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## Analysis of Modern Sportswear Materials

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**ABSTRACT:** In recent years, development in active sportswear fabrics has been progressing to perform high functions and to achieve comfort. The sportswear manufacturing textile industries not only keep their eyes on market diversification for fibrous materials but also on textile science and technology. The use of innovative textile science and technology in the manufacturing of sports and leisurewear fabrics is continuously enhancing day by day to fulfil the requirements for athletics and leisure activities for their better performance in the sports. The performance requirements of many sports goods often demand widely different properties. The contributing factors for developing active sportswear fabrics are: polymer science, fibre science, production techniques, lamination and finishing techniques to obtain sophisticated fibre, modified structure of yarns and fabrics. In this paper, literature related to fabrics properties and works done in development of sportswear have been reviewed.

**KEYWORDS:** Leisurewear, recreation textiles, Sportswear, Sporttech, technical textiles

### I. INTRODUCTION

Sport today is becoming an important component of the life of every modern person. In this regard, science and industry are studying the characteristics of various sports, identify requirements for materials and design clothing, offers new developments in this area. The tendency here is to create materials that are lighter in weight, but possess such qualities as hygroscopicity, thermal insulation, elongation, and resistance to wear. All listed requirements are fully met by polyester. This is polyester fiber produced by molding a melt of polyethylene terephthalate or its derivatives. To its advantages, in addition to the above, can also be attributed to crushability, high light fastness, resistance to atmospheric phenomena. Also, a doubtless positive aspect is its relatively low cost. The presence of all these factors explains the fact that polyester is the most popular of all types of chemical fibers for the production of textiles, including sports, products. Complying with the requirements for modern sportswear, which in addition to the above, include such as: quick drying of the product, ease of washing, the ability to drain moisture from the body and at the same time protect from moderate precipitation - material manufacturers develop high technologies; combining the production of special microfiber polyester, the use of a special weave fabric and the use of various final processing material.

Thanks to these technologies, numerous air cavities are created inside the woven layer, which contribute to the removal of vapors to the outside. However, the composition of the fibers themselves and the structure of the weave create conditions under which the material practically does not absorb atmospheric moisture. The development of the polymer industry and the emergence of new materials sets the development vector for designers and designers of clothing, demanding new design solutions [1].

### II. TEXTILE MATERIAL AND FABRIC STRUCTURE FOR SPORTSWEAR

It is not possible to achieve all required properties for sportswear in a simple structure of any single fiber. The right type of fiber should be in the right place. The behavior of the fabric is mainly depending on its base fibers properties. The most important properties are: fiber type; weave construction; weight or thickness of the material and presence of chemical treatments [2].



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## A. DEVELOPMENT IN POLYMER

Some developments in polymer introduce some special functional properties. Some are as under [3,4]: "Phase Change" materials (PCM) are being developed for sportswear. This means that they contain a chemical that changes from being a liquid to a gel at around body temperature. This alters the fabric's insulation properties so that you can design clothes that keep the body at a constant temperature no matter what happens to the air temperature. These are used in cold weather protective clothing like gloves, boots and hats. Phase change stuff produce microcapsules full of paraffin. When the capsules are heated, the paraffin liquidifies and heat energy is stored. When the environment cools, the paraffin crystallizes again, releasing heat. The paraffin, which is available in different recipes with various melting points, is referred to the phase change material or PCM. Because the paraffin can be formulated with different melting points, the microcapsules can be designed to keep the wearer either warm or cool.

"Shape memory polymers" material can remember and retain its shape or return to a previous form. A garment made from these shape memory polymers is able to sense changes in the surroundings environment; and can evaluate intelligently and control its response to ensure the highest level of comfort. This polymer is also unique as the temperature at which micro-Brownian motion begins can be freely specified. This means that the activation point can be set to match the environmental conditions in which a garment is likely to be worn.

## B. FABRICS OF MEMBRANE TYPE.

It would be nice if the winter jacket could change its properties depending on weather conditions, so that its owner would feel comfortable regardless of the ambient temperature. Modern materials of the membrane type make your clothes exactly the one you dreamed of.

