International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

Analysis of Requirements for Threads and Fabrics for the Manufacture of Compression Sports Products

N. B. Maqsudov[1], R. Ergasheva[2]

[1]Doctoral Student, Tashkent Institute of Textile and Light Industry Uzbekistan, Namangan Region

[2]Assistant, Namangan Institute of Engineering and Technology Uzbekistan, Namangan Region

Abstract: ***Compression knitted fabrics can differ from each other in the type of polyurethane fibers used with different characteristics of properties, their percentage, structure of elastomeric yarns, methods of fabric production, it's weaving and other structural parameters i.e. have a rather complicated internal organization, which determines the differences between their properties and the properties of traditional knitwear. The clothes from them, including sports, densely fit a figure, providing thus sufficient freedom of movement and, simultaneously, supporting a necessary muscular tone that is especially important for sportsmen at achievement of good results. In article the analysis compression knitted fabrics for playing sports is carried out.***

Keywords: sportswear, active sport, heat protection, elastic fibers and threads, heat transfer

1. Introduction

Today, the sportswear market, as an important component of the global textile industry, is actively growing every year. The development of the textile industry, the emergence of new textile fibers and innovative technologies in the production of knitted materials contributes to the active development of the sportswear market. Over the past 20 years there has been a huge growth in the global market for sportswear - by 7.5% and amounted to 244 billion dollars. Today, the largest segments of the global sportswear market are occupied by the following countries: the United States occupies 35% of the market, China 10%, Japan 7%, Brazil 5%, Germany, Great Britain and France 4% each, Russia and Italy 3% each, Spain 2 %, and the remaining 23% of the aggregate falls on all other countries [1].

2. Requirements for materials for the manufacture of sports compression clothing

For the manufacture of sports compression clothing used modern materials that have a high tensile properties with low operating loads, high elasticity and moisture resistance. When wearing such clothes, the heart rate decreases and blood flow to the muscles increases. This significantly increases the endurance of the athlete and leads to improved results. As a result of the snug fit of the kit to the athlete's body, there is an active release of lactic acid from the loaded muscles. As a result, the procedure of recovery of the body after exercise is reduced several times. In addition, compression prevents muscle tension during exercise. Thus, the use of compression clothing is a good prevention of sports injuries.

Among the indicators of elastic properties of tensile textile materials most important for designing clothes are as follows:

1) Extensibility, defined as a relative change in length samples under the action of a given load. Dependence "effort-stretching" is nonlinear, so measurements are carried out for different loads, and the most complete data obtained on the basis of the analysis of the schedule the dependencies of these quantities obtained by automated measuring complexes Insertions, Kawabata-FB1 [2,3].
2) Elasticity equal to the ratio of the shares of elastic and total strain expressed as a percentage. With fast amplitude movements during the occupation of active sports material sizes must be restored at the same speed to maintain contact with body surface. Therefore, for sportswear materials important is the value of dynamic elasticity (DER), numerically equal the ratio of the areas under the unloading and loading curves of the material,expressed as a percentage [4].
3) Residual deformation, which determines the relative increase in the size of the material after removal of the load.

As well as elasticity, it has a complex dependence on the magnitude and method of loading. Most informative for solving design problems will be residual deformation under operational loads of the material . For tight clothing, the shaping of which occurs due to the elastic tensile properties of the material, important is the requirement to preserve the size and performance of properties throughout the period operation. Therefore, in scientific research the index of elastic-elastic and plastic deformation of materials is also determined [5]. Increased stretch ability with a high degree of elasticity, i.e. a significant proportion (more than 95%) of rapidly reversible deformation, creating a complex of valuable properties characteristic of highly elastic materials. Clothing from them, including sportswear, tightly fits the figure, while providing sufficient freedom of movement and, at the same time, maintaining the necessary muscle tone, which is especially important for athletes when achieving high results. Materials intended for sports compression clothing, perform their functions in the range of stretching from 20 to 70%. Therefore, the tensile properties of such materials are investigated in the strain range up to 100%.

With a relative deformation of 100%, the tensile force of sportswear materials is 140-210 N / cm [6].

Stretch ability of the compression material can occur due to the stretching of fibers consisting of elastic chains of molecules of polymeric materials, for example, elastane or latex; thermally or chemically textured textured fiber; "Springy" looped structure (weave) of the material, easily changing under the action of an external load. It is known that knit materials, which include elastomeric fibers, have the best ratio of properties of elasticity and dimensional stability [7]. Studies of knitted fabrics, differing in the ratio of lycra in the composition, showed that the stretch ability of the material can occur due to the structure and properties of elastane fibers, parameters of the looped structure, weave and methods of knitwear production [8]. The amount of elastane depends on the purpose of the sports product. In casual clothes use materials containing 2 to 5% lycra. This content is enough to create the necessary properties of drape and fit the product. In the composition of materials for compression clothing (foundation garments) the content of elasticfibers can reach 45% [9]. Materials with a lycra content of up to 15–40% are used for clothing for active sports [10], providing elastic deformations in excess of 100%.

