Manufacturing of Microfibres

The technology involved in the extrusion of microfibres is more sophisticated and costly than that of conventional deniers. Microfibres are delicate yarns that require great care in handling during textile mill processing. [19]

There are various methods of producing microfibres, including modified conventional spinning. All three conventional spinning methods, namely melt spinning, wet spinning, and dry spinning can be employed to manufacture microfibres. For this method, carefully selected polymerisation, polymer spinning and drawing conditions are required. Polyester, nylon, and acrylic microfibres may be manufactured by this method. The extrusion spinnerets should contain many holes of very fine diameter, each of which will make one uninterrupted filament, in spite of complex thermal and rheological changes. Detailed aspects of the various manufacturing methods are presented in this review . [20]

Microfibers are classified into two types, continuous filament type and staple type. Continuous filament type microfilaments can be produced by different methods namely; alkaline weight reduction, direct spinning and bicomponent spinning. [21]

Microfiber spinning

Microfiber spinning is now possible by many major fiber producers on their existing equipment, however economical production of high quality microfibers will require significant changes in future machine design and operation. Ultra-fine fibers are classified into two types: filament type, and staple type. Recent developments in the field of ultra-fine fibers have focused on the filament type Ultra fine fiber of the filament type is produced by the methods including: [22]

- Direct Spinning (Conventional poy Spinning)
- Bi-Component Process (Separation or splitting type And Island-In-Sea Type).

- Islands in a sea type
- Separation or splitting type
- Multi-layer type

Production of Microfibers Filament Type

Direct spinning

In this method microfiber is directly manufactured by melt spinning with this method, the fineness of the microfibers produced is limited to 0.1 dtex because of the tendency of the individual filaments to stick together. Improvements in processing conditions and finishing, such as more accurate spinnerets and strictly controlled cooling conditions after extrusion, together with lower polymer viscosity, can however make the production of microfiber yarns possible . [23]

Bi-Component Process

The technical problems in direct spinning can be solved by conjugate spinning, which yields

homogenous ultra-fine fibers. investigated the extrusion of conjugate fibers with a cross section consisting of highly dispersed conjugate components by modifying the spinneret structure. Conjugate spinning is classified into two types from technical viewpoint: the islands in a sea type and separation or splitting type. In either case, the microfiberization is performed in the form of fabrics. No special technical problems arise in later processing, compared with conventional spinning

Islands in a sea type

In islands in a sea method, a number of continuous very fine filaments are extruded in a matrix of another polymer. In the spinneret a number of bi-component sheath-core polymer flows are combined into a single flow and extruded. The islands in the sea fiber are then quenched and drawn in the usual way. Polyester, nylon, polypropylene, Polyester, polyethylene and polyphenylene sulfide are the polymers employed as island components

The various combinations of polymers to form fibers by this method successfully are polystyrene/polyamide and polystyrene/polyester. The sea component is removed by dissolving it in a solvent after conventional processing into woven, knitted or nonwoven fabrics. This technology provided a means of industrial production of suede type artificial leather, silk like fabrics, wiping cloths and fine filters. Since the ultra fine filaments (the island component) are sheathed by the sea component, they are protected from damage during later processing. Three component spinning can be carried out with two island components by designing a three component spinneret assembly. The sea component can be reduced to 2-10% of the total components, but the space between the ultra fine filaments is also reduced and this may lead to poorer handle of the products. When the sea component is small in amount and not miscible with the island component, the splitting can be carried our mechanically.

Separation or splitting type

This type of spinning aims to utilize the second component in the final product by splitting the two components instead of removing the second component by dissolving. The ultra fine fiberization is performed by a mechanical or chemical process in the splitting and separation types of spinning. This method of microfiber production involves extruding a bicomponent fiber which two polymers with poor adhesion to each other are used.

In split spinning, the starting fibre consists of segments of two different polymers. Each wedge of polymer A has a wedge of polymer B on either side. The general production principle of splittable fibres is given in Figure 3. The fibres are designed to split into the wedges by different treatments to produce the ultimate microfiber. Segmented pie fibers are, therefore, known as ‘splittable microfibres’.