Fans of winter sports and outdoor activities often wear clothes made of synthetic fabrics, designed to keep warm. These fabrics are usually covered with a layer of laminate with a multitude of microscopic pores that circulate air and water vapor. You might think that the moisture and cold air outside will also penetrate through these holes, but this is not the case. Due to the fact that these pores are large enough for water molecules vapor, but at the same time small compared to water molecules, such fabrics have water and windproof properties.

## C. FIVE REASONS WHY YOU SHOULD HAVE WARDROBE CLOTHES:

1. **Functionality:** elastic woven material is designed to be worn in any conditions and meets the highest quality standards and all the requirements that can only be imposed on modern clothes.
2. **Comfortable fit:** tight or, on the contrary, baggy, in a word, poorly fitting clothes are a thing of the past. Do you go in for sports of the highest achievements or just went for a country walk, stuff your movements, while maintaining its natural form.
3. **Unsurpassed comfort:** modern membrane-type tissue provides an optimal level of air circulation and full moisture removal - your body will remain dry even with intense physical exertion. The weather does not matter, the fabric will equally fully protect you from snow, rain and cold wind.
4. **Excellent appearance:** clothing made of fabric has a high degree of wear resistance, does not require particularly complex care, so it looks like new even after long wear, thereby justifying the cost of purchasing it.
5. **Extraordinary softness and comfort:** the material is soft and pleasant to the touch, light, does not rustle when moving, does not cause allergic reactions and irritation of the skin.

Fabrics for sports, and for active recreation, for winter and summer, spring and autumn.

## III. THE MAIN CHARACTERISTICS OF FABRICS USED IN THE CREATION OF SPORTSWEAR.

### A. Logic Micro 800

Microfibre with windproof properties. The teflon layer provides reliable protection against moisture and wind. The material perfectly "breathes", takes moisture out.

Water resistance 1000 mm

Composition - polyester

Weight - 100 g / sq. m



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## **B. Windtex**

Elastic and lightweight membrane material. Water - and windproof. Excellent "breathes." Stretched in two directions. Displays up to 15,000 g of water vapor in 1 square meter in 24 hours. Weight - 250 g / sq. m

## **C. ISC-Tech**

Waterproof and windproof, breathable membrane material. Upperlayer - laminate, with standing the pressure of water column to 28 000 mm. The bottom layer is a membrane that allows up to 20,000 g of water vapor per square meter per day.

## **D. Dialight Soft Shell**

High-tech material of the membrane type. The top layer is a breathable, water-repellent elastic fabric-laminate, the middle layer is a hydrophobic membrane that permits water vapor and does not absorb moisture, the bottom layer is fleece, pleasant to the touch and having thermal insulation properties. The material externally withstands a water column pressure of up to 10,000 mm, passing up to 10,000 g of water vapor per square meter per day from the inside. Elasticity reaches 200%, that is, the material can be stretched twice in all directions.

## **E. Sensitive**

High-tech material based on Meryl nylon microfiber with elastane additives. Stretched in all directions.

Composition - Nylon / Lycra

Weight - 120-240 g / sq. m

## **F. Sensitive 3L Cubic**

This material combines the properties of SENSITIVE and 3L CUBIC fabrics. Due to the three-dimensional structure of the fabric, it does not stick to the body. The membrane layer provides waterproof outside and the transmission of water vapor from the inside.

Composition - top layer: 72% polyamide, 28% elastane / membrane: 100% polyurethane / inner layer: 100% polyester

Water resistance 10 000 mm of water column

Weight -240 g / sq. m

## **G. Superroubaix**

Lightweight, elastic material. Stretches in two directions and does not constrain movements. The fleecy surface adjacent to the body is pleasant to the touch and does not cause skin irritation. Perfectly passes air and water vapor. Weight -150 g / sq. m

## **H. Thermoroubaix**

Dense elastic material. Stretches in two directions and does not constrain movements. The fleecy surface adjacent to the body is pleasant to the touch and does not cause skin irritation. Perfectly passes air and water vapor. Possesses high wear resistance and retains the appearance and properties after repeated washes.

