ACADEMICIA: An International Multidisciplinary Research Journal
ISSN: 2249-7137 Vol. 11, Issue 11, November 2021 SJIF 2021 = 7.492
A peer reviewed journal

ON OBTAINING COMPOSITE FABRICS AND PRODUCTS

N. N. Matchonova*

*Faculty of Industrial Technology,
Department of Natural Fibers and Fabric Processing, Jizzakh,
Jizzakh Polytechnic Institute, UZBEKISTAN
Email id: nargis_83@ inbox.ru
DOI: 10.5958/2249-7137.2021.02540.4

ABSTRACT

There are described the possibilities of creating unconventional materials, targeted functional paintings, and value-added products through the use of basalt raw materials in this article. The chemical composition of basalt is mainly: SiO2 - 45-60%, Al2O3 - 12-19%, Fe2O3 and FeO - 5-15%, SaO - 6-12% MgO - 3-7%, TiO2 - 0.9-2%, Na2O and K2O - 2.5-6% and other compounds -2-3.5%. The strength of basalt fiber, in accordance with the existing dimensions of the diameter of elementary fibers: 5.0 microns - 215 kg / mm2; 6.0 microns - 210 kg / mm2; 8.0 microns - 208 kg / mm2; 9.0 microns - 214 kg / mm2; 11.0 microns - 205 kg / mm2. Basalt fabrics and products have high strength, non-flammable and flammable, maintain their integrity up to +980 ° C, are resistant to electromagnetic radiation, moisture, corrosion, resistant to chemical influences (acidic, alkaline media and salts) and have electrical insulating properties . The article is devoted to the prospects for creating functionally oriented products, innovative composite materials aimed at localizing and creating additional value and research on the use of basalt.

KEYWORDS: *Basalt, Basalt Fiber, Roving, Cord, Twisted Reinforced Roving, Woven, Bedding, Knitwear, Sleeve, Composite.*

INTRODUCTION

Decree of the President of the Republic of Uzbekistan of 2019 Resolutions PQ-4277 of April 10 “on additional measures for the organization of the development of fiberglass, fiberglass products, composite materials, energy-saving heating equipment and modern energy-saving systems”[1], PQ-4198 of February 20, 2019 “On measures for the radical improvement and integrated development of the Building Materials industry”[2] are aimed at further development of the production of building materials, increasing the range of modern building materials based on local raw materials and secondary resources. special attention is expected to be paid to.

As a logical continuation of the large-scale reforms being carried out in the country, the distinguished President, at a meeting held on January 31, 2020, devoted to the development of science and education, as well as during visits to research institutions in the field of geology, put issues on the development of science on the agenda areas of mathematics, chemistry, biology, and geology, to bring the cooperation of the Ministry of Science with production and the national economy, educational institutions to a new level of quality.

LITERATURE REVIEW

In the world, basalt was first used as a filler for concrete foundations, in the formation of railway tracks, and then continuous basalt fibers were obtained, from which specific threads, woven fabrics, semi-finished products and composites reinforced with them quickly penetrated. aircraft construction, shipbuilding and other industries.

At the beginning of the XXI century, with the advent of several new enterprises in Russia, Austria, China, Ukraine, the production and use of basalt fiber has further improved [3].

It has been established that, according to the resistance of crystalline structures to intense mechanical stress, basaltic silicates are arranged in the following order: hydro silicates -> framework aluminosilicates (plagioclases) - "chain silicates (pyroxenes) -" orthosilicates (forsterite). The low mechanical resistance of hydro silicate is explained by the presence of large interplanar distances along which the destruction of the structure begins. The greater stability of pyroxenes than plagioclases indicates that the chain framework is more mechanically resistant than silicon-aluminum [4].

Today, basalt fiber is of great interest in the market of composites, experts consider it one of the most promising materials with a unique combination of properties. Basalt fiber has excellent mechanical properties and is intermediate between fiberglass and carbon fiber in terms of low cost. Serious studies of the industrial production of continuous basalt fiber began simultaneously in the 1960s in the United States and the USSR. Initially, the main goal of the work was to obtain high-quality basalt fiber, necessary for rocket science. However, in the 70s, experts abandoned this idea and focused on its use in the production of special high-modulus glasses, as a result of which S2 glass was created [3].