Applications of these fibers are suede for clothing and upholstery, silk like fabrics, wiping cloths, wall coverings, automobile trims, golf gloves and moisture-permeable and water-repellent fabrics. In this method the overall shape of the fiber determines the ease of splitting. If the components are in a radial configuration then splitting is more difficult than if one polymer is located at the ends of the lobes in a multilobal shape .Suitable polymer combinations for splittable bi-component filament spinning are polyamide/polyester and polyester/polyolefin .

Figure 2: Typical bicomponent fibre type

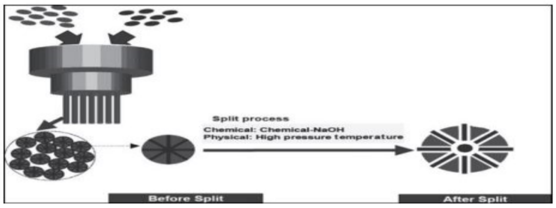

Figure 3: Schematic diagram of the splitable microfibre production

ulti-layer type

Two components are spun into a conjugate fiber of multilayered structure with an ovalshaped cross section, which is microfiberized into filaments of 0.2-0.3 denier .

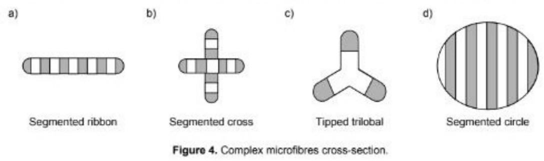

Figure 4: Complex microfibers cross section

Production of staple type microfibers

Ultra fine fiber of the staple type is produced by the methods including: [24]

Melt blowing or jet spinning

This method is employed for the production of nonwoven fabrics of polypropylene ultra fine fibers. The polymer melt is blown apart immediately after extrusion by an air jet stream in this method, so it is sometimes termed "jet spinning". Thus, this method is an application of spraying technology rather than true spinning . It finds applications in an increasing number of fields, such as filtration, absorbency, hygiene and apparel [25]

Flash spinning

The polymer is dissolved in transparent solutions at high temperature under high pressure. The spinning solution is jetted out of a nozzle into the air to form a fibrous network. A fiber network is obtained by spreading a single stream of fiber spun from one spinneret hole. The filament thickness varies from 0.01 denier to 10 denier . [26]

Polymer blend spinning

In this method the conjugate fiber is produced by extruding and drawing a blended polymer melt of two components. The fiber fineness can not be controlled and the fiber often breaks during spinning, although the spinning stability is strongly dependent on the combination of polymers. Since the dispersed polymer phase is drawn to yield ultra-fine fibers, no filament type of ultra fine fiber is produced at present by polymer blend spinning .[27]

Weaving of microfibers

Carding

It has so far proved impossible to card microfibres at production rates which are comparable with conventional type of fibres, and so the cost per unit weight of production is much greater. In carding it is necessary to have a greater density of carding wire points.

Winding and warping

All guide surfaces must be very smooth and in the best mechanical condition, as microfilaments are likely to break more easily than regular filament. The frictionless rotating discs type of tension devices are desired to minimise the drug.

Sizing

Warp sizing of microfibres should ideally be done on single-end sizing machines to minimise filament breakage at splitting rods. If single-end sizing is not available, then a pre-dryer is essential. The size pick up on microfibre yarn is higher and it is also more desirable. The size recipe should be decided by trial and error determining.

Weaving

Generally the tensions should be kept as low as possible. Weft yarn for air jet or water jet looms will need some finish to perform at maximum efficiency.

Dyeing Microfibers

Microfibers are super-absorbent, absorbing over seven times their weight in water and they dry in one-third of the time of ordinary fibers. They insulate well against wind, rain and cold and furthermore are environmentally friendly. [28]

The higher absorption surface of microfibers results in a dyeing rate four times higher than that of normal fibers. Therefore, to reach the same depth of shade they require more dyestuff than standard fibers, which can cause unevenness in the dyeing. Their larger external surface means an increase in the number of threads exposed to light which, on destruction of dye, is expressed as the lower light fastness rating. Because of the fineness, the total surface area of microfiber yarn or fabric is much bigger than ordinary fibers. Therefore the quantity of required size needed to be applied on microfilament warp yarns is higher. Since microfibers have very small interstitches, with consequent difficulties of size accessibility and diffusibility, desizing becomes quite difficult and costly.

