Technological Indicators of New Structure Two-Layer Knitted Fabrics Analyzed

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ABSTRACT

In the article technological capabilities of modern double bed flat knitting machines results of analyses of technological parameters double-layer knitted fabrics

Keywords: double-layer knitting, surface density, thickness, wolume density, technological parameteres

Changes in the structure of knitted fabrics, the composition of raw materials, rapporti and production methods will definitely affect its technological and quality indicators.

It is known from the scientific research conducted by a number of scientists that reducing the surface density index of knitted fabrics within certain limits leads to saving the consumption of raw materials and does not have a negative effect on the durability properties, because the absolute durability of knitted fabrics is high and does not exceed 20% breaking strength in the use of products. it is determined to face tensions.

Technological indicators of knitted fabric can be determined using three methods:[1-4].

1. Determination by standard (GOST, OST, TSh). This method is used when it is not required to determine the parameters of the knitted fabric by calculation, or when the technological indicators of the knitted fabric are significantly different from the actual indicators when calculated using existing formulas.

2. Experimental determination. This method is used in the process of carrying out scientific work on the development of new knitted fabrics.

3. Determination by calculation method. This method can be used to determine the main parameters of the tissue. This method is based on the sequence of calculation of technological indicators and the length of the ring thread L.

The structure of loops in knitted fabrics is characterized by the filling of the yarn used per unit area. In the production of knitted fabrics, the yarn used per unit area is less than that of textile fabrics. For this reason, the volume density indicator of knitted fabric is high (density of knitted fabric is 0.2-0.3 g/cm3, density of gauze is 1.1-1.9 g/cm3) [5]. Finally, one of the important criteria is the economic advantage of the knitwear production network.

The parameters of any knitted fabric are influenced by the characteristics of raw materials, yarn cutting, finishing method 6-7. Double-layer knitted fabric is composed of two same or two different single-layer fabrics, the performance of one fabric can be much better than the other fabric. This situation depends on the interaction of two monolayers. When one layer is attached to a second layer, it can change its initial parameters, and another, in turn, can change the parameters of the first layer. Therefore, the length and density of the loop yarn forming the layers of the double-layer knitted fabric cannot be determined by the formula for the single-layer fabric. In addition, these indicators depend on the type and method of attachment [8-9].

It is of great interest to study the production of two-layer knitted fabrics of a new structure, because it affects the performance of the fabric.

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It is recommended to determine the raw psho consumption for cross and flat knit fabrics by the following formula:

$M_S = l \cdot T / A \cdot B$ (1)

Here: Ms- surface density of knitted fabric;

l- A·B the length of the ring thread, corresponding to the surface of the ring (мм);

T- linear density of yarn (Teks).

The length of the loop yarn for each knitted fabric is directly related to the surface of the loop. For any two-layer knitted fabric, the layers interact with each other and they are at different levels, resulting in different descriptive interactions.

When the density of two layers of knitted fabric is the same, the knitted fabric can have different values of loop length l and, therefore, different consumption of raw materials per 1m2 fabric unit, or vice versa, when the value of knitting density is different, it can have a constant surface density value.

As the loop surface increases according to a near-parabolic law and tends to a certain limit with the increase of the loop length of the double-layer knitted fabric, the first component in the formula gradually decreases, while the second component first decreases and then increases.

Based on the results of scientific research, in order to expand the assortment, save raw material consumption and improve quality, 6 variants of two-layer knitted fabrics of a new structure were woven on a 14-class flat two-needle knitting machine manufactured by the Chinese company Long Xing LXA 252 SC. A polyacrylonitrile thread with a linear density of 30 tex x 2 was used as a raw material.

The method of obtaining knitted fabrics and the effect of fabric structure on the technological performance of knitting were studied.

A graphical record of the two-layer knitted fabric of the new structure produced is shown in Fig. 1.

The technological parameters of the two-layer knitted fabrics of the new structure were tested in a standard way in the "CentexUz" test laboratory at TTESI, the results are presented in Table 1.

Based on the results of the analysis, technological indicators such as ring pitch, ring row height, density in horizontal and vertical directions, and length of ring thread are determined.