Scientific research on the production of basalt fiber, which began in the 60s, was carried out in the territory of the former Soviet Union until the end of the 90s, mainly in Ukraine. The first military enterprises were opened in Georgia and Kazakhstan. In 1991, central funding for these purposes was discontinued. Compared with existing knowledge, technology, and investment, it was impossible to obtain basalt fiber, which at the same time was cheap and had high mechanical properties. It is also known that the cost of electricity and labor has a large share in the cost of producing basalt fiber, which, in addition to technological problems, makes it inefficient for producing this fiber in regions with expensive natural gas, electricity, and labor.

In 2000, a large enterprise was established specializing in the production of continuous basalt fiber-based on new technologies, and all of its products were sent to the TOYOTA engineering company. Later, with the involvement of experts from the former Soviet Union, these processes were widely developed in China [5].

Currently, there are a number of technical conditions for obtaining basalt fiber, usually the technological parameters and properties of the fiber correspond to the technical requirements of the final product: fibrous heat-insulating fabric, sandwich panels, multi-turn reinforced threads, special reinforcing. castings or nets (construction, automobile, etc.), fittings, heat-insulating cord (obtained by the method of "cord-braided" machine roving from very thin fibers wound with twisted basalt threads) [6]. Attention is paid to the linear density of basalt fibers (microns) and roving (tex), their treatment with special surfactants (lubricant), and in the production of twisted yarn, the twist coefficient, direction (S and Z) and the number of complex threads in it.

D.D. Dzhigiris, M.F. Makhova conducted research on the production of basalt fibers, as well as on their practical application [7-9].

V.P. Shevchenko studied the fundamental laws of the formation of insoluble eutectics in silicate systems of concentration intervals based on basalt, limestone, phosphorus components and studied the technology for obtaining fiber from them[10].

According to F.M. Rozanov and L.A. Chernikina [11], complex indicators of the structure of the fabric take into account the ratio of filling the base and back, this factor takes into account the type of weaving, changes in cross-sectional shape and the size of the threads in the fabric. With their help, the filling ratio is defined as the ratio of the actual filling of the tissue to the maximum level.

A.A. Kurbanov studied the structural parameters of basalt rocks and recommended the production of filter materials from their fibers [12].

According to the analysis of the scientific literature, one-sided (unidirectional), two-sided (biaxal), three-way (triaxal) or multilayer fabric obtained from reinforced basalt fibers is also deposited. The above-mentioned textures, used for special purposes, were the result of the interaction of specialists from several industries, which allowed us to obtain relatively inexpensive innovative products, such as various non-traditional (sports goods, some parts of cars and motorcycles, boat and boat hulls, parts with a complex profile, various construction panels, heat, sound insulation and refractory materials, building structures, wind wings). At the same time, in most cases, there are no cases in the literature when basalt fiber can be observed even in production processes that violate environmental requirements, and the enterprise can become a source of environmental pollution [7, 10]. Therefore, along with the expansion of the range of basalt fiber and products made from it, the improvement of production technology is also an urgent issue today.

Various surfactants are used today depending on the intended use of the basalt fiber. Surfactants used in textiles protect yarns from abrasion and abrasion during processing into textiles (fabrics, geonets, sewing materials). The function of direct surfactants is to improve the adhesion of fiberglass surfaces to polymers in composites and fiberglass. The fibers can be processed directly during the production of surfactants or during processing after thermochemical treatment.

Surfactants must meet the following general requirements: ensures the adhesion of the individual fibers coming out of the fillet, i.e. the formation of a primary single thread, while at the same time preventing the threads from sticking to each other; facilitate the process of unraveling and twisting of the primary individual threads; protection of primary single threads from friction and mechanical damage when passing through numerous thread-cutting organs of textile machines; prevention of static charging; forms a strong, elastic and abrasion-resistant film evenly distributed over the diameter and length of the yarn.

"Paraffin emulsion", which is a multicomponent water-based dispersion containing paraffin, stearin, vaseline, transformer oils, OC-20 preparation, DTSU fasteners and water, is one of the most common surfactants in the textile industry.

Surfactants are used in the manufacture of complex filaments of various compositions intended for the production of various reinforcing materials from basalt fibers. The main dangerous and

harmful factors in the preparation of surfactants are physical (electric shock) and chemical (poisoning through the skin) if the concentration norm is not observed.

A number of scientific studies by K.L. Kuzmina, D.E. Zimin, S.I. Gutnikova, B.I. Lazoryaka, A.N. Selezneva is devoted to surfactants used in the manufacture of products from basalt fiber.

