Topic № 2
TEXTILE TECHNOLOGIES: SPINNING, WEAVING AND KNITTING

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Textile Industry.
Technology of textile materials.

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BALLISTIC IMPACT RESPONSE OF TEXTILE MATERIALS - A REVIEW

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Protection from different kinds of threats, such as sharp objects and ballistic projectiles, dates back to the history of humankind. People were wearing protection equipment made of different kinds of primitive materials to protect themselves from various kinds of threats. Various textiles made of traditional fibers such as linen, cotton, silk, and nylon have been used for garments but also as protecting materials against threats. In the late 1960s, high-strength, high-modulus fibers were invented to support the new era of protection by developing body armor systems against different ammunition. That was be followed by the development of different trade marked synthetic fibrous materials with anti-ballistic performance.

Modern armies and law enforcement agencies use body armor consisting of an outer tactical vest (OTV) with inserted hard ceramic insert to stop the high-speed rifles, handguns, and soft armor plates to stop handgun projectiles and reduce ballistic impact consequences. Even though armors with heavier inserts are essential to protect against armor-piercing, they also result in excessive weights in the armour system, affecting a soldier's mobility in the field. Today, the current technology-driven military operations and on-street sophisticated weapons and ammunition impose the development of advanced damage-resistant, flexible, lightweight, and huge energy-absorbing ballistic protection armor systems based on soft materials.

Due to these trends, various high-performance fiber types have been developed. Para-aramids and ultrahigh molecular weight polyethylene (UHMWPE), Twaron®, Kevlar®, Dyneema®, and Spectra® are among the well-known high-performance fibers extensively used for flexible personnel ballistic protection armor. Zylon (Toyobo), Spectra®, M5 Vectran, and Nextel are also used. Those developed high-performance fibers possessed a unique performance, and these fabrics' ballistic impact response mechanism is different from the traditional fibers and even each other.

Ballistic impact mechanism is a complex mechanical process that mainly depends on the target material's thickness, strength, ductility, toughness and density, and projectile parameters. The developments of high-strength, high-modulus fibers have led to using fabrics and their composite laminates for various impact-related applications. The different influential mechanisms and factors that affect the target's ballistic impact performances also impose experimental research work and different analytical, numerical modeling, and empirical techniques-based research approaches.

This paper provides outline and discussion regarding mainly different types of ballistic textile fabrics and composite materials and their ballistic impact response, which affects the ballistic impact resistance performances. To do that, this review paper first outlines various ballistic soft materials involved in the ballistic applications, including body armor. Besides, various approaches used for a understanding of the ballistic impact mechanisms and responses of the textile ballistic materials will be examined.

Keywords: ballistic textile fabrics, equipment, body armor

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COMPARATIVE DESCRIPTION OF THE DEFECTS IN THE APPEARANCE OF THE FABRICS

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Garments are an integral part of our daily life. They should be not only fashionable, but also practical and comfortable. The comfort of our clothing is taken care of by the designers and technologists who recreate the constructive solutions of the model in comfortable fashion collections. Operators in textile production, textile technicians and fabric designers are responsible for the quality of textile surface products. But the most important thing is that the fabric from which the garment is made should be produced in good quality.

In the specialized literature, there are known sources that consider defects in the appearance of fabrics. On the one hand, these are textbooks and monographs, and on the other hand, standards and other normative documents.

As part of the overall quality of fabrics, defects in appearance occupy a special place.

The other properties such as areal mass, strength or surface resistance are due to the machine settings of the textile machines and appear as deterministic functions of the interplay between the working organs and the textile raw materials. For example, the areal mass of a fabric depends on the linear density of the weft and the weft packing. These properties are probabilistically described by a normal distribution.

Defects in the appearance of the fabrics are due to sudden and accidental breakdowns in the machines that go out of the normal mode of operation.

They appear as rare events and are described by random functions of their distribution.

The random nature of the reasons for their appearance and the determining importance for the quality of the fabric require a strict definition of the defects as causes, type and impact.

In the known literature, defects in appearance are presented with extensive descriptions but no classification, or with names resembling technological jargon and a narrow local distribution. In any case, it is periodically necessary to update the description of the defects and their reference to modern textile techniques.

The subject of the article is the description of defects in the appearance of fabrics according to the type of fabrics: woven or knitted, according to the technological stage: spinning, weaving, knitting, dyeing and finishing, and according to the impact on the general quality of the sewing products.

The purpose of the development is the compilation of a modern catalogue with the main defects and the corresponding description, as well as the necessary references for prevention and impact assessment.

Tasks include literature research, technological observations, specimen collection, cataloguing and description.

Keywords: quality, fabrics, defects, appearance, catalogue

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PROMISING CONCEPT FOR HAND WEAVING WITH ECONOMIC APPLICATION IN MASS PRODUCTION

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Hand weaving is a textile technique in which the interaction between the weaver, the loom and the threads is carried out by the human body, without additional sources of propulsion. Nowadays, hand weaving exists in three main directions.