The most useful machine for microfiber fabric processing is a Jet dyeing machine, as it allows the fabric to develop a desirable bulk. The difficulty in processing microfibers can be overcome by proper selection of dyestuffs, using appropriate dyeing machinery (air jet type) and choosing suitable processing parameters. Proper dye selection eliminates problems regarding build-up and fastness properties. Staple microfibers offer difficulty in carding, but the emerising effect, which imparts a slightly napped, peach-like surface and a pleasant soft.

Printing styles of microfibers

Printing on microfibers can be achieved using various techniques, each with its unique advantages and applications. Here are some common printing styles on microfibers:

1. **Sublimation Printing**: Sublimation printing involves the transfer of dye onto a substrate using heat. This technique is particularly suitable for microfiber fabrics due to their polyester composition, which allows the dye to sublimate directly from a solid to a gas without passing through a liquid phase. Sublimation printing produces vibrant, durable, and high-resolution prints that are resistant to fading and washing.
2. **Digital Printing**: Digital printing, also known as direct-to-garment (DTG) printing, involves printing designs directly onto microfiber fabrics using specialized inkjet printers. This method offers excellent color accuracy and allows for the printing of intricate designs with fine details. Digital printing is suitable for both small and large production runs and offers the flexibility to print on-demand without the need for costly setup processes.
3. **Screen Printing**: Screen printing involves transferring ink onto a substrate through a fine mesh screen. This technique is versatile and can be used to print on a wide range of fabrics, including microfibers. Screen printing offers vibrant colors and good durability, making it suitable for producing high-quality prints on microfiber textiles. However, it may be less suitable for intricate designs with fine details compared to digital printing.
4. **Heat Transfer Printing**: Heat transfer printing involves transferring pre-printed designs onto microfiber fabrics using heat and pressure. This method offers versatility and is suitable for producing custom designs with multiple colors and gradients. Heat transfer printing is often used for small-scale production or for printing on-demand, as it does not require large setup costs associated with other printing techniques.
5. **Rotary Printing**: Rotary printing is a high-speed printing process that involves transferring designs onto microfiber fabrics using engraved rollers. This technique is commonly used for large-scale production runs and offers high productivity and consistent print quality. Rotary printing is suitable for simple designs and patterns with repetitive motifs.

Each printing style has its own advantages and limitations, and the choice of technique depends on factors such as the desired print quality, complexity of the design, production volume, and budget constraints.

General Properties Of Microfibres:-

Fabrics made of microfibers are generally :

- lightweight, resist wrinkling, have a luxurious drape on the body, retain shape, and resist pilling.
- They are also relatively strong and durable in relation to other fabrics of similar weight, and they are more breathable and more comfortable to wear.
- microfibers show lower heat conductance and therefore Higher thermal insulation properties. Microfiber fibers exhibit a warmer feeling than conventional fabrics depending on pressure, which may be due to the difference in the fiber and fabric surface in contact with the human skin .
- Microfibers are specified by their remarkable properties such as luster, pleasant softness and handle, good drapability, bulk and outstanding surface properties.
- Woven fabric was produced from a 0.1 dtex UFF hollow microfiber combined with a single hollow staple fiber. This product offers a sense of warmth, dry handle, softness, bulk, good recovery, and is lightweight.
- Microfibers have high strength properties, are very soft, have luxurious hand with a silken or suede touch, extreme drapability, ultra-fine linear density (less than 0.1 dtex/f) and are finer than the most delicate silk.
- They are shrink resistant, ashable, dry-cleanable, non-electrostatic and are hypoallergenic, therefore they do not create problems for those suffering from allergies.
- Anti-microbial agents help to protect the wearers from the dangers of the bacteria that cause odor and mildew.

