Interrelationship Of Thread Deformation And Structure

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ABSTRACT

In this article, the relationship between yarn deformation and the structure of textile and light industrial products was studied. The theoretical and experimental foundations of the mechanics of the stretching deformation of textile threads, and the study of test conditions taking into account the linear density of the semi-finished product are covered. The purpose of these practical tests is to determine the zones of elastic and plastic deformations of the threads and the numerical values of the change in the deformation of the thread at the same moment when the load is applied and removed.

Keywords: Semi-periodic deformation, one-periodic deformation, multi-periodic deformation, experimental, structural structure, density, quality.

Introduction

The conclusions of the fundamental research conducted in the development of textile science and technology are based on the results of experimental research [1], because in it new laws are determined and factors affecting technological processes are found. For example, in the study of the structure and properties of threads, the laws of thread mechanics play a major role. In particular, effective use of the latest advances in measuring techniques and personal computers has created the basis for the development of thread mechanics.

The properties of the fibres that make up the thread, technological parameters and environment in production determine the performance of the final product. The structural structure of the thread is defined as the density of the fibres that make up it and the migration of the fibres [2].

The structure of the thread is also evaluated by the difference in the number and quality of fibre distribution in the thread [3].

Therefore, many researchers pay attention to the given criterion and take into account the influence of fibres on the quality of yarn. It should be noted that without studying the structure (structural structure) of the thread, it is difficult to give a qualitative conclusion regarding its mechanical, especially deformational properties. When determining the structure of the thread in different ways, that is, cross-section micrographs are studied or physical-mechanical properties of the thread are evaluated in relation to the quantities obtained by experimental methods.

The fibres that make up the thread can be made of filament and staple fibres. A staple can be thought of as having a finite length and a filament as having a continuous length. Yarns obtained from fibres of limited length have a complex structure, which changes under the influence of spinning parameters and methods. The structure of yarn and its influence on yarn properties have been studied since 1950. Indian researcher A. Basu summarized. As a conclusion of the scientific results, the scientist analyzed the dependence of the tensile strength of the semi-finished product on the length of the fibre, the density of the fibres and the length of the thread.

Materials and methods

In theoretical studies, it is appropriate to divide into two groups as staple fibres or filament fibres of the same length, according to the conclusions of the previous scientific sources, and production conditions. It is appropriate to take into account that filament length fibres are used in a small amount in our country and cotton fibre is the main raw material. The fact that staple cotton fibres have different lengths and differences in thickness, even if they are insignificant, is the main reason for their movement concerning each other in the thread, that is, their migration. We know that the twists of the semi-finished products are different, which significantly affects the mutual movement of the fibres. As a result of the interaction of long fibres, they have a large outer surface. At relatively small lengths, the opposite is more likely. We can determine the differences when considering the conditions of thread formation as annular and pneumomechanical. In the ring method, the two ends create tension under the influence of certain mechanisms and tools, and the parallel arrangement of the fibres is higher than in the pneumomechanical method. In the second method, due to the high-speed rotational movement, the fibrous mass approaches each other due to its weight and begins to form a thread by combining with the previous tufts. In this case, the fibres stick together due to their own mass, and as a result of pulling from one end, they gradually become a thread. Since the fibres are pulled in only one direction, they are unevenly placed on the surface of the yarn relative to the ring. In many studies by researchers, the higher the average length of the fibre, the higher the mechanical parameters of the yarn made from it, resistance to stretching and frictional forces.

In addition to the number of twists, the properties of the fibre have a wide influence on the studied property, and it was found in the scientific sources studied by the team of authors that the results of the previous research showed that tests were carried out in this direction. According to him, it was determined theoretically that fibre maturity, colour, and elasticity affect the mechanical properties of the yarn and the migration of fibres. As the Micronaire (MIC) index of cotton fibre increases, its elasticity or flexibility partially decreases and its cantilever increases. According to the definition given by the Egyptian Cotton Fibre Research Center, the MIC index is equal to the milligram weight of several fibres placed on one inch of surface. This scientific centre concludes that the name of the cotton plant is given by the name of the region of Giza (in Arabic it gives the expression "g'oza" (cotton)), where this raw material was used for the first time. As the fibre matures, the walls of the flour become fuller, and the micro-bubbles on the outer surface decrease, that is, the upper part becomes smoother. As the twist of yarns made of smooth surface fibres is reduced, it is easier to move the fibres in the yarn structure. The reason for this can be the smoothness of the surfaces on which adhesion occurs. A fibre with a higher micron (5.0) increases the cantilever and consequently increases the number of visible, i.e. hairs, protruding from the yarn core.