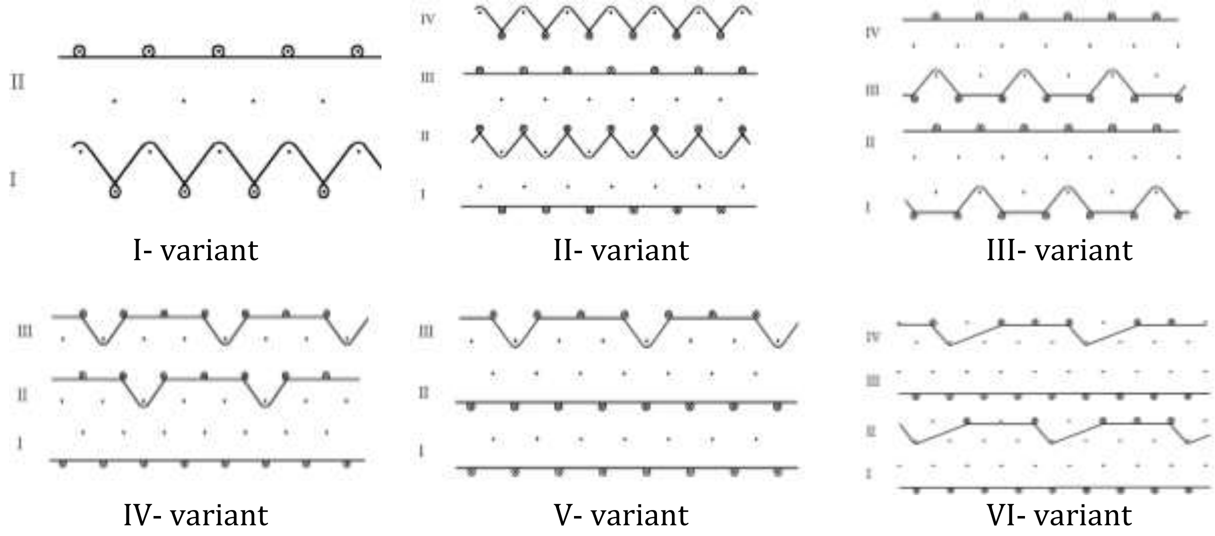

Figure 1. A graphic record of two-layer knitted fabrics in a new structure

Surface density depends on the type of thread used in the fabric, linear density, and also changes in the percentage of threads.

The loop yarn length of the front layer of the two-layer knitted fabric in the new structure was changed from 5.5 mm to 9.7 mm, and the loop yarn length of the back layer was changed from 4.6 mm to 8.3 mm. This is expressed by the fact that it consists of glad rings and press half rings, which have a uniform shape when weaving layers.

Among two-layer knitted fabrics, the first option was chosen as the base fabric (I-option, Fig. 1). The resulting knitted fabric consists of a front layer of glad and a press semi-ring, and is connected to the glad fabric of the back layer.

Table 1
Technological indicators of two-layer knitted fabrics of a new structure

Indicators		Options					
		I	II	III	IV	V	VI
Thread type and linear density, tex	Front layer	PAN 30 tex x 2, 100%					
	Back layer						
Ring step A, mm	Front layer	2	2	1,7	1,6	1,56	1,56
	Back layer	2	2	1,8	1,6	1,56	1,56
Ring row height B, mm	Front layer	1,1	1,4	1,4	1,25	1,1	1,4
	Back layer	1,1	1,0	1,4	1,0	1,1	1,48
The density of rings on the horizontal, $P_г$,	Front layer	25	25	29	31	32	32
	Back layer	25	25	28	31	32	32
Density of rings in vertical $P_в$,	Front layer	45	36	36	40	45	36
	Back layer	45	50	36	50	45	34
Loop thread length L, mm	Front layer	9,7	6,5/8,5	8,1	5,5	5,4	5,6
	Back layer	6,0	6,3/8,3	4,6	7,7	8,3	6,1
Surface density of knitted fabric Ms, g/m²		358,6	362,7	370,3	363,6	356,7	346,6
Thickness T, mm		1,5	1,8	1,6	1,77	1,92	1,5
Volumetric density of knitted fabric δ, mg/sm³		239	201,5	231,4	205,4	185,8	231,1
Absolute volumetric lightness Δδ, mg/sm³		-	37,5	7,6	33,6	53,2	7,9