Weight -230 g / sq. m

## **I. Knitting structure**

Knitting is done by a set of connected loops from a series of yarn in warp or weft direction. Therefore, there are two main types of knitted fabric: weft knitted fabric and warp knitted fabric. In a weft knitted fabric, a horizontal row of loops are made using one thread that runs in the horizontal direction. While in a warp knitted fabric, each loop in the horizontal direction is made from different threads. Different types of machines, structures, stitch types, yarns and needle sizes may be used to create knitted fabrics with different properties and applications. Knitting is known for its forming technology and the greater performances to knit mesh and spacer fabric. The features of forming technology are higher production efficiency, various patterns and flexible structures. It just needs one step to realize the process from fibers or yarns to fabrics. And the materials and structures have many choices to meet different requirements in application[5].

Knitting meshes include weft-knitted mesh and warp-knitted mesh. Table 1 shows some structures of knitted meshes. Fabrics with meshes often have great breathability, permeability and moisture conductivity. And the sizes of

meshes are flexible and depend on the requirements. Spacer fabric has a three-dimensional structure and can be knitted on both weft knitting machine and warp knitting machine. Spacer fabric often has certain thickness. The thickness is changeable and relies on the applications, which gives the fabric greater breathability and elastic resilience. Fig. 3 is a weft knitted spacer fabric and Fig. 4 is a warp-knitted spacer fabric.

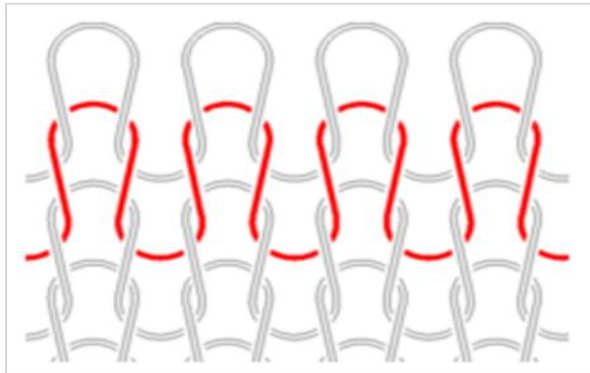
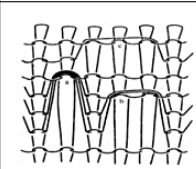
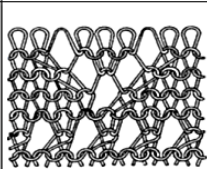
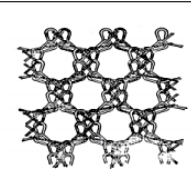
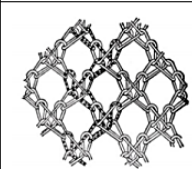
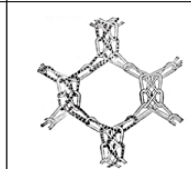
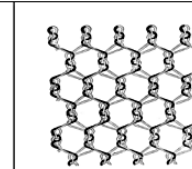


Fig. 1. Basic pattern of weft knitting



Fig. 2. Basic pattern of warp knitting

Table 1 Some structures of the knitted meshes

Weft-knitted meshes		Warp-knitted meshes			
Tuck stitch	Dummy stitch	Elliptic mesh	Diamond mesh	Hexagonal mesh	
					

