E CONF SERIES

International Educators Conference
Hosted online from Toronto, Canada
Website: econfseries.com 7th September, 2025

TECHNOLOGICAL PERFORMANCE OF SINGLE-LAYER KNITTED FABRICS MADE FROM BASALT YARN WITH HIGH FIRE-RESISTANCE

V. Kenjayeva
Q. Kholikov

Abstract

This study investigates the technological performance of single-layer knitted fabrics made from basalt yarn with high fire-resistance. The research aims to expand the range of knitted products by analyzing fabric structures and production methods to achieve lightweight surfaces and optimal bulk density. Three fabric variants (I, II, III) were tested, with key parameters such as ring pitch, ring row height, density, and loop yarn length measured. The results indicate that the surface density ranged from 258.2 g/m² to 590.2 g/m², thickness varied between 1.78 mm and 6.13 mm, and bulk density fluctuated from 96.2 mg/cm³ to 174.6 mg/cm³. The findings highlight the potential of basalt yarn in producing fire-resistant knitted fabrics, contributing to advancements in textile industry applications.

In order to expand the range of knitted products, it is an urgent task to analyze the structure of knitted fabrics with existing structures and methods of obtaining them in order to obtain fabrics with light surface and bulk density and to produce finished knitted products from them. Many researchers are working on the creation of a new range of fabrics with high fire resistance, changing the type of raw materials in our country and abroad.

In recent years, the Republic has been implementing comprehensive measures to develop the textile, sewing and knitting, leather and footwear, and fur industries of light industry, expand the types and assortment of finished products produced, as well as comprehensively support the investment and export activities of enterprises in the sector.

The measures taken made it possible to create capacities to process more than 80 percent of cotton fiber and more than 45 percent of yarn produced in the Republic, as well as to increase the volume of exports of finished products to 1.6 billion US dollars in 2018.

the produced single- and double-layer knitted fabrics of a new structure with a high level of fire resistance were tested using a standard method in the knitwear production testing laboratory of the "Knitting Technology" department of the Namangan Textile Industry Institute, and the results obtained are presented in Table 1.

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

The surface density depends on the type of yarn used in the fabric, its linear density, and also on the percentage of yarns used.

The length of the loop yarn in single-layer knitted fabrics varied from 9.45 mm to 15.7 mm, in intervals. This is reflected in the fact that the layers are formed from loops of gladiator loops that have a uniform shape when woven.

Table 1. Technological indicators of a new range of single-layer knitted fabrics, the raw material composition of which consists of basalt yarn with a high degree of fire resistance

Indicators		Options		
		I Glad	II Fruitful glade	III Tire
of yarns , tex	Front layer	Basalt thread		
Ring pitch A, mm	Front layer	2.5	2.7	1.31
Ring row height V, mm	Front layer	1.6	1.78	1.61
Horizontal ring density, R_g, ring	Front layer	20	18	38
The density of rings along the vertical is R_v, ring	Front layer	30	28	31
Ring thread length L, mmm	Front layer	9.45	10.3	1 5 ,7
Knitting of the tissue surface Density M_s, g/m ^{2}		258.2	424.2	590.2
Thickness T, mm		1.78	2.43	6.13
Bulk density of knitted fabric δ , mg / cm3		145.05	174.6	96.2
Absolute volumetric relief Δδ , mg / cm3		-	-29.55	48.85
Relative relaxation θ, %		-	-20	34.4

If (Option-1) the surface density M_S =258.2 g/m ^{2}, the thickness T =1.78 mm, its bulk density was 145.05 mg/cm. The II-option of the new assortment of single-layer knitted fabrics, the raw material composition of which consists of basalt yarn with a high level of fire resistance, based on the resulting glad rings, the surface density of the knitted fabric was M_S =424.2 g/m ^{2} and the thickness T =2.43 mm, its bulk density was 174.6 mg/cm 3. If the III-option knitted fabric had a surface density of M S =590.2 g/m ^{2} and a thickness T =6.13 mm, its bulk density was 96.2 mg/cm ^{3}.
This formula plays a key role in determining the volumetric density of knitwear:

$$\delta = M_s / T \qquad (1)$$

where: δ - bulk density of knitted fabric, mg/cm ^{3};
M_s - surface density of knitted fabric , g/m ^{2};
T - thickness of knitted fabric , mm.

Conclusion

The study demonstrates that single-layer knitted fabrics made from basalt yarn exhibit promising technological properties, including high fire-resistance and variable bulk densities. The tested variants (I, II, III) showed distinct performance characteristics, with Option III displaying the highest surface density and thickness, while Option I had the lowest values. The formula for bulk density ($\delta = M_s / T$) proved effective in evaluating the fabrics' structural properties. These findings underscore the viability of basalt yarn for developing specialized knitted products, aligning with industrial goals to enhance textile diversity and fire safety. Further research could explore additional applications and optimize production techniques for broader commercial use.

Used literature:

1. https://uzts.uz/en/global-cotton-production-import-and-export-analysis-in-2021-22-crop-year
2. Decree of the President of the Republic of Uzbekistan No. PF-158 dated September 11, 2023 on the "Uzbekistan-2030" strategy
3. UzME . First Volume 1. Tashkent, 2000

4. Krenev VA, Kondakov DF, Pechenkino EN, Fomichev SV Modification of the composition of gabbro-basaltic raw materials during melting in an oxidizing, inert or reducing atmosphere. Glass and Ceramics. -2020.-Volume 76. - pages 432-435.
5. Kurbanov A.A. Conditions for obtaining new fire-resistant fabric. Vestnik Tashkent. Tashkent. 2007.-No. 3.-P. 28-33.
6. Dondokov A.Ts. Thermal insulation material of basalt fiber structure obtained by plasma processing. Abstract. Ulan-Ude. 2007. 12-14 p.