ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 9 , September 2021

The Investigation of the endurance of natural silk threads to multiple tensile deformations

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ABSTRACT:The article investigates the resistance of natural silk threads with low curl, prepared for weaving, to multiple tensile deformations.It has been established that the greater the number of threads and the greater the number of threads when twisting the thread, the higher the resistance of the thread to deformations of repeated tension.

KEYWORDS: crepe fabric, technology, warping of threads, threads mechanics, threadsdeformation, deformation resistance, natural silk.

I.INTRODUCTION

At present, the issue of expanding the range of products made of natural silk and expanding the range of equipment, especially to increase efficiency and energy efficiency, improve and strengthen the feed base of the industry, cultivation and processing of quality cocoons, its primary processing, raw silk and silk yarn One of the urgent tasks today is to build new facilities and modernize existing ones, organize deep processing of cocoons, increase productivity and improve the quality of finished silk products, develop the most popular types, increase exports of finished silk products [1].

Deep processing of cocoon raw materials, production of finished silk products, creation and development of new and popular types of fabrics, modernization of technological equipment and improvement of technology remains one of the most pressing and important issues today. In turn, the efficiency of the loom is mainly determined by the quality of preparation of yarns for weaving. It depends on the quality of raw materials, packaging parameters [2, 3, 4] and optimization of the technological process [5, 6], especially in the processing of natural silk [7, 8].

In this regard, the mechanical properties of natural silk yarns prepared for weaving are of great importance.

II. LITERATURE SURVEY

In the manufacture of products from textile yarns and the use of finished products, they undergo multi-cycle elongation deformation. When weaving fabrics, tanda yarns undergo several thousand cycles of elongation deformation on a loom. In turn, the finished products made of fabric undergo various periodic deformations during use. As a result, complex changes occur in the structure of the threads. These feature changes take place in three stages. In the first stage, the structure of the yarns improves after several cycles of elongation deformation. Scattered loose fibres bind together in the yarn, the yarn stretches, the strength increases. The improved structure of the yarn withstands periodic deformation for a long time. This condition of the rope corresponds to the second stage. In the third stage, the structure of the rope is weakened. This is because some of the damaged fibres break and the yarn becomes tired after multiple cycles of deformation [9].

The amount of residual periodic deformation increases. As a result, the yarn stretches, breaking after a certain period of elongation deformation. The first researchers in yarn mechanics were usually scientists such as Ya. Bernoulli, L. Eyler, J. Lagrange, Sen-Venan, G. Kirxgof, A. Klebsh of the seventeenth and nineteenth centuries, who studied the mechanics of thin rods and virgin yarns based on general equations of elasticity theory. The bending strength of yarns in the textile process was studied in the late twentieth century by scientists such as Yu.V. Yakubovskiy, P.V. Shcherbakov, G.N. Fendoseev, E.D. Efrimov and V.S. Jivov [10].

At this time, N.I. Kudryashova, B.A. Kudryashov and other scientists show that it is necessary to take into account that the elastic properties of textile yarns are nonlinear, and this issue was discussed by I.I. Migushov found his most complete solution in his works. M.T. Orozboev, B.M. Mardonov and M. Research on yarn mechanics under the guidance of Ergashovs made a significant contribution to the development of this field [11].

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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It is known that in yarn mechanics two different yarns are used. 1- real yarn or yarn object, 2 - theoretical yarn or yarn model. A mechanical thread is a system of materials that have certain geometric dimensions and take the shape of an arbitrary geometric line under the action of an applied force. A real yarn is a physical body whose cross-sections are several times smaller than its length and can resist specific bending and twisting. Examples include textile yarns and fibres, wires, cables and ropes, and thin and flexible parts in machine parts. An ideal yarn is a material line that has no resistance to bending and twisting [12].
Maqsood M., Nawab Ya., Shaker Kh. have studied the effect of the type of weaving weave and the density of yarns in the fabric on the mechanical and operational properties of the fabric [13].
In the work of Yan Z., Yuyue CH., Hong L., the process of obtaining silk yarn consisting of two individual yarns twisted in different directions was studied, which is treated in a solution of calcium nitrate at 95 °C to form a corrugated 3-D structure [14].
X.T. Bobojonov studied semi-circular, single-cycle and multi-cycle deformations of yarns of different structures [15].
In the work of O.A. Axunbabaev, G.N. Valievs in the study of the deformation of tanda yarns on a loom, an analytical relationship of the increase in tension of tanda yarns as a result of the formation of “homuza” and the bonding of the back yarn to the tissue edge was obtained [16].
In U.B. Rajapova's work, the single-cycle elongation deformation of yarns spun from a mixture of modified nitron and cotton was studied, and the results obtained were found to be similar to those of unmodified yarns [17].
In B.B. Donyorov's dissertation, the qualitative indicators of multi-period deformation and abrasion resistance of chipped and modified yarns are studied [18].

III. METHODOLOGY

Crepe fabrics made of natural silk include crepe de chine, crepe georgette, crepe waffle, crepe chiffon, crepe satin, feyeshin, crepe perizens. The use of highly baked yarns in the left and right directions as body or back yarns results in the formation of granules on the surface of the fabric after the finishing process. It is known that in crepe textures crepe yarns in right and left twists are applied at the same time. Typically, the fabric is woven in pairs in the direction of the twist, 2 threads in the right twist, 2 threads in the left twist [9].
Raw silk yarns are used as crepe in crepe de chine fabrics. In recent years, new types of crepe fabric and their production technologies have been created, consisting of low-twisted baked yarns as tanda yarns to increase the efficiency of the selection process, improve the physical and mechanical properties of tan yarns, create opportunities to use tanda monitors on the loom [20].
In this regard, it is of great importance to study the resistance of low-twisted natural silk yarns prepared for weaving to multi-period elongation deformation.