Mechanical Properties of Microfiber

Microfiber has a number of properties that make it an attractive choice for various applications. Some of the key properties of micro fiber include:

1. **Softness:** Microfiber is extremely soft and gentle to the touch, making it comfortable to wear as clothing or use as bedding. This is due to the ultra-fine threads of the fiber, which are much finer and smoother than natural fibers like cotton.
2. **Absorbency:** They are highly absorbent and can hold up to seven times its weight in water. This makes it an effective material for cleaning products, such as towels and mops. The absorbent properties of microfiber are due to the large surface area of the ultra-fine threads, which can trap and hold water and other liquids.
3. **Lightweight:** Microfiber is very lightweight, which makes it easy to wear and handle. This is because the ultra-fine threads of the fiber are much lighter than natural fibers like cotton, silk, and wool.
4. **Durability:** these fibers are extremely durable and can withstand a lot of wear and tear, making it an ideal material for products that are used frequently. This is because the ultra-fine threads of the fiber are very strong and resistant to damage from friction and stretching.
5. **Stain resistance:** Microfiber is naturally resistant to stains and can be easily cleaned with a damp cloth or sponge. This is because the ultra-fine threads of the fiber are tightly woven together, which makes it difficult for dirt and stains to penetrate the fabric.
6. **Breathability:** Microfibre is breathable, which allows air to circulate through the fabric, keeping the wearer cool and comfortable. This is because the ultra-fine threads of the fiber are spaced apart, which allows air to flow through the fabric and evaporate sweat and moisture.
7. **Water-repellency:** They are naturally water-repellent, making it ideal for use in outdoor clothing and gear. This is because the ultra-fine threads of the fiber are tightly woven together, which makes it difficult for water to penetrate the fabric.
8. **Resistant to wrinkles and fading:** Microfiber is resistant to wrinkles and fading, which makes it a popular choice for bedding, upholstery, and clothing.

The Effect of Oxidizing Agent on Microfiber

Oxidants are substances that react with other substances when exposed to oxygen or catalyzed by an oxidizer. As for microfiber fibers, most microfibers are considered to be resistant to oxidation, this means that they remain effective and are not significantly affected when exposed to oxygen. [29]

Microfiber fibers are characterized by durability and good mechanical strength, and are usually designed to withstand repeated use and washing. And in general, they retain their characteristic properties, such as softness and high absorbency, over time.

However, microfiber fibers should be treated with caution when using strong or oxidizing chemicals that may affect the fiber structure. It is important to always follow the care and maintenance instructions provided by the manufacturer to maintain the quality and performance of microfiber.

The Effect of Reducing gent on Microfiber

Reducing substances are substances that react with other substances when they lose electrons, and are the opposite of oxidants that react when they gain electrons. For microfiber fibers, most fibers do not react significantly with reducing substances.

Microfiber fibers are often made of synthetic materials such as polyester or nylon, and these materials are usually stable to various influences. If properly processed and properly cared for, microfiber remains resistant to most chemical influences.

However, the care instructions provided by the manufacturer of microfiber products should always be observed. It is preferable to avoid the use of strong chemicals that may affect the structure of the fibers, as some strong reducing substances may degrade the fibers or change their natural properties.

Applications of Microfibres

Microfibres are characterised by advantageous properties such as pleasant softness of handle, good draping qualities, lustre, bulk and outstanding surface properties. At the start of development, the researchers searched for suitable fields of application for their microfibres, since they had properties which had not yet existed in previous clothing and technical textile concepts.

Fashion clothing textiles

Woven fabric was produced from even a 0.1 dtex UFF hollow microfibre combined with a single hollow staple fibre. This product offers softness, bulk, dry handle, a sense of warmth, good recovery, and is lightweight. High-performance filter fabrics

Owing to their fine, compact structure, microfibre textiles offer excellent filtration effects for both air and fluid filtration. Independently on common microfibres, also ultra-fine microfibre products, such as 0.05 dtex PP microfibre nonwovens, in combination with a high electrical voltage, which will provide permanent polarisation to the nonwoven, attract and absorb charged dust particles. Microfibre textiles can produce excellent filtration effects in the process of filtering solid or liquid materials

Microfibres for cleaning

Most cleaning microfibers have a so-called "pie wedges" cross section made of polyester and nylon (polyamide). Splitting those fibbers separates the nylon star-shaped core from the polyester wedges and divides the fiber into 9 different (in size, shape and composition) strands. As a result the fibers capacities, such as water absorption or dust attraction are greatly increased. They are also environmentally friendly by reducing consumables used such as chemical cleaners and paper towels . Microfiber's ability to clean with a reduction in chemical usage and the removal of bacteria and viruses has propelled the product to new areas . Microfiber technology allows workers to clean faster, better and safer than traditional cleaning methods .

