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INVESTIGATION OF THE PROPERTIES OF FELT FOR THE MANUFACTURE OF OUTERWEAR

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Abstract. When designing felted products, the issues of choosing the design, forms, decorative solutions, and additional materials remain unresolved. Due to mainly artisanal production, there are no methods for predicting properties. In the manufacture of outerwear, these issues are resolved only in terms of ensuring physical and mechanical properties.

The main requirements for outerwear made of felt are:
- preservation of the shape and properties of the product when exposed to the external environment;
- the ability to provide care for the product during operation.

The production of felt outerwear based on the analysis of experimental data on changes in properties during the manufacture, operation and care of the product is relevant.

The purpose of the article is to study the properties of felt to provide the required operational characteristics. The construction and technology of outerwear and felt must be designedы to meet the required условиям operating conditions.

The article suggests using experimental methods for studying the physical and mechanical properties of felt, methods for analyzing and synthesizing the processes of designing and manufacturing clothing, and obtaining new informationй about the operational properties of outerwear made of felt with silk.

Keywords: felting, fibero, silk, wool, surface density, outerwear, hats, nun's wool, breaking elongation, non-woven fabric.

Felt is a non- woven textile fabric made from wool fibers, with high bending and tear

resistance. Despite the fact that it is one of the oldest, most widely used and convenient materials, the manufacturing technology has not changed much. Prolonged physical exposure is the first and still relevant по сегодняшний день method of producing felt.

Felting is an invention of nomads, the most ancient textile manufacturing technique on Earth, which has entered the global culture. Archaeologists date the appearance of the first felted products to 8000 years of age, its production belongs to the earliest and most universal types of domestic industry. For centuries, this unusual material has served the nomadic peoples of the Earth, helping them survive in the most difficult climate conditions of the steppes and mountains. Over time, felting began to be used for making clothes and shoes. Large felting workshops appeared. In the mid-19th and early 20th centuries, felting presses and felting machines were invented. Felling was carried out by squeezing and rolling wool or by mechanical action of special needles that tangled wool fibers.

Unique, environmentally friendly, versatile, with the potential to improve felt attracts the attention of technologists, designers, fabric artists, designers, fashion designers all over the world. And this attention is not only an interest in reviving and promoting the traditional craft of making felt, but also an economic interest. Today, more and more young people are joining the business of felt, despite the great work that its production requires.

There are three technologies for making felt:

- flat technology used to produce details of clothing, carpets, panels, materials for yurts, blankets;
- seamless method or hollow shape technology, which involves cutting out the solid frame of a clothing model or, most often, small products that are covered with combed wool, and the felting process is carried out in the same way;
- volumetric technology allows you to make spherical objects – balls, fruit dummies, toys.

Wool is the only fiber that has rollability. It is caused by a combination of scaliness of the wool, which creates an unequal coefficient of friction (greater in the direction of the root than the tip of the hair) and contributes to the directional movement of the fibers, and elasticity, which allows the fibers to intertwine and then contract under mechanical action in conditions of humidity, temperature and acidic or alkaline environment, which makes it possible to When rolling, the product shrinks over the area. This increases the density and strength of the product. The maximum density created by the roller is 0.55 g / cm3 (the density of the sole of felt boots is 0.42 g/cm3). A further increase in density causes the product to fall apart due to the rupture of overstressed fibers.

All operations are performed manually, because automation, although it saves time, but it is more harmful, in particular, by breaking off the hairs, thereby reducing the strength. For

knowledgeable people, automation is a real source of evil for felt production. In addition, handmade items are always in price, and there is always a demand for them.

Almost all nonwovens, including felt, can be given various properties with the help of additives: antistatic properties, UV resistance, hydrophobicity, hydrophilicity, increase and decrease vapor and water permeability, paint in any color, apply a drawing without problems, perform embossing.

And the assortment of felt products, the advantage of which is naturalness, is very diverse. There are markets for souvenirs, products, and felt clothing both inside and outside the country. In terms of the quantity and quality of products made from felt, the scope of their application, it can rightly be called unique. It is made from:

- both designer and outdoor clothing, which provides high thermal insulation properties;
- hats – in summer they protect from the sun, in winter-from the cold (bath caps – they are easier to breathe under steam);
- shoes-home slippers – are almost a basic necessity and a year-round product. The ability to absorb moisture and let it pass through itself, determine the use in the manufacture of winter shoes, valenok - they are easy to walk, in, their feet "live" in them-they breathe, do not sweat and do not freeze, and the antibacterial properties of the material do not allow microorganisms to develop during long wear.;
- bags, cases, souvenirs, toys.

In the narrow segment of products made from natural raw materials, felt products occupy their proper place. Stylish and eco-friendly things are always in the price.

Felt is equally in demand in agriculture, and in medicine (as an allergen, helps in treating arthritis and heart disease; it turned out that it is useful to work with this material to children suffering from developmental delay, since there is a constant hand massage that stimulates fine motor skills of fingers), hygiene, cosmetics, construction, electronics, electronics, harness manufacturing, furniture manufacturing, mechanical engineering. Its main advantage over traditionally used materials is a pleasant appearance, ease of cutting, and the absence of allergic reactions when in contact with human skin.

For a long time, felt consisted only of wool fibers. In recent years, the use of additional fibers and fabrics has become widespread. The addition of felt additional fibers, fabrics, and threads to felt, the most common of which is silk, improves its consumer and aesthetic properties [3].

During an experiment Simonyan A.A., consisting of 6 experiments, the felt part was modified by introducing an additional layer of silk material into the canvas over four layers of wool fibers. And the force at uniaxial stretching of the sample before breaking and the relative elongation at break were studied. Factors such as the surface density of felt and the surface

density of silk material were also changed. The variations in the factors of the same age group are shown in Table 1.

Table 1. Levels of variation of factors

Factors	**Variation levels**			**Variation interval**
	-1	**0**	**+1**	
Surface density of silk, dens., g/ m2	190	205	220	15
Number of felt layers, N.	4	5	6	1

The levels of variation were: - surface density of felt Ms from 220 to 380 g / m" with an interval of 80g/m2; - surface density of silk M (dv)5 from 15 to 21 g / m with an interval of 3g/ m2.

The results of experiments on the breaking load and elongation at break of two samples of felt with different surface densities in combination with two different types of silk are presented in Table 2.

Table 2. Results of tests for breaking load and elongation at break of felt samples

№	**Full name**	**Sample**	**Breaking load**	**Elongation at break**	**Surface density**
1	Felt 1	1	12,5	53	220
		2	13	61	
		3	12,5	62	
		mid.mean	12.67	58.67	
2	Felt 1 Silk 1	1	15	78	235
		2	14,5	76	
		3	14,5	77	
		mid.mean	14.67	77	
3	felt 1 silk 2	1	31	81	241
		2	35	92	
		3	35,5	92	
		mid.mean	33.83	89.33	
		1	26	77	

4	Felt 2	2	25	86	380
		3	22	70	
		mid.mean	24,33	77,67	
5	Felt 2 Silk 1	1	35	90	395
		2	34	95	
		3	31	90	
		mid.mean	33,33	91,67	
6	felt 2 silk 2	1	33	90	401
		2	33,5	95	
		3	33	90	
		mid.mean	33,17	91,67	

Analysis of the properties of parts made of felt with additionalми materials, carried по out as a result of experiments, showed that the, presence of a layer of silk material in felt has a significant effect on its physical and mechanical properties.

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