The elasticity of the web can be achieved by using elastomeric yarns (rubber, latex or polyurethane), yarns or yarns that have elastic properties

3. Threads and materials for the manufacture of compression products

The most characteristic feature of compression knitwear is its elastic mechanical properties. They make it an effective membrane stretching element acting on a curved part of the human body. Elastic fibers and filaments exhibit good tensile properties and elastic recovery, are used for the manufacture of elastic materials. Cloths used in the manufacture of compression materials, most often in their structure contain polyurethane filaments. The embedding of these threads gives the materials a complex of valuable properties, which, first of all, include increased tensile properties with low operating loads and a high degree of elasticity. New types of elastic fabrics can be divided into two groups: the Tactel® group, used in materials for sports products, and the Lycra® group, which has a wide range of uses [11].

Special polyamide Tactel® fiber is intended for the manufacture of sportswear, subjected to a variety of loads. Tactel® yarns are made of durable, ultrathin fabrics and knitted fabrics used in top and sportswear for skiers and climbers. They give sportswear the following properties: strength, durability, protection from wind and moisture, the ability to divert body sweat to the outer surface of clothing, quick drying, a variety of aesthetic effects, light weight, easy care. The combination of Tactel® with Lycra® gives softness, comfort, ease of care for clothes, long-term preservation of shape, comfortable fit, freedom of movement, good appearance.

Very often Tactel technology is used in compression knitwear. It consists in the fact that fibers with a large diameter are in direct contact with the skin, while fibers of a smaller diameter are located on the outer surface, the effect of biomimetic. But at the same time, the density of the loop from the wrong side is higher, which leads to an increase in the area between the yarn on the inside and the lower density of the structure on the face, imitating the taper of the aqueducts on the trees. The loops on the back side are formed by two threads, connected together on each other needle on the weft of a knitting machine, which facilitates the transport of fluid from the back to the face, creating a process similar to the “grip-tension” mechanism in plants. These materials have significantly better water absorption [12].

Biomimetic knitwear with a branched structure was developed using two guide rods with polyester and nylon [13]. In the structure of such knitwear a smaller number of longer loops on the inside than on the outside, which creates a branching tree structure, pumps up the moisture from the inside to the outside and facilitates water transport properties. The area of evaporation increases significantly (about 8-10 times depending on the characteristics of the fabric), so the product remains dry, which is important when in a warm and humid climate.

Materials with a biomimetic effect maintain a constant body temperature, absorbing excess heat and moisture from the body, while maintaining the body's comfortable sensations [14]. Inotek® fiber is an innovative biomimetic. When the fiber absorbs moisture, it shrinks to a fine structure, resulting in microscopic open air pockets, which increase breathability. This answer is reversible and the fibers can return to their original size in the dry state of the body [15].

In chemical terminology, Lycra® is classified as segmented polyurethane [16]. Available in various ranges from 8 to 2550 dtex. Lycra fibers have 5 fold extensibility without permanent deformation, they are chemically neutral and resistant to chemicals. Due to the higher strength, polyurethane threads are produced thinner in the range of linear densities of 2.2-125 tex, which allows to obtain the effect of compression in the widest limits, as well as significantly expand the scope of their application. A spandex-type thread can be used as braided or without braid, which is also an advantage, since the process of braiding threads complicates the technology [17]. It should be noted that when knitting on machines, a forced feed of this thread to the loop-forming organs is used, which allows you to create the necessary tension on the thread and give elasticity to the product. Products in which spandex-type threads are used are very resistant to washing and aging [18].

According to the method of manufacture, all elastomeric threads can be [19] molded, cut, complex. All processing elastomeric yarns are of the form: homogeneous monofilaments; reinforced heterogeneous filaments obtained by wrapping an elastomeric core with filaments or fibers of different nature [20].

The percentage investment of elastinan fibers is determined by the type and purpose of the products, ensuring their

optimum performance properties and aesthetic characteristics. So 2% of the Lycra thread is enough to increase the durability, fit ability and dimensional stability of products for everyday use. In swimwear, underwear and clothing for outdoor activities, their specific content is from 14 to 40% (by weight). In many types of sportswear (cycling t-shirts and shorts, skater suit) where a high degree of fitting is required while maintaining the necessary ergonomic properties, as well as ensuring sufficient compression forces on the athlete's body, Lycra content ranges from 15 to 20%. The embedding of polyurethane fibers in knitted fabrics, due to their high elasticity and elasticity, provides sportswear with significantly higher comfort and fulfillment of the above requirements, which has a direct impact on the consumption of elastomeric yarns and production growth in this sector [21,22].

