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Oksana DMYTRYK, Svitlana BOBROVA,
Liudmyla HALAVSKA
Kyiv National University of Technologies and Design, Ukraine

STUDY OF FACTORS INFLUENCING LOSS OF STRENGTH OF HIGH MOLECULAR WEIGHT POLYETHYLENE THREADS

Purpose. *To investigate the influence of the number of threads resisting to break, the griping length, and the change in the position of the interlacing point when researching the breaking characteristics of complex polyethylene threads in the form of a loop.*

Keywords: *complex polyethylene thread, breaking load, breaking elongation, thread strength, loop break, protective textile material.*

Objectives. High-strength polyethylene threads, due to their physical and mechanical characteristics, are widely used in the production of protective textile materials to provide protection against mechanical damage to piercing and cutting objects, for comfortable operating conditions of the product.

In the process of processing on knitting equipment and weaving into the structure of the knitted fabric, complex polyethylene threads bend around working bodies with a small radius of curvature, are subjected to bending and friction, which further leads to the destruction of individual filaments and loss of strength of the original complex thread. In the process of power loads on the knitted structure, the thread is first redistributed from the sinker and needle of the loop arcs to the legs of loops when stretched along the length and vice versa from legs of loops to the needle and sinker of the loop arcs when stretched along the width. As a result, the knitwear lengthens in the direction of stretching. Upon completion of the redistribution of the thread under the action of the tensile force, the straightened sections of the threads in the knitwear structure begin to resist the breaking load, in particular at the points of weaving of the threads in the loops.

The authors of [1] investigated the strength of the threads after their processing on knitting equipment in the form of a rectilinear segment in a griping length of 500 mm according to the standard technique, as well as a loop formed from two mutually intertwined threads with a change in the angle of coverage of the threads. The different wrap angle allows you to simulate the load on the threads

in the structure of the knitted fabric when it is stretched. However, the authors use in their research the types of raw materials traditional for the knitwear industry.

In work [2], the author presents the discontinuous characteristics of super-strong raw materials, in wet and dry conditions, in the form of a straight-line segment, with an imitation of a loop and a knot. This made it possible to assess the heterogeneity of the structure of the threads, to reveal the changes that occur in the threads during their processing into a textile material.

Determination of the factors affecting the loss of strength of a complex polyethylene thread will allow, in the future, at the stage of designing knitwear using the developed 3D models of its structure in computer modeling systems, to provide for the loss of its strength under the action of a breaking force.

Methodology. For this research, an experimental method was used to determine the breaking characteristics of high molecular weight polyethylene threads on a tensile testing machine WDW-5ES in accordance with DSTU ISO 2062: 2004 [3].

Research results. Simulation of the knitwear rupture process using the developed 3D models of its structure in computer modeling systems presupposes a preliminary process of studying the behavior of threads under the action of force loads and studying the factors that affect its strength when tensile forces are applied. For this purpose, experimental researches were carried out to determine the influence of the griping value, the number of threads that resist breaking, and the conditions of threading (a straight piece of thread or loop) on the breaking characteristics of complex multifilament polyethylene threads. In the course of the research, the griping length was changed from 25 mm to 300 mm and, with a constant griping length (100 mm), the location of the point of weaving of the threads in relation to the lower and upper grips was changed. It should be noted that the breaking performance is influenced by the griping value. In the range from 25 mm to 100 mm, the breaking force increases. And then it decreases. At the same time, with an increase in the griping value, the relative breaking elongation decreases, which can be explained by a decrease in the breaking load per unit length of the thread segment.

When conducting researches of the breaking characteristics of threads in the form of a loop, two pieces of threads were threaded into the grips of the machine in such a way that an imitation of the weave point, which is characteristic of the structure of knitwear, was formed. In this case, the weave point in the loop was

located at a distance of 75, 50, and 25 mm from the movable grip with a griping length of 100 mm (Fig. 4). This makes it possible to analyze how the magnitude of the breaking force and elongation changes with a change in the position of the weave point in relation to the movable grip.

The displacement of the weave point from the movable grip to the immovable grip leads to a decrease in the braking force value, which is explained by a decrease in the shoulder of application of force in relation to the section of the loop of the lower grip, that is, the force per unit length of the segment of thread in the loop of the upper grip increases. In this case, the elongation at break increases.

Conclusion. The tensile performance of a complex polyethylene thread is influenced by both the griping length and the location of the weave point when looping tests. The magnitude of the specific breaking force when conducting research with a loop is greater than when researching straight segments of the thread. This can be explained by the parallelism and compaction of the filaments due to the presence of an interlacing point on the segment that rests on the rupture of the thread.

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