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**CHITORELIDZE, IRMA R.**

**DEVELOPMENT OF TECHNOLOGICAL PROCESSES OF THE COMBINED YARN  
RECEPTION**

Specialty: 05.19.03 – Technology of Textile Materials

**THE AUTHOR'S ABSTRACT**  
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Dissertational work is executed on faculty «**Technology, Equipment, and Merchandising of the Textile Industry**» of the **Kutaisi Niko Mushelishvili State Technical University (KSTU)**.

The supervisor of studies:

**BAKURADZE, EMIRI I.**

Doctor of Technical Sciences, Full Professor

The scientific adviser:

**GOGOLADZE, MAQVALA SH.**

Candidate of Technical Sciences, Associate Professor

Official opponents:

**BUADZE, ELIZAVETA P.**

Doctor of Technical Sciences, Full Professor

**RATIANI, NINELI I.**

Candidate of Technical Sciences, Associate Professor  
Academic of Engineering Academy, Head of Research  
Institute of Textile Manufacturing of Georgia

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**The address:** TsSU, Building 1, auditory 101. 98 Akhlagzrdobis Gamziri.  
4614, Kutaisi, GEORGIA.

**Acquaintance with the Dissertation is possible at the Librarian of the TsSU.**

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Academic Secretary of the Dissertational Board

Candidate of Technical Sciences, Associate Professor **OTSKHELI, VALERY N.**

## **GENERAL CHARACTERISTIC OF WORK**

**Urgency of work.** Prospects of the textile industry development, basically, depend on creation of new kinds of raw material with new properties, improvements of existing properties,

searches of new technologies and their introduction. In the specified direction, the set of works of industrial and research character is on a global scale carried out.

Occurrence in industrial sphere of each new kind of raw material and materials causes revolutionary changes in set of industries and technique. Therefore the positive results received in this direction, despite of small perspectives of their use now, as a whole for branch will have rather important value.

Practice shows, that for textile materials, especially technical purpose, it is important to project and develop them by selection of raw material with the certain qualitative characteristics that is rather actual problem by manufacture of these materials.

The sphere of use of the composite materials made on a textile basis, in connection with uniqueness of their properties, includes any industry and technics from manufacture of children's toys up to used in space engineering.

Proceeding from above-stated, dissertational work on a theme: «Development of technological processes of the combined yarn reception», devoted to reception of the combined yarn and strings with new properties from the cotton, woolen and artificial fibres intended for specific goals, on various installations of the textile industry, are rather actual.

**Subject and problematics of research** are means and methods of technical and technological perfection of ways of the combined yarn and threads reception on modernized pneumomechanical and mechanical spinning-torsional machines that is especially actual for development of a textile material of technical purpose. The theoretical questions arising at designing pneumomechanical of the spinning-torsional machine, in particular, geometrical parameters of the chamber of the pneumomechanical spinning machine, forming a tape as a stream of fibres, in view of technological conditions, are also studied.

**The purpose and tasks of research.** The purpose of work is development of formation process on pneumomechanical and mechanical spinning-torsional machines, with the help of the new technologies, the combined threads having new structure and composition, with use of natural and artificial fibres; increase of their physical, mechanical, consumer, and operational properties; development of recommendations for manufacturing of various kinds of textile materials of household and technical purpose.

The primary task of work is development and use of new technologies for various kinds of the modernized textile installations for what it is necessary:

- Research of an opportunity of the combined yarn and threads reception on pneumomechanical and mechanical spinning-torsional machines;
- Scientific-theoretical substantiation of an opportunity of reception of the combined yarn and threads of new structure with use of cotton, woolen, artificial fibers and spandex - the elastic strings;

- Achievement of technologically optimum value of a tension of the combined yarn and threads by selection of a relative positioning on pneumomechanical spinning-torsional machine the conveying channel and yarn leading-out cone;
- Reduction of a useless tension and breakage at formation of the combined yarn with use of the developed method of friction coefficient determination and selection of speed of a yarn output;
- Modernization of the equipment assembly units forming a shell at manufacturing of combined threads of new structure;
- Development of textile materials with use of the combined yarn and threads.

**Methods of research.** For the decision of the problems put by us methods of mathematical modelling, optimization and applied mechanics, textile aerodynamics, a basis electrotensometry, and methods of spinning have been used.

For research of structure and physic mechanical properties of a yarn and threads apparatus OMCT, Uster device, oscillographs TY-1M, tenso-amplifier YT4-1 have been used.

The method of experiment planning has been used. Experimental data were processed by methods of mathematical statistics with application of a personal computer.

**Object of research** is process of formation of the combined yarn and threads, and also textile production produced from them with new structure, in particular, fabrics and the composites received on their base.

**Scientific novelty:**

- Formation technology of the combined hybrid and homogeneous threads and yarn on the pneumomechanical and mechanical spinning-torsional machines;
- The textile material of technical purpose from the combined yarn and threads of new structure (a fabric, hand-rails of escalator, etc.) is developed;
- Adhesive properties of the fabric received from new threads of axial and shell structure, generated with use spandex are investigated;
- The new method of determination of friction factor at movement of a yarn is offered;
- The new technology of manufacturing of a qualitative threads with the raised strength containing up to 15 % of a kapron fibre and natural fibres of a rough wool together with tow of combing machines is developed;
- The increase in productivity of machines is achieved.

