OPTIMUM THREAD SPEED WHEN APPLYING GLUE FOR THE PRODUCTION OF FLOCKED YARN

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https://doi.org/10.5281/zenodo.10974912

Abstract. *Analysis of experimental data carried out on a computer showed a fairly good adequacy of the proposed description. Moreover, the proposed formula turned out to be equally good for describing the process of gluing both with and without the use of a special knife.*

Keywords: *connecting threads, adhesive layer, core thread, shaft, knife, experiment.*

Introduction. A similar nature of the dependence is observed when using a special knife, but the position of the maximum in this case is shifted to the region of lower speeds. This phenomenon, apparently, can be explained by the fact that the thread in this case takes away all the glue brought by the shaft. Then it is clear that with an even greater increase in the speed of its movement, there is “not enough glue” for it, and its thickness decreases [1].

Flocked yarns are used for the production of pile fabrics, non-woven and knitted fabrics for furniture, decorative and upholstery purposes (for covering the seats of vehicles - especially cars), carpets, drapes, clothing items and other products.

Materials and products made from such a thread combine high wear resistance with an attractive appearance, and the volumetric structure (flocked thread) provides good water and air permeability, sound and thermal insulation, moisture absorption; combinations of these properties for a specific thread are achievable with the appropriate selection of components: core thread, flock, glue [2].

In electro-flocking technology in particular for the production of flocked yarn, the method and design of the drying chamber has an extremely strong influence on the productivity and energy consumption of the line.

The most suitable method for curing the binder on flocked yarn is, apparently, the drying method using IR radiation [3].

To obtain an empirical formula describing that part of the curve, which, due to the above, we attributed to the region of “high” thread speeds, it should be taken into account that the amount of glue oscillating on the shaft is inversely proportional to its rotation speed. Then we can assume that the following nature of the dependence takes place:

$$V = C/v. \qquad (1)$$

when: C - proportionality coefficient;

v – shaft rotation speed, (m/min).

If we express the shaft rotation frequency, similar to the formula

$$f = \frac{1}{\pi D} \left(\frac{K}{\gamma} - 1 \right) V \qquad (2)$$

when: f – rotation speed of the glue application shaft, (rpm);

D – diameter of the glue roller, m;

γ – adhesive layer on thread, (mg/m);

$$К = 1535 \pm 35 \text{ mg/m.}$$

to (2), we get:

$$f = \frac{C}{\pi D}\frac{1}{\gamma V} - 1 \qquad (3)$$

MATERIALS AND METHODS

The resulting formula (3) is very simple and convenient for determining the rotation speed of the gluing roller, which must be set in order to obtain a given adhesive layer at a known speed of movement of the threads V.

Analysis of experimental data carried out on a computer showed a fairly good adequacy of the proposed description. [4]. Moreover, the proposed formula turned out to be equally good for describing the process of gluing both with and without the use of a special knife. In these cases, the formula differs only in the value of the coefficient C. Its value without using a knife:

$$C_1 = (3{,}5 \pm 0{,}3) * 10^5, \quad \left(\frac{mg*m}{min^2}\right);$$

and with the use of a knife

$$C_2 = (2{,}04 \pm 0{,}15) * 10^5, \quad \left(\frac{mg*m}{min^2}\right)$$

Results

To calculate using formula (3) using coefficients C1 and C2, it is necessary to substitute the diameter of the shaft D in m, the speed of movement of the threads V in m/min, and the linear density of the adhesive layer γ in mg/m, then the required frequency of the adhesive roller will be obtained in rpm.

As mentioned earlier, one of the fairly convenient ways to reduce the thickness of the adhesive layer on threads while maintaining the possibility of its adjustment is to install a special knife that removes part of the adhesive layer from the shaft [5].

Computer calculations using the least squares method showed that when using a knife, the same dependence can be used to describe the process, but with a different value of the coefficient K (see Fig. 1). In this particular case it turned out to be equal to:

$$K = 1410 + 100 \text{ (mg/m).}$$

Discussion.

The somewhat larger error in this case is probably explained by the fact that without special tools it is extremely difficult to re-install the knife into a position identical to the previous one.
Dependence of the linear density of the adhesive layer on the value τ = V/(v+V), calculated using the least squares method for the case of applying glue with a knife.

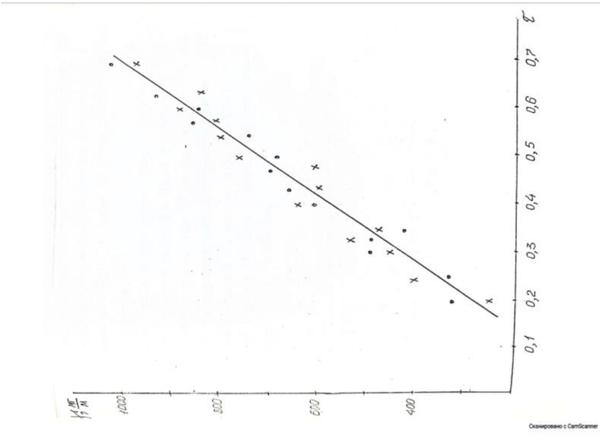

Figure 1. Dependence of the linear density of the adhesive layer.

Conclusion.

Thus, the resulting empirical formula allows, having a set of coefficients for different knife positions, to easily calculate the necessary parameters within its field of application.

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