Microfibre products are suitable for cleaning anything. Unlike ordinary cleaning fabrics that move or push dirt and dust from one place to another, microfibres actually ‘scrape’ the dirt or stain from the surface, and then store the dirt particles in the fabric until it is washed. Microfibre cleaning clothes trap dirt and dust inside the cloth, and do not spread dust or dirt around. The user can clean the cloths with water alone; no chemicals are needed. The scheme of cleaning dirt by common fibres and microfibres are shown in Figure 5.

Microfibres are the well-kept secret of professional housekeepers, custodians and car retailers.

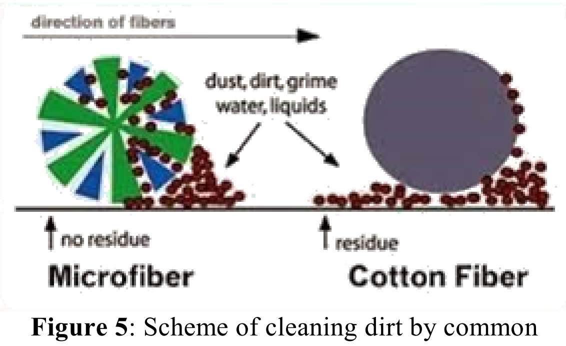

Figure 5: Scheme of cleaning dirt by common microfibres

The characteristics of microfibre liquid filters are as follows

‰ high water passage speed, ‰ high extraction performance (retention of particles up to micrometers dimensions), and ‰ ease of cleaning micro-particles from the filter. The micrometer-sized fibre segments add mechanical filtration properties to the filter medium. Also, two different dissimilar polymers can be selected that will generate turboelectric properties under flow conditions. The two polymers may also be electrostatically chargeable to enhance first-step filtration properties. These filtration mechanisms, when combined properly, may be able to create a higher efficiency, lower pressures drop-filter materials that will last longer before plugging in both air and liquid applications.

Many potential applications exist where synthetic splittable fibres can be used to add value, and create marketing advantages and a head start onto the market for innovative filter suppliers. The addition of a small amount of splittable fibre should increase the dust spot efficiency of filter materials significantly due to its low fibre diameter, in relation to the other fibre diameters currently being incorporated into the filter medium.

In pulsing applications where the filter medium is continuously flexed but also requires stiffness, splittable synthetic fibres add a high degree of reinforcement to the filter medium because there are number is at least 16 times the number of fibres available for reinforcement when they are spilt for segmented fibres or more than 33 times for the islands-in-the-sea type fibres. handle, has grown in importance for microfiber fabrics. The emerising treatment must always be carried out before pre-setting to prevent an uneven surface.

Synthetic game leather and imitation leather

When it was proved that natural game leather collagen fibres have diameters within the range of 4 micrometers, imitation game leather and artificial leather could be developed with great success, since the new microfibres equated with this level in dimensional terms.

Synthetic game leather and leather products are today produced industrially in Japan by impregnating nonwovens produced from PET, PA or PAN microfibres with polyurethane (UP). These products offer outstanding advantages compared to natural leather and game leather in terms of uniformity, dimensional stability, ease of care, colour fastness, and low mass.

Protection against the weather

Woven fabrics for protection against the weather were previously coated with polyvinyl chloride in most cases . But today, closely woven microfilament fabrics offer a new era for protection against weather. As the number of filaments in a yarn of given linear density increases, then the surface area of all the fibers increases and, in a fabric of close construction, the gaps between the fibers become smaller.

Woven sportswear fabrics are also used for protection against wind and weather, and also for insulation purposes.

The PVC coating guarantees absolute waterproofness, but has a serious disadvantage. It allows no passage of air, the wearer perspires after only a few minutes, and has no opportunity of expelling his body moisture to the outside of the garment. This coating is equivalent to an airproof package, and is used nowadays only for heavy duty rainproof clothing (the so-called oil-cloth).

Today, there is a wealth of alternative coatings and methods to replace PVC, such as microporous fluorocarbon coatings, which guarantee some breathing activity on the part of the fabric. Thanks to ever finer yarns, fabrics can now be produced to meet practically all functional sportswear requirements without additional coating or membranes. They are wind- and water-repellent, yet can breathe.