IV. EXPERIMENTAL RESULTS

It is known that the multi-period deformation forces acting on materials are much less than the durability of the material in terms of quantity. But as a result of these forces being exposed many times over a long period of time, complex changes in the structure of the materials are formed and eroded. A pulsator laboratory instrument of the brand PN-5 (Fig. 1) was used to determine the resistance of multi-cycle elongation deformation of natural silk yarns with low twists prepared for weaving [10].
In this tool, the multi-period elongation of the threads is done by the sinusoidal law. When using the PN-5 tool, the tested yarn was fastened between the clamps and a static load was hung on the lower part of the yarn, which weighed 25% of the strength of the yarn [9].
2.33 tex x 2 and 2.33 tex x 4 twists prepared for weaving, non-twisted and 100 - 600 twists/meter twisted 2.33 tex x 2 and 2.33 tex x 4 Experiments were performed 24 times on each sample on 5 pulsator laboratory equipment and the results given in Table 1 below were obtained. Figure 2 shows the dependence of the resistance of natural silk yarns to multi-cycle elongation deformation on the number of twists.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 9 , September 2021

Figure 1. The appearance of the PN-5 pulsator device

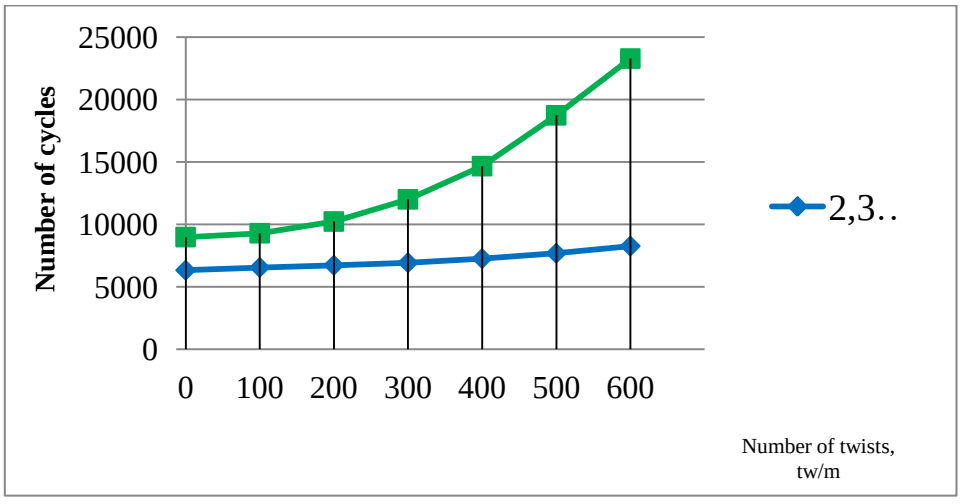

Figure 2. The dependence of the resistance of natural silk yarns to multi-cycle elongation deformation on the number of twists

Table 1. Multi-cycle elongation deformation resistance of natural silk yarns

№	Options (Samples)	Number of cycles, average	Mean square deviation	Deviation coefficient	Reliable error	
					Absolutely	Relative, %
Immature yarns						
1	2,33x2	6336	744	11,74	307	4,85
1	2,33x4	8991	1051	11,69	434	4,83
Two layers of hardened yarn						
1	(2,33x2)Z100	6559	769	11,72	317	4,84
2	(2,33x2)Z200	6737	802	11,9	331	4,91
3	(2,33x2)Z300	6940	745	10,73	308	4,43
4	(2,33x2)Z400	7270	746	10,26	308	4,24
5	(2,33x2)Z500	7693	599	7,78	247	3,21

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 8, Issue 9 , September 2021

6	(2,33x2)Z600	8270	636	7,69	262	3,17
Four layers of hardened filaments						
1	(2,33x4)Z100	9300	1083	11,65	447	4,81
2	(2,33x4)Z200	10237	906	8,85	3,74	3,65
3	(2,33x4)Z300	12014	919	7,65	379	3,16
4	(2,33x4)Z400	14672	1115	7,6	460	3,14
5	(2,33x4)Z500	18742	1417	7,56	585	3,12
6	(2,33x4)Z600	23285	2048	8,8	846	3,63

Analysis of the results obtained on the resistance of multi-cycle elongation deformation of low-twisted natural silk yarns prepared for weaving shows that when twisted yarns, their resistance to multi-cycle elongation deformation increases, and the higher the number of twists, the higher the resistance.Also, the higher the number of threads, the higher the resistance of the thread to multi-cycle elongation deformation, and the higher the number of twists, the faster the resistance of the thread.Four-layer yarns were found to have higher resistance to multi-cycle elongation than two-layer yarns.The obtained results can be applied in the enterprises of the silk industry.

V.CONCLUSION AND FUTURE WORK

1. The resistance of multi-cycle elongation deformation of low-twisted natural silk yarns prepared for weaving has been studied.
2. It was found that when twisted yarns, their resistance to long-term elongation deformation increases, with the greater the number of twists of the yarn, the higher the resistance.
3. The greater the number of threads, the higher the resistance of the thread to multi-cycle elongation deformation, and as the number of twists increases, the resistance of the thread increases rapidly.
4. The obtained results can be applied in the enterprises of the silk industry.

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ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

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