In the first place is the craft weaving, which takes place in ethnographic museums and its main purpose is the preservation of local knowledge and skills in hand weaving. In second place is artistic weaving. It takes place in creative studios and aims to produce unique textile art products with artistic value. The third direction is educational weaving. Its main purpose is to show the weaving technique as a principle and as a process with the possible separation of certain stages, movements and interactions. Hand weaving for educational purposes combines three features. The looms are made in different versions according to the level of the trainees, but are generally simplified in terms of construction and materials. The essential feature is in the group implementation of educational weaving, or - its partial/limited mass.

The subject of this article is the idea of a balance between a cheap and light hand horizontal loom with simple operation, allowing for personal creativity, ergonomic, allowing 45-60 minutes of continuous work, having clear mechanical action and predictable productivity. The purpose of the development at this initial stage is to indicate the main principles and guidelines in the development of a hand weaving project with a manufacturing application. The tasks are primarily focused on literature research and gathering information and facts on the matter.

The disadvantages of the currently common handlooms are divided into three groups: structures and materials, technological possibilities and ergonomic conditions.

1. Construction and materials: constructions with 19th century carpentry techniques, unstable structures with unstable fixed and movable connections and large clearances, contact surfaces: thread/organ have high friction and low wear resistance, application of stretch/elastic rope ties to manage the warp threads in forming the shed, contact surfaces of the working bodies with the threads with high wear resistance and low coefficient of friction, special, single constructive solutions, closed constructions without the possibility of improvement, upgrading and easy replacement of working bodies and parts.

2. Technological disadvantages: Impossibility of mass reproduction of uniform fabrics of constant quality, limited builds with fitting and handling of up to 4 heddles frames and inability to reproduce weaves with a repeat greater than 4, non-functional and underdeveloped working organs: take-off brake, attractive cross, width holders and shade frames with the reed, absence or subordination of auxiliary devices: shuttles, spinning wheels, pulleys, bobbins, etc., insufficient ergonomic functionality in modern conditions, large resistance forces for driving, due to high friction between the working bodies, absence of an ergonomic workplace to ensure a comfortable posture for the weaver.

Requirements:

1. Universal construction relative to: the weaver, raw materials, fabrics and loom reproduction.
2. Saving the wood for contact with the weaver and weaving auxiliaries.
3. Ease with minimal load when performing the weaving cycle, possibility of constant, rhythmic work for 45-60 minutes. Distribution of efforts of the limbs and musculature of the weaver. Ability to maintain uniformity in effort and in packing.
4. Ease and convenience in auxiliary operations: winding, twisting, spooling and warping.
5. Drive by human power only.
6. Possibility of improvement by upgrading with modules from plain weaving loom to loom for lobby and jacquard fabrics.
7. Possibility of manufacturing unification of 3-6 looms in one hall.
8. Possibility of manufacturing reproduction of mass quantities.
9. Preservation of opportunities for unique creative solutions in weaving.
10. Unification in homogeneous quality.
11. Low cost and affordable price.
12. Durability and durability of weaving equipment.
13. Preservation of traditional techniques and good weaving practices.
14. Perspective: manufactory, no workshop.
15. FSC, FairTrade, GRS, safety and similar certification.

The forward-looking concept **ProConWeaving** is looking for solutions for the application of hand weaving in mass production, with preserved possibilities for **original solutions and unique effects**.

1. Basic construction: stable, with the necessary inertial mass and a low centre of gravity, Functional independence of the working bodies, upgrade options, modular construction principle.
2. Selection of materials: different types of wood according to the functions of the machine elements, the surfaces of the working organs in contact with the human organs must be made of wood, working bodies in contact with textile materials - as appropriate, modern construction materials for the fixed joints.
3. Removable links: modern construction materials, modern machine elements, replaceable spare parts, Possibilities for automation.
4. Accompanying activities: development of constructive documentation and protection of intellectual property, compilation of teaching aids and training of weavers and technicians.

Keywords: textile, hand-loom weaving, perspective concept

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TECHNOLOGY OF GREASY WOOL PROCESSING QUALITY CONTROL

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"Lempriere Wool" EOOD, Sliven, Bulgaria is one of the largest wool traders and processors in the world with the most diversified portfolio, including a wool tops production plant that began operations in 2016 in Sliven, Bulgaria.