Energy conservation

Experiments have shown the drastic savings in the energy consumption in heat exchanges which are brought about by using metal-coated microfibres. In this case, the microfibre shows its heat conveying properties. By using the metal-coated microfibres inside the tubes of heat exchangers, heat transfer enhancement can be achieved. The findings of the above experiments are as follows:

- ‰ Heat transfer increases with the number of metal-coated microfibres.
- ‰ Pressure drops increase with the number of microfibres.

Medical applications

When it comes to the medical market, microfibre nonwovens are exactly what the doctor ordered. Both manufacturers and consumers are already aware of the many benefits microfibre nonwovens offer to the medical market. When compared the commonly textiles to microfibre nonwovens, they are lower in cost, easier to use, more versatile, safer, and features of better disposability. With this in mind, it is no wonder that microfibre nonwovens are found in hospital surgical drapes and gowns, protective face masks, gloves, surgical packs, and bedding & linens.

Construction applications

Composites are multilayer materials consisting of different layers with distinct properties in each layer. The composte is constructed in order better to utilise a combination of properties from different layers. Polypropylene and bi-component microfibres can be very important components of fibre-reinforced composites, as they function not only as a reinforcing element, but also as a binder fibre between the individual layers. Polypropylene and bi-component microfibres are used in many different composite products: Micro-fibre-reinforced concrete (to reinforce and prevent cracks), insulation material (to avoid the use of chemical binders), multifunctional liquid transport media (acquisition and distribution layers), woven fabrics (as a dimensional stability network), and laminated products (lamination between textiles and boards). Polypropylene and bi-component (PP/PE) microfibres have the ability to add structural performance and functionality to the composite materials. Polypropylene and bi-component (PP/PE) microfibres provide the following advantages in fibre-reinforced composites: ‰ they enable lightweight constructions (PP fibres have the lowest specific gravity of all fibres); ‰ easy to process and environmentally friendly thermoplastics; ‰ good mechanical properties, toughness and impact strength; ‰ stability in rigid environments (resistant to deterioration from chemicals, mildew, perspiration, rot and weather); ‰ ability to add bulkiness and softness to the composite.

Conclusion

Microfiber is a synthetic fabric made of very fine fibers that has become increasingly popular due to its unique properties. It is soft, lightweight, and highly absorbent, making it an ideal choice for a wide range of applications, from cleaning cloths and towels to clothing, bedding, and upholstery. Microfiber is also easy to clean, durable, and quick-drying, making it a more environmentally friendly choice than many other materials. Due to its versatility and effectiveness, microfiber is widely used in various industries, including the cleaning, automotive, medical, and sports industries. We can foresee a brighter future in the market due to the aesthetic properties of the fabrics made out of the yarns. However, the industry has to gear up to handle these delicate yarns in the downstream processes, such as twisting, sizing, warping, weaving, dyeing,printing and finishing.

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Conflict of Interest

The authors declared no competing interests in the publication of this article

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تصنيع وخصائص الألياف الدقيقة

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المستخلص

لقد تم فرض صناعة الألياف الاصطناعية على إجراء تطورات بسبب الطلب المتزايد على الأداء من منتجات المنسوجات. أحد أهم التطورات في صناعة الألياف الاصطناعية هو إنتاج ألياف دقيقة للغاية تسمى الألياف الدقيقة. توفر الألياف الدقيقة وزنًا خفيفًا ونعومة وقابلية جيدة للثني وامتصاصًا عاليًا للماء وجفافًا سريعًا والعديد من الخصائص المميزة للاستخدامات النهائية المختلفة مثل الملابس والملابس الرياضية وتأثيث المنزل. يمكن نسج الألياف الدقيقة أو حياكتها في مجموعة متنوعة من هياكل الأقمشة. تستعرض هذه الأدبيات الألياف الدقيقة، بما في ذلك خصائصها العامة وتصنيفها وعمليات التصنيع والأشكال المتعددة للألياف وتطبيقاتها.

الكلمات المفتاحية: الألياف الدقيقة، طرق التصنيع، المقطع العرضي للألياف.