4. Conclusion

Compression knitted fabrics can differ from each other in the type of polyurethane fibers used with different characteristics of properties, their percentage, structure of elastomeric yarns, methods of fabric production, its weaving and other structural parameters, i.e. have a rather complicated internal organization, which determines the differences between their properties and the properties of traditional knitwear. These canvases have a small mass, pleasant appearance. Embedding them in the composition of natural and chemical fibers affects the change in the structural, physic mechanical and operational properties of the latter, which, in turn, necessitates the development of methods for designing clothes made from such fabrics compared to traditional knitwear. Clothing from them, including sportswear, tightly fits the figure, while providing sufficient freedom of movement and, at the same time, maintaining the necessary muscle tone, which is especially important for athletes when achieving high results.

References

[1] I Rumyantsev“The history of sports knitwear” TEXTILE SPACE august 2017 No 4 pp. 13-20.
[2] http://www.instron.us/en-us/products/testing-systemsSenthilkumar, M. Dynamics of Elastic fabrics for sportswear / M.
[3] Senthilkumar, N. Anbuman // Journal of industrial textiles, 2011, 41(1), pp. 13-24.
[4] Ashayeri, E. An investigation into pressure delivery by sport compression garments and their physiological comfort properties // Thesis ofMaster of Technology Dissertation. – RMIT University, 2012. – 166 p.
[5] Buzov B.A. Materials science in the manufacture of products of light industry. Clothing industry: textbook for universities / B.A. Buzov, L D. Alymenkova. –M .: Academy, 2004. pp-448.
[6] Sinclair, R. Textiles and Fashion. Materials, Design and Technology //Woodhead Publishing, 2014, – 894 p.
[7] Kasimov AB, Mirusmanov B.F., Nigmatova FU Investigation of the physicomechanical properties of cotton and nitron yarn for the production of knitwear // Composite materials, 2011, No. 2, pp. 28-30.
[8] Venkatraman, P. Application of compression sportswear / P.Venkatraman, D. Tyler // S. Hayes, P. Venkatramann, (eds.) Materials and technology for sportswear and performance apparel. – CRC Press, 2015, pp. 171-204.
[9] Senthilkumar, M. Dynamics of Elastic fabrics for sportswear / M.Senthilkumar, N. Anbuman // Journal of industrial textiles, 2011, 41(1), pp. 13-24.
[10] Sinclair , R. Textiles and Fashion. Materials, Design and Technology // Woodhead Publishing, 2014, – 894 p.
[11] Starkova G.P. Methodological foundations of designing sportswear from highly elastic materials: Doctor of Technical Sciences: 05.19.04 / StarkovaPetrovna: Vladivostok State University of Economics and Service. - Vladivostok, 2004, pp-308.
[12] Active Sportswear Fabrics, High Functions and Comfort, JTN, The Int. Text. Magazine, Jan. 2001, No. 554, pp 34-76..
[13] Chen Q & Fan J, *Text Res J*, 82 (11) (2012) 1131.
[14] Smart Sportswear signs with outlast, *Apparel Magazine*, 48(11) (2007) 44
[15] http://www.fibre2fashion.com/news/textile-news/newsdetails. aspx? news_id120745 (accessed on 20.06.2013)
[16] Brown, R.P. Polymers in Sport and Leisure; Rapra Review Reports 135; Rapra Technology Ltd.: Shawbury, UK, 2001; Volume 12.
[17] Nabiyeva I.A. Report on research work on the topic: IOT-2014-2-10 Development and implementation of an integrated technology for the production of knitted products from a mixture of natural and synthetic fibers", Tashkent 2015.
[18] Filatov V.N. Elastic textile shells: Monogr. -M.: Legprombytizdat, 1987. -248 p.
[19] Baranova E.V. Investigation of the structure of chrome tanned leathers and the development of a method for improving dimensional stability: Dis. ...Cand. those. sciences. M .: MGUS, 2007 .- 154 p.
[20] [Hu, J.; Lu, J. Recent developments in elastic fibers and yarns for sportswear. In Textiles for Sportswear; Elsevier: New York, NY, USA, 2015; pp. 53–76.].
[21] GOST R 51219-98. Medical elastic fixation and compression products. General technical requirements. Test methods. M .: Publishing house of standards, 1999.-p.18.
[22] Gorchakova V.M. Physical and mechanical properties of nonwoven materials. - M .: MSTU, 2003.