Theoretical research

«Uzmetkimbinat» JSC in Bekobot, Tashkent region (7-8 thousand tons), «Mega Invest Industrial» LLC in the Forish district of Jizzakh region (1-1.5 thousand tons) and « Elektroizolit» LLC in Tashkent (0.2 - 0.25 thousand tons) associated its activity with basalt.

JV LLC "Mega Invest Industrial" manufactures a range of products from basalt fiber: rebar, mesh, geogrid, geotextile, roving, fiber..

“Geobasalt” LLC was established in December 2020. The company produces corrosion-resistant, durable geonets made of basalt fibers (600, 1200, 2400 tex). The new geosynthesis, in contrast to the metal mesh, does not require corrosion resistance and dryness, lies flat on the surface, is safe to use, can be easily cut with construction scissors, does not lose the strength of alkaline concrete, conducts little heat, and provides high adhesion when using special alloys. allows [13].

The development of production in the country, an increase in the standard of living of the population contributes to the rapid development of inter-sectoral relations. The main factor that determines the specificity of any fabric or functional product is the type of raw material. For example, in world practice, the use of high modulus yarns has led to the expansion of the range of technical textiles [14].

The aforementioned enterprises of the country produce building materials from basalt stone, such as basalt fiber, fiberglass, high heat-retaining slabs, composite reinforcement, composite mesh. However, today's need is to strengthen theoretical and practical research on the use of this type of raw material in the production of textile and composite materials.

It is aimed at creating a classification related to the production and use of continuous basalt fibers, as well as the development of basalt fibers in this area and the creation of not only textiles, but also new types of shaped products, and the improvement of existing technologies.

RESULTS AND DISCUSSION

If we look at world experience [5], firstly, the chemical composition of basalt is mainly: SiO2 - 45-60%, Al2O3 - 12-19%, Fe2O3 and FeO - 5-15%, SaO - 6-12% MgO - 3-7%, TiO2 - 0.9-2%, Na2O and K2O - 2.5-6% and other compounds -2-3.5%. This is a natural raw material, more ready for fiber than glass.

Secondly, the strength of basalt fiber is several times higher than that of other similar fibers, that is, in accordance with the existing dimensions of the diameter of elementary fibers: 5.0 microns - 215 kg / mm^2; 6.0 microns - 210 kg / mm^2; 8.0 microns - 208 kg / mm^2; 9.0 microns - 214 kg / mm^2; 11.0 microns - 205 kg / mm^2.

Thirdly, basalt fabrics and products have high strength, non-flammable and flammable, maintain their integrity up to +980 ° C, are resistant to electromagnetic radiation, moisture, corrosion, resistant to chemical influences (acidic, alkaline media and salts) and have electrical insulating

properties . Compared to fabrics and products made of glass yarn, their tensile strength is more than 25%, the operating temperature range is from -260 ° C to + 820 ° C (maximum + 980 ° C).

BalFat series basalt fiber fabrics are made from basalt fiber, which is interwoven in a special way on a loom. According to the weaving method, they can be classified as simple fabrics, diagonal weave fabrics, satin weave fabrics and unidirectional fabrics. Basalt fiber fabrics are widely used in the manufacture of laminated plastic with copper foil, fire-resistant materials, to strengthen building structures and bridge structures, the production of sports equipment, as the basis of composite materials, etc. [4]. The following table shows the general characteristics of basalt fabrics (Table 1).

Characteristics of basalt fabrics

Code	Type of weaving	Density, g/m^2	Thread diameter, μm	Width, mm	Thickness. mm
BWP200	Plain	200	9	1000	0.18
BWP200	Plain	200	13	1000	0.19
BWP700	Plain	700	13	1000	0.53
BWP900	Plain	900	13	1000	0.82
BWT350	Twill	350	13	1000	0.25
BWT750	Twill	750	13	1000	0.75
BWU200	Unidirectional	200	9	1000	0.11
BWU300	Unidirectional	300	13	1000	0.16
BWU400	Unidirectional	400	13	1000	0.18

As mentioned above, the type of raw material, its properties determine the specific properties of both the final fabric and the product. But every aspect related to the structure of non-woven material, fabric, or knitwear upon receipt of a specifically targeted fabric or finished product requires a scientific approach by a specialist in this field.

TITLI Leading scientists of the Department "Technology of Textile Fabrics", Jizpi, the Institute of TKT, specialists of the joint venture "Mega Invest indastrial" LLC jointly found it expedient to send to the relevant sectors of the national economy developments related to further improving the quality of basalt fiber using continuous basalt fibers, obtaining **functional target fabrics and products, as well as the production of new composite materials**. At the same time, it was decided to conduct the following theoretical and practical studies:

The improvement of basalt fiber production technology is associated with the multiplication of basalt fiber types (microns) and linear density roving (tex); production of reinforced basalt filaments in accordance with the requirements of the textile industry; preparation and processing of basalt filaments with surfactants of the appropriate linear density in accordance with the requirements of use; weaving, knitting, production of nonwovens; investigation of the possibilities of obtaining a thermal insulation cord ("braid cord" in a machine) filled with a very thin (ultra-thin) roving fiber; how to get a fabric and piece product using knitting; obtaining composites with specific properties, reinforced with fabric and seamless sleeves.

At the same time, two different approaches to obtaining winding products were considered appropriate: development of basalt threads treated with a special surfactant, with a linear density corresponding to the class of sock looms, and the formation of the best product from them; in two-needle knitting machines, the basis of the motor product is the formation of basalt (or other synthetic, artificial) yarn, as well as the use of bulk base yarn in the form of a filler.

At the joint venture of **"Mega Invest Industrial"** LLC, the largest sample was taken from basalt yarn treated with a special surfactant with a linear density of 85 tex, which was made in the form of an experimental sample wrapped in a single-needle sock of the "Soosan 604" automatic machine [15,16,17].

CONCLUSION AND RECOMMENDATIONS

The conditions of a cluster development system, which require innovation, industry and intersect oral knowledge, require a comprehensive study of world experience, the production of basalt fibers, the creation of functional fabrics and products, the production of functional composite materials and their targeted use in cooperation with experts in related fields. Effective innovative cooperation, in-depth research, and analysis of scientific databases will accelerate innovation processes and ensure economic growth.

REFERENCES

1. Decree of the President of the Republic of Uzbekistan of 2019 Resolution PQ-4277 of April 10 "on additional measures for the organization of the development of fiberglass, fiberglass products, composite materials, energy-saving heating equipment and modern energy-saving systems".
2. Resolution PQ-4198"on measures for radical improvement and integrated development of the construction materials industry " of February 20, 2019.
3. https://basalt.today/ru/technologies/
4. [4] K.S. Makarevich. Research, development and production of basalt fibers from igneous rocks: the example of the basalts of the Far East. Abstract. Diss. cand. tech. sciences. Khabarovsk-2006 -8 pp.
5. http://ru.firesleeve-china.com/about-us_d14.
6. https://basfiber.com/ru/products/basalt-rope
7. D.D. Jigiris. Basics of the production of basalt fibers and products / D.D. Dzhigiris, M.F.Makhova - M .: Teploenergetik, 2002.-416 p.
8. Ya.A. Shkolnikov. Glass staple fiber / Ya.A. Shkolnikov, B.M. Polik, E.P. Kocharov, E.R. Nigin. M .: Chemistry 1969.-362 p.
9. M.S. Aslanova. Glass fibers / M.S. Aslanova, Yu.I. Kolesnikov, V.E. Khazanov, etc., ed. M.S. Aslanova. M .: Chemistry. 1979.-251 p.
10. V. P. Shevchenko. Development of basalt fiber production technology based on mineral raw materials of the Republic of Uzbekistan. Diss... Candidate of Technical Sciences. Tashkent-2012.

11. N.K. Romanichev. Development and production on STB machines of technical fabrics from heat-resistant strands of glass and basalt. Abstract. diss ... cand. tech. sciences. Ivanova 2010 year.

12. A. A. Kurbanov. Development of a rational technology for processing different types of basalts in Uzbekistan. Doc. diss... Navoi -2016 year.

13. I. K. Shakasimov, X.Q.Rooziboev. The prospect of a localized geogrid of basalt stone products. Collection of materials of the Republican Conference "Actual problems and solutions for the development of the production of innovative building materials". Association " Uzsanoat qurilish materiallari". 2020 December 25.

14. F.Kh.Rakhimov. Basic development of constructions and technologies of knitted and armored polyfunctional composites. "New Century Generation", Tashkent. 2013. –B. 190.

15. Matchonova N., Rakhimov F. Basalt Fiber and Capabilities for Creating Added Product //Solid State Technology. – 2020. – Т. 63. – №. 5. – С. 5013-5018.

16. Matchanova, N. N. (2019). Results of studying the properties of basalt fibers and their structure. Advances in Science and Technology, 125-127.

17. Matchonova, N. N., & Sayfullaevna, G'. S. (2020). USE OF BASALT FIBER AND ITS POSSIBILITIES. Journal of Technical Research, 3 (5).