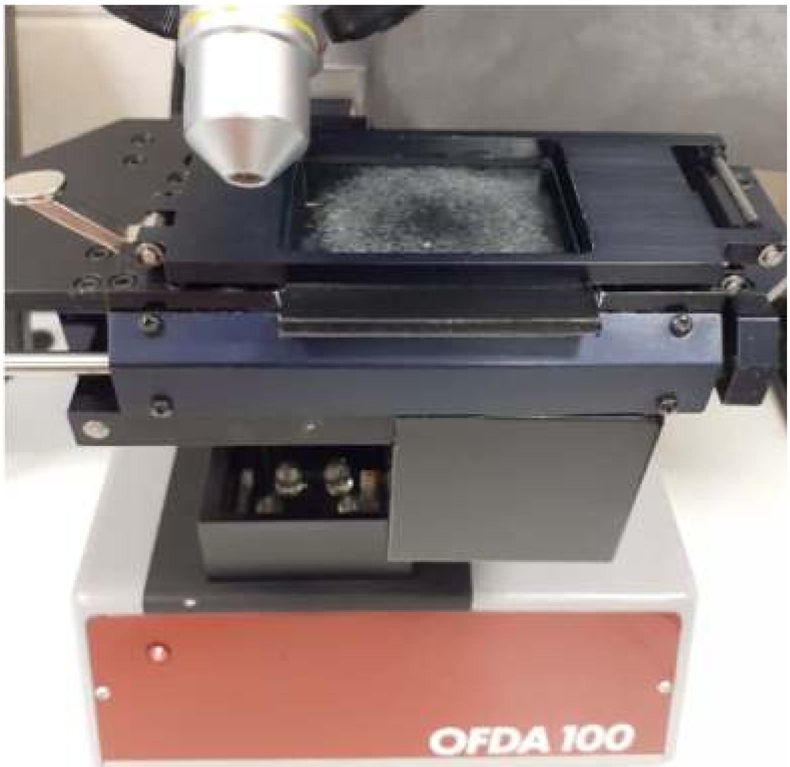
As co- products, the company produces wool open tops, wool cut tops, wool noils (in raw white and bleached), as well as wool grease- lanolin. Lanolin is the natural fat of the wool fiber and is extracted in the process of scouring the greasy wool. It is used in the cosmetic and pharmaceutical industries.

Description of the technological process: 1.Dissolving and blending the greasy wool, 2. Scouring line: Soaking, Actual scouring (this is where the lanolin extraction takes place), Rinsing, Drying, 3. Oiling with lubricant, 4. Carding, 5. Gilling and oiling with antistatic- 1st, 2-nd and 3-rd passage, 6. Combing, 7. Gilling, 8. Bumps press, 9. Packing

Quality Control Plan

Procedures for performing laboratory analyses: Average length measurement, Measurement of average fineness-OFDA and Air-Flow, Wool sliver weight measurement,

pH measurement, Measuring the evenness of the wool sliver, Moisture content measurement, cleanliness control - presence of slubs and neps, as well vegetable material, Control for the presence of colored, medulated and kemps fibers, Determination of fat content by the Soxhlet method, Measure the color of the wool tops, Determining the concentration of Hydrogen Peroxide during bleaching, Ash content.



Moisture contents in lanolin, also acid value, free fatti acid value.

By implementing a quality control system and maintaining standards such as OEKO- TEX, EU Ecolabel, GOTS, RWS, Inditex and Interwoollabs, our organization strives to satisfy the expectations of all customers.

Keywords: greasy wool, lanolin, wool slivers, quality control, certificates

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ANALYSIS OF THE POSSIBILITIES FOR EFFECTIVE USE OF TEXTILE RESOURCES

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Abstract: The textile sector is one of the significant environmental pollutants. It uses a lot of raw materials and leaves piles of textile waste around the world. Their accumulation is becoming a global problem, and their elimination is one of humanity's biggest challenges. The 10% of carbon emissions, released into the atmosphere, is due to the fashion industry, and to the finishing treatments (dyeing, laundry, etc.) - about 20% of the pollution of fresh water in the world. Annually in Bulgaria, 170 thousand tonnes of waste from old clothes and shoes are "created" as a result of fast fashion, over-consumption, shorter clothing life, global population increase, and affordable clothing prices [1,2,3]. More than 60% of modern clothing contains synthetic fibers that are not bio-decomposed. They have a long breakdown period and fall into nature forming huge piles of waste, and in the water spaces – microfibers [6]. The purchased new clothes in the EU reach quantities of 6.4 million tonnes a year. For the last 25 years, one person's purchased clothes have grown by 40%. The average consumer today buys 60% more clothes and uses them 50% shorter time than 15 years ago [2,7]. Textile waste in the EU-27 and Europe is expected to increase from 7.0-7.5 million tonnes in 2020 to 8.5-9.0 (gross) in 2030 [8]. Textile waste can be seen as industrial and waste of life, respectively generated in the production of textile products and in their consumption by humans. Denim products are the most widespread in the world and at the same time some of the most mass textile waste. They are also the most preferred used processing items in a new type of products. Unique new products are sewn from old denim clothing to extend the „life" of textile material and reduce domestic waste.

This study analyzes the possibilities for the effective use of textile resources. A technology for prolonging the life cycle of textile material fabric \"denim\" is proposed through re-use as a new product: a sports bag has been created from jeans. The parts of the jeans are processed in a way that the minimum loss from the fabric remains. The pockets of jeans are sewn like pockets of the bag without modification. Thus, the decorative threads are saved and the consumption of threads was reduced.

Keywords: textile, reuse, denim, new clothes, sport bag.

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