**The positions which are born on protection:**

- Methods of development of the combined yarn and threads of new structure with use of a cotton, wool, artificial fibres and spandex;
- Results of research of properties of raw material of new structure and the textile materials produced from them;

- Mathematical models of technologies of manufacturing of raw material with new structure;
- Scientific, technical and economic results of introduction of new technologies;
- Modernization of units mechanical and pneumomechanical spinning-torsional machines for manufacturing of the combined homogeneous and hybrid threads with reference to the developed technologies.

**Reliability and validity of results.** Reliability of theoretical and practical results submitted in work is provided with use during research of modern methods, installations and devices. The received results do not contradict theoretical bases and the positions existing in technologies of textile manufacture on a global scale. The offered new technologies and their practical realization develop and enrich results of the researches received by different scientists.

**Practical value.** Theoretical and experimental researches results of formation of the combined yarn and threads of new structure on pneumomechanical and mechanical spinning-torsional machines enable:

- Increases of labour productivity in 2...2,5 times;
- Increases in a zone of service in 2 times;
- Reduction the first cost of the produced materials in 2 times.

**Realization of results.** The new technology of manufacturing of the combined yarn and threads of a various origin and linear density has been developed in the Industrial-Technological Laboratory of Textile Industry of the KSTU. With use of the received raw material experimental samples of hosiery and fabrics of household and technical purpose have been produced. The technical fabric of special purpose has been transferred to Kutaisi joint-stock company "Dyne" for use in a composite rubber woven material.

**Approbation.** The basic results of the dissertational work have been submitted and considered on the II International Scientific-Technical Conference of KSTU and on the chair «Technology, Equipment, and Merchandising of the Textile Industry» of the KSTU (2004-2006); at session of advice of Technological Faculty of the KSTU (2006).

**Publications.** On a theme of the dissertation it is published 6 scientific articles.

**Structure and volume.** Dissertational work will consist of the introduction, four chapters, the basic conclusions and the appendix. Work contains 111 pages of the computer text 19 tables 40 figures and the list of the used literature from 83 titles.

## **THE BASIC CONCLUSIONS**

1. The new technology of manufacturing of a qualitative threads with the raised strength from waste products of a wool with addition of chemical fibres on pneumomechanical on the spinning-torsional machine is developed.

2. The technology is developed and introduced, allowing to increase productivity of the machine almost in 2 times due to increase in durability of a yarn and speed of its release.
3. Technologically optimum values of the form of the combined yarn and a tension of a threads are provided due to regulation of a relative positioning of the conveying channel and yarn leading-out cone on pneumomechanical spinning-torsional machine.
4. Dependence between a tension of a threads and number of revolutions of the chamber is experimentally determined at various designs cone.
5. Dependences between physic mechanical properties of the combined yarn and parameters of the machine are experimentally established; it is shown, that they have a polynomial kind.
6. The technology providing reception of the combined threads of axial and shell structure of various linear density on the modernized spinning-torsional machine ПК-100 is developed.
7. For the first time technical purpose textile materials with the raised adhesive effect, for example, handhold of the escalator of underground, with use of the offered threads of axial and shell structures are produced.

**SUBSTANTIVE PROVISIONS OF DISSERTATIONAL WORK ARE REFLECTED  
IN THE FOLLOWING WORKS:**

1. Chitorelidze, I. Production of the combined yarn a method of pneumomechanical spinning. / Works of the KSTU, № 1 (10). – Kutaisi: Sakartvelo, 2002. – p. 97-98 (in Georgian).
2. Chitorelidze, I.; Gogoladze, M. Research of process of formation крученой а yarn. / Works of the KSTU, № 2 (11). – Kutaisi: Sakartvelo, 2002. – p. 14-16 (in Georgian).
3. Chitorelidze, I.; Gogoladze, M. Determination of geometrical parameters spinning-torsional machines the equipment. / Works of the KSTU works КГТУ, № 2 (11). – Kutaisi: Sakartvelo, 2002. – p. 16-18 (in Georgian).
4. Gogoladze, M., Bakuradze, E., Chitorelidze, I. Balancing influence of spinning chamrer is a one of the most actual question of pneumomechanics spinning. / Works of the KSTU works КГТУ, № 2 (13). – Kutaisi: Sakartvelo, 2004. – p. 142-144 (in Georgian).
5. Gogoladze, M.; Chitorelidze, I.; Bakuradze, K. Research of process of torsion at pneumomechanical spinning. / Works of the KSTU works КГТУ, № 1 (14). – Kutaisi: Sakartvelo, 2004. – p. 132-135 (in Georgian).
6. Chitorelidze, I. Determination of friction factor of a yarn at its movement on a surface./ Works of the KSTU, № 2 (15). – Kutaisi: Sakartvelo, 2004. – p. 170-175 (in Georgian).