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# ANALYSIS OF ROLLING ON THE EDGES OF AN ASSEMBLY DOUBLED USING THERMOFUSION

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***Abstract*****:** *In this paper we analyze an undesirable effect that appeared as a result of the thermal or humidothermal thermofusion operation, due to the incorrect choice and use of the thermofusion parameters, the angle of overlap of the warp threads of the two materials (in the case of a chemicalized weaved insertion), or, most commonly, due to the incompatibility of the shrinkage percentage of the chemicalized insertion with the percentage of shrinkage of the base material. Thus, a twisting effect of the edges of the assembly, consisting of the base material and the insert with adhesive, may appear (especially for fused parts with a small surface). The twisting edge may be towards the chemicalized insert, in this case being considered positive, when the percentage of shrinkage is greater in the insert, and can be considered negative when the twisting is towards the base material, when this has a contraction rate higher than the insertion. In fused assemblies - base material and adhesive chemicalized insert - with large surfaces, the difference between the contraction percentage of the coated insert and the base material manifests itself in the form of bubbles, which can be observed better during rolling or handling of the material while performing certain work operations. In contrast to fused assemblies with small surfaces, for which the difference in the percentage of contraction is observed immediately, for fused assemblies with large surfaces, this difference is observed during manipulations in technological processing, during wearing, or after cleaning.*

***Key words:*** *contraction percentage, humidothermal treatment, thermofusing, chemicalized insert, twisting, flaking, differential contraction*

## 1. INTRODUCTION

The paper examines the issue related to one of the thermal processes specific to the textile industry, namely, the heat fusing process, