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**PRODUCTION OF A HIGH-VOLUME COMBINED
YARN WITH THE USE OF HIGH FREQUENCY
CURRENTS**

**ПРОИЗВОДСТВО ВЫСОКООБЪЕМНОЙ
КОМБИНИРОВАННОЙ ПРЯЖИ С
ИСПОЛЬЗОВАНИЕМ ТОКОВ СВЕРХВЫСОКОЙ
ЧАСТОТЫ**

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Ключевые слова: пряжа, степень объёмности, СВЧ, объём, усадка.

Abstract. The aim of the research is to develop a new technology for producing high-volume yarns using microwave currents. In the research experiments on increase of volume of the combined yarn are conducted, results of researches show increase in volume of a yarn in 1.5-3 times.

Аннотация. Целью проводимых исследований является разработка новой технологии получения высокообъёмной пряжи с использованием токов СВЧ. В

работе проведены эксперименты по повышению объёмности комбинированной пряжи, результаты исследований показывают увеличение объёмности пряжи в 1,5-3 раза.

At present, much attention is paid to reducing the material consumption of textiles. There is a huge demand for the production of yarns and yarns with increased volume, as well as having good physical and mechanical properties. A promising direction in obtaining high-volume yarns and fibres is the use of a complex chemical high-shrinkage yarn as the core, and woolen, nitron fiber as coating material, as well as their mixtures [1, p. 143]. The use of modern technologies, such as microwave treatment, will allow for a deeper and even warming of textile materials, accelerate the process of heat treatment and reduce its energy intensity. The aim of the research is to influence the microwave currents to increase the volume and properties of the yarn after the heat treatment process.

As the core of the combined yarn, a complex polyester yarn was used with a linear density of 9.4 tex to 16.8 tex, with a linear shrinkage of up to 40% obtained at OJSC "SvetlogorskKhimvolokno" (Svetlogorsk, Republic of Belarus). As a covering material we used a half wool roving of a linear density of 1200 tex obtained at OJSC "Polesie" (Pinsk, Republic of Belarus).

The methodology for carrying out studies of the process of increasing the volume of combined yarns, of various linear densities using microwave electromagnetic waves, consisted of the following stages [2, p. 9-16.]:

1. Preparation of samples in accordance with GOST 6611.0 - 73.
2. Moistening of combined high-shrinkage yarns to excess moisture content.
3. Squeeze to a residual moisture content of 100-300%.
4. Microwave processing for given modes.
5. Determination of sample volume.

After the heat treatment of the combined yarn, the high-shrink component shrinks. The low-shrink component twists high-shrinkage, which gives the combined yarn properties such as increased volume and fluffiness, and also reduces the bulk weight. Table 1 presents the results of experiments to increase the volume of the combined yarn using electromagnetic microwave currents.

Table 1 – Results of experiments to increase the volume of the combined yarn with the use of electromagnetic microwave currents

	Combined aerodynamic yarn after heat treatment by microwave currents			
Microwave power, Vt	Linear density, tex	Shrinkage, %	Diameter, mm	Volume, cm^3/g
300	54	10	0.560	4.56
450	58	14	0.583	4.6
600	63	17	0.630	4.94
850	69	19	0.663	5.01
1000	73	23	0.705	5.34

Also, the results of the least squares experiments yielded a regression model of shrinkage dependence on the initial moisture content, microwave power, and treatment time [3, p. 207]:

$$s = \frac{\tau \cdot P \cdot W}{((2,20 \cdot \tau + 193) \cdot (-0,197 \cdot P - 17) \cdot (0,515 \cdot 10^{-3} \cdot W - 5,08))}, \quad (1)$$

where: S – relative shrinkage,%;

τ – heat treatment time, sec;

P – Radiation power, W;

W – Relative humidity of samples before heat treatment,%.

As a result of the conducted studies, it was found that the use of a complex high-shrink chemical thread in yarns allows to obtain specific properties of yarn, such as high shrinkage of 15-25% and increased volume of 150-200% of volume to moisture-heat treatment. Application of microwave currents makes it possible to reduce the time of moisture-heat treatment by 1.5-2 times compared to the usual wet-heat treatment applied at JSC “Polesie” (Pinsk, Republic of Belarus), which will increase the volume of output and reduce energy costs.

The resulting knitted fabric, which has both softness and extensibility, reduced material consumption due to the use of the resulting combined yarn with increased volume. These properties will significantly expand the range of knitwear products.

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