According to the conclusion of foreign scientific research, yarns obtained from fibres with low MIC showed higher resistance to breaking in stretching compared to fully matured ones. To determine the length of cotton fibre, the Republic of Uzbekistan has adopted its own DSt 633:2021 "Cotton fibre. "Methods for determining the length" are included in the appendix of the state standard of the Republic of Uzbekistan. The part of the above state standard for measuring fibre length in a fibrograph is harmonized with the international standard ASTM D1447-07 Standard Test Method for Length and Length Uniformity of Cotton Fibres by Photoelectric Measurement.

The procedure for determining the length of cotton fibres grown in our republic in the SITC (NVI) system is carried out according to OZ DSt 3295

Cotton fibre measuring conditions are defined using the following standards.

Before testing, samples for testing are stored in climatic conditions according to GOST ISO 139 for at least 1 day, and testing is carried out under these conditions.

If the capacity of the conditioning device is according to GOST 10681, it is allowed to condition samples and test fibres in climatic conditions.

Own DSt 632:2021 "Cotton fibre. "Methods for determining the amount of defects and impurities" approved following the state standards of the Republic of Uzbekistan. The requirements of the above state standard OZ DSt 632:2021 This state standard for determining the mass fraction of defects and impurities in the Shirley cotton analyzer ASTM D2812-07 Standard Test Method for №on-Lint Content of Cotton) and SITC systems for determining the amount of SITC neps requirements: ASTM D5866-12 Standard Test Method for Neps in Cotton Fibres is harmonized with international standards:

GOST 24104-2001-Vesi laboratory. Obshchiye tehnicheskiye trebovaniya

Own DSt 581:2002 Cotton processing. Terms and definitions

Own DSt 604:2016 Cotton fibre. Technical conditions

Own DSt 629:2021 Cotton fibre. Methods of determining colour and appearance

Own DSt 3295:2018 Cotton fibre. Standard test methods for measuring physico-mechanical properties of cotton fibre using classifiers.

When determining the length by the classifier method, it is allowed not to condition the cotton fibre sample, as well as to conduct tests without maintaining climatic conditions [5].

Preparation of samples for testing from the cotton fibre is selected according to OZ DSt 614.

To determine the migration of fibres, certain parts of them are dyed in a different colour, and then a thread is made. It estimates their location by taking photocopies of a random portion on a high-precision scanning device or by counting them manually.

Professor GNKukin studied all the mechanical properties of textile materials and created a classification for the method of obtaining mechanical indicators [6].

Based on this classification, the indicators obtained in each deformation are divided into three periodic classes:

1. Indicators obtained in a half-term class;
2. Indicators obtained in one period class;
3. Indicators obtained in a multi-period class.

In the semi-cyclic class, the material stretches and breaks in a short time under the influence of the load.

In the one-cycle class, the material is subjected to a load for a long time and is in the process of relaxation. As a result, the ability of the material to retain its shape is studied.

In the multi-cycle class, their long-term durability is studied as a result of the repeated one-cycle process of the material [7].

A one-period class consists of three processes. Material: exposure to load, release from load, rest.

The practice of evaluating the above-mentioned properties of yarn by studying tensile deformation is widely used. In this case, one-cycle deformations with 25% of the load corresponding to the breaking strength indicator of the semi-product, and multi-cycle deformations with a load equal to 10% are determined. The test duration (3-25 seconds) is taken as the main indicator for half-deformation.

Conclusions

It was based on the results of experimental research, because new laws were determined in it, and factors affecting technological processes were found. It was found that the laws of thread mechanics play an important role in the study of thread structure and properties. It was found that the fibres that make up the thread are composed of filament and staple fibres, and the staple length can be considered as finite and the filament as a continuous length. Yarns obtained from fibres of limited length have a complex structure, and it was found that they change under the influence of spinning parameters and methods, which have been studied by several scientists.

It was found that although the linear density of compact and ordinary yarns at the initial moments of yarn deformations is the same, their resistance to stretching is different.

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