

ANALYSIS OF PHYSICAL AND MECHANICAL PROPERTIES OF REFRACTORY BASALT YARN

V. Kenjayeva
Q. Xoliqov

Abstract

This study examines the physical and mechanical properties of refractory basalt yarn, focusing on its application in the textile industry to produce high fire-resistant knitted fabrics. The research highlights the development of 35-tex basalt yarn, derived from volcanic rock, and its testing under both untwisted and twisted conditions. Key parameters such as thread variation (CV), deformation (EL), breaking strength (RKM), and twist count (K) were analyzed. The study also explores the production of three variants of knitted fabrics using a 7th-class flat double-needle knitting machine. The results demonstrate the potential of basalt yarn in creating durable, flame-resistant fabrics suitable for specialized outerwear, contributing to advancements in textile material science.

Keywords: Basalt yarn, fire-resistant fabric, knitted textiles, physical-mechanical properties, flat-needle knitting machine, refractory materials, textile innovation.

Introduction

In recent years, the Republic has been implementing comprehensive measures to develop the textile, sewing and knitting, 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. At the same time, increased competition in world markets, the development of technologies and the reduction of production costs by foreign manufacturers by expanding the assortment of products require the development of additional measures for the development of these industries.

Currently, research is being conducted to improve flat-needle knitting machines, most often in these works polyacrylonitrile yarns are used in the weaving process. In the ongoing scientific research work, work is being carried out on the production of 35-tex basalt yarn, which is obtained by crushing volcanic rock that has matured at the bottom of the sea for a hundred years, in the process of obtaining the main fabrics, glad, derivative glad and rubber fabric. The capabilities of modern flat-needle knitting machines can be used in machines from 3 to 7 classes, respectively. Thus, it is possible to knit with one needle or with each needle, depending on the required class of the machine.

the conducted scientific research work showed that it is important to expand the range of types of knitted fabrics intended for special outerwear, develop new methods for obtaining knitted

fabrics with new structures by using yarn with high fire resistance in the composition of the fabric.



Fig. 1. Appearance of basalt thread.

Analysis of the physical and mechanical properties of textured basalt yarn in the laboratory of MEGA TEXTILE M.CH.J.

Physical and mechanical properties of basalt yarn (in the untwisted state)

Table 1

T(text)	$U_m\%$	$CV_m\%$	EL	RKM	KR
4800	0.24	42.47	2.31	152,515	0-6

CV - threads variation indicator (on the thread o ' change); EL – deformation in the yarn under the influence of force; RKM – relative breaking strength in the yarn; KR – number of twists in the yarn

Table 2 Physical and mechanical properties of basalt yarn (in twisted condition)

T(text)	$U_m\%$	$CV_m\%$	EL	RKM	KR
4800	0.24	38.26	2.20	210.52	192



Fig. 2. Machine for determining the number of twists in basalt fiber

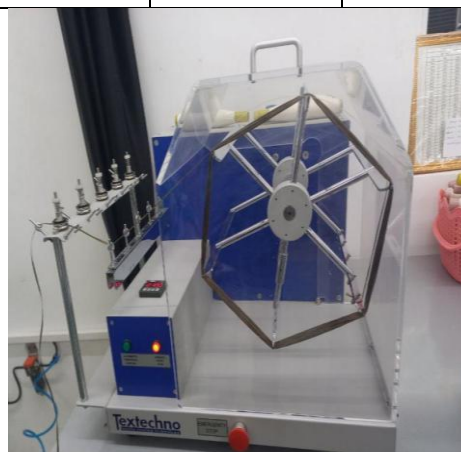


Fig. 3. Yarn winding machine.

The YG002C model is a computerized microscope designed for fiber analysis, with a measurement speed of 15-30 minutes, high-precision level 0.1 μm to equal.



Fig. 4. Microscopic view of basalt fiber.

According to him, in order to solve the current problems mentioned above, a new type of fire protection is needed for professionals working with fire. A technology for producing knitted fabrics with high fire resistance has been developed.