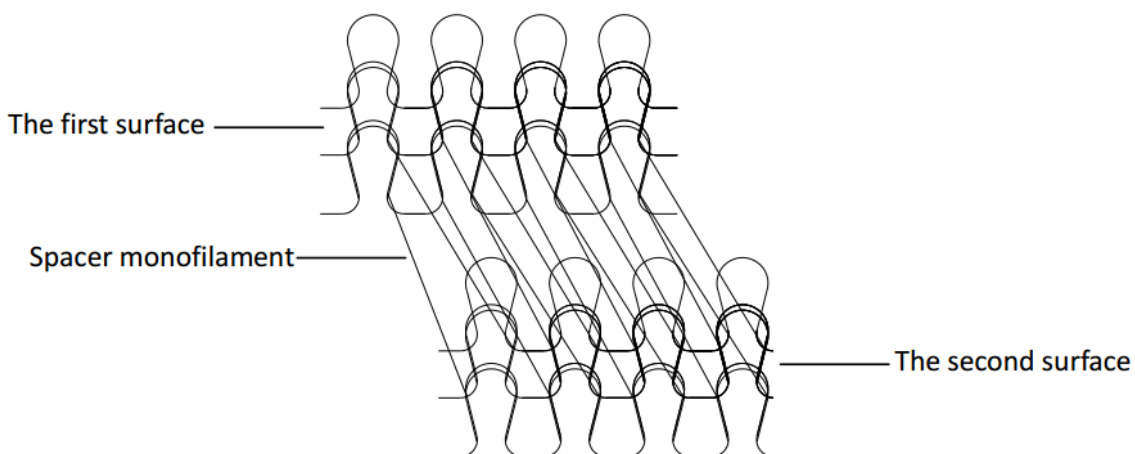


Fig. 3. Weft-knitted spacer fabric

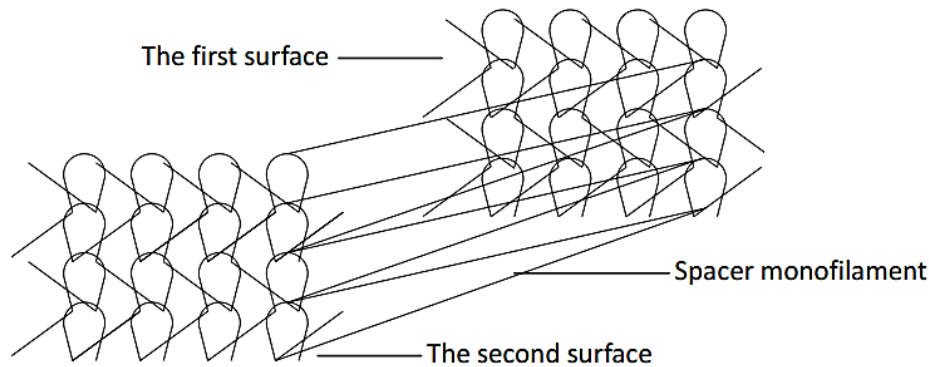


Fig. 4. Warp-knitted spacer fabric [5].

Elastic dublerin is also called knitwear. This is a cushioning material for sportswear materials: Elastic dublerin perfectly stretches in different directions, is indispensable in the manufacture of knitted sportswear, as it perfectly retains the shape of products when worn and after many washes.

RA - polyamide glue, perfectly tolerates dry cleaning, loses its adhesive properties after washing.

PET - polyethylene adhesive, perfectly tolerates any washing, loses its adhesive properties after dry cleaning.

PES - polyester adhesive, tolerates washing up to 40 degrees, only light dry cleaning

**The main characteristic of elastic sportswear strip**

Brand and manufacturer	Vendor code	Densityg / m	The composition of the base (fiber)	Glue	Temperature ° C	Pressure kg / cm	Time, sec.
DANELLI (China)	D1LP48	48	100% PES	PA	130-140	2,5-3	12-2
	D3LP25	25					
	D2LP35	35					
	D3LP55	D3LP55					
FLEX (Spain)	3038	62				3-5	10-12

**IV. CONCLUSIONS**

Modern peoples are paying more attention to sports activity. The use of sports fabric is increasing day by day in various sports and leisure activities. The consumers seem to be prepared to spend considerable amounts of money on sportswear and other functional fabrics. During designing the sportswear fabrics, the aspects which are considered: protection/safety functions to protect wearers from adverse weather, comfort functions which gives wear comfort (thermal, sensorial and body movement comfort), exercise function to enhance performance of athlete, and aesthetic appeal and high fashion ability. The required functions of sportswear fabrics differ in different situations such as type of sports, environmental conditions and level of activity etc. Sportswear developed by using special type of polymer, type of fibrous material, modifying the fibre/yarn/fabric structure, lamination, finishing technology and manufacturing technology etc. The introduction of high functionality and comfort in the sportswear fabrics provide unlimited scope for sportswear fabrics.

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