Relative lightness θ, %	-	15,7	3,2	14	22,2	3,3

If the surface density of the base fabric (option I) was MS=358.6 g/m2, thickness T=1.5 mm, its volume density was 239.1 mg/cm3 (Table 1). Option II of the two-layer knitted fabric of the new structure, due to the alternating glad and press semi-rings in the front and back layers, the surface density of the knitted fabric is Ms=362.7 g/m2 and the thickness T=1.8 mm, and its volume density is 201.5 mg /cm3 was. The surface density of the III-variant knitted fabric is MS=370.3 g/m2, its thickness is T=1.6 mm, and its volume density is 231.4 mg/cm3. Since the front layer of the IV-variant two-layer knitted fabric consists of a cross between glad and press semi-rings, and the back layer consists of full glad rings, its surface density is MS=363.6 g/m2, and its thickness is T=1.7 mm. volume density was 205.4 mg/cm3. According to the structure of the V-variant two-layer knitted fabric, the front layer is made of glad and press semi-loops, and the back layer is made of full glad rings, so if the surface density is MS=356.7 g/m2, and the thickness is T=1.92 mm, its volume density was 185.8 mg/cm3. Variant VI, since the front layer of the two-layer knitted fabric is made up of full glade and press semi-ring, and the back layer is made of glade rings made by spinning one needle, the surface density is MS=346.6 g/m2, the thickness is T=1.5 mm and its volume density was 231.1 mg/cm3 (Fig. 2).

This formula mainly plays an important role in determining the volume density index of knitwear:

$$\delta = M_s / T \quad (2)$$

δ - volumetric density of knitted fabric, mg/cm^3;

M_s - surface density of knitted fabric, g/m^2;

T - thickness of knitted fabric, mm.

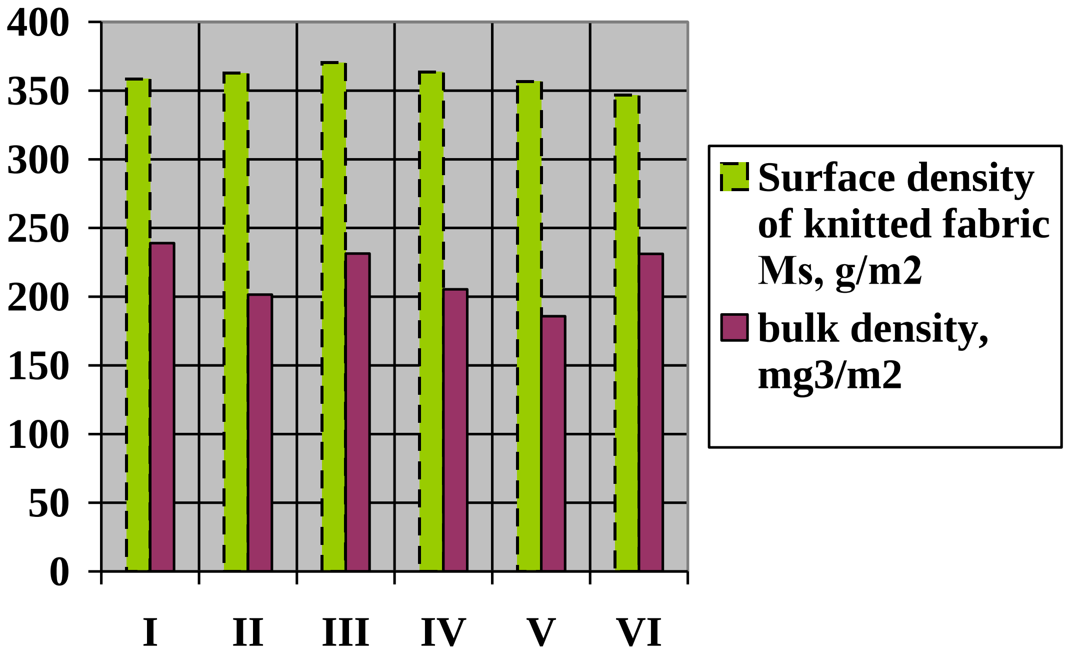

Figure 2. Histogram of changes in surface and volume densities of two-layer knitted fabrics in a new structure.

The volume densities of the two-layer knitted fabric samples of the new structure varied from 185.8 to 231.4 mg/cm3, and the highest volume density indicator was observed in the base fabric I-variant, which was 239 mg/cm3. In the remaining samples of two-layer knitted fabric, this indicator was low compared to the basic knitted fabric. The lowest volume density index structure was observed in the V-variant, the front layer of which is made of glad and press semi-ring prototyping, and the back layer is made of full glad rings, and it is 22.2% lighter than the base fabric and was 185.8 mg/cm3 (Table 1. Fig. 2). The decrease in volume density of this option is estimated by the arrangement of knitting needles in a rubber pattern and consisting of glad and press semi-rings when obtaining knitted fabric.