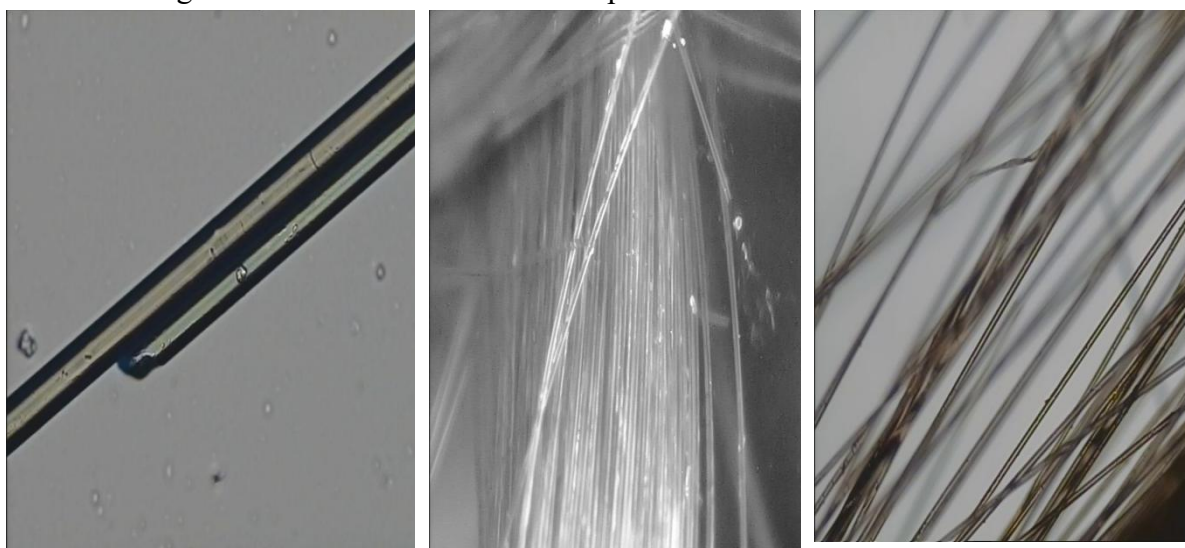


Fig. 5. Microscopic view of basalt fiber.

New type 3 variants of knitted fabrics were woven on a 7th class flat double-needle knitting machine manufactured by Wonderful HP252, a Chinese company.

It is known that obtaining fabrics with a certain repetition of rows or individual elements of the fabric in a certain order is one of the most promising directions for creating a new assortment of knitted fabrics. One of them is the connection of single-layer fabrics with each other using a loop thread in the weaving method.

In order to expand the range of knitted fabrics, change the type of raw materials, and improve quality indicators, samples of knitted fabrics obtained by adding yarn with a high level of fire resistance to the fabric composition were obtained.

According to it, a high-fire-resistant yarn was used as a raw material in knitted fabrics, using basalt yarn with a linear density of 35 tex. The samples of single-layer knitted fabrics in the new range for outerwear differ from each other in the production method and the change in the weave structure.

The third version of the new assortment of single and double-layer knitted fabrics was produced.

The technology for arranging the knitting needles of a flat-needle knitting machine in a glad, derivative glad and elastic pattern, as well as the production of knitted fabrics, was developed, and new assortments of knitted fabrics were woven due to the technology for producing a new assortment.

Given the high shape retention and flame resistance properties of the resulting knitted fabrics, it is advisable to use them in the production of outerwear.

Conclusion:

The research underscores the viability of basalt yarn as a high-performance material for fire-resistant knitted fabrics. The analysis of its physical and mechanical properties revealed favorable characteristics, including low thread variation (CV) and high breaking strength (RKM). The production of three fabric variants using advanced knitting technology demonstrated the adaptability of basalt yarn in creating diverse textile structures. These findings highlight the material's potential for use in protective outerwear, offering both flame resistance and durability. Future studies could further optimize production techniques and explore additional applications, solidifying basalt yarn's role in the textile industry's evolution toward innovative, safety-focused materials.

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