The volumetric and relative lightness indicators of the two-layer knitted fabrics of the new structure were compared to the I-option, and the volumetric and relative lightness indicators of the II option are determined by the following formulas:

$$\Delta\delta = \delta_I - \delta_{II} = 239 - 201{,}5 = 37{,}5\ mg/sm^3 \quad (3)$$

Here: Δδ - true volumetric lightness, mg/sm³;

δ_I - base tissue volume density, mg/sm³;

δ_{II} -bulk density of experimental knitted fabric, mg/sm³

Relative lightness is defined as follows:

$$\theta = (1 - \frac{\delta_{II}}{\delta_I}) \cdot 100\% = (1 - \frac{201{,}5}{239}) \cdot 100\% = 15{,}7\ \% \quad (4)$$

in this: θ - relative lightness of the tissue, %.

The values of changes in absolute and relative lightness indicators for further variants of two-layer knitted fabrics in the new structure are given below (Fig. 3).

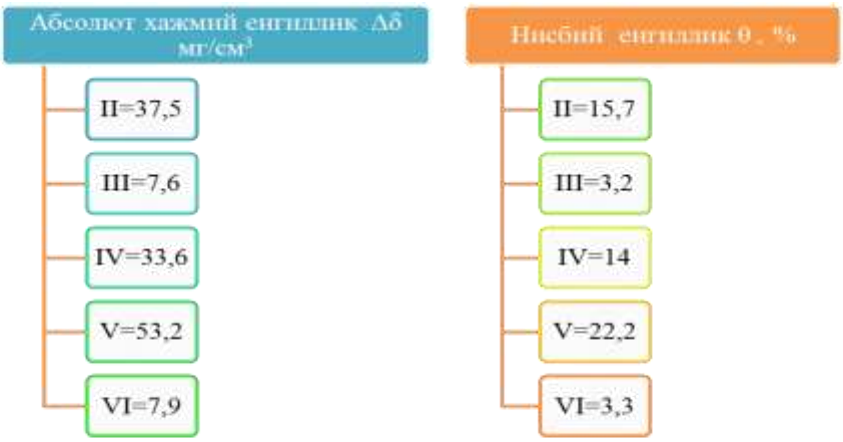

Figure 3. Absolute and relative lightness indicators of two-layer knitted fabrics of a new structure

Another important factor in knitted fabric is the thickness index, and it is one of the factors affecting the volume density of knitted fabric. During the research, the thickness indicators of knitted fabrics were determined using thickness measuring devices (Table 1, Figure 4).

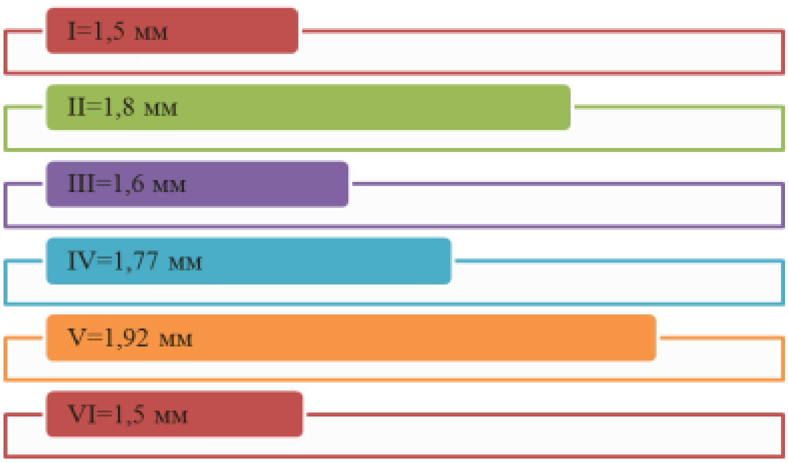

Figure 4. Thickness parameters of two-layer knitted fabric of new structure

The thickness indicators of the two-layer knitted fabric samples in the new structure changed from 1.5mm to 1.92mm. The greatest thickness indicator was observed in the V-variant, which consisted of a front layer of glad and press semi-ring backing, and a back layer of full glad rings, and it was 28% thicker than the base fabric and was 1.92 mm (Table 1, Figure 4).

It was found that the raw material consumption indicators of two-layer knitted fabrics of options II, IV and V are less than the base fabric due to the change of the fabric structures of the new structured two-layer knitted fabric samples, as well as the placement of needles in elastic order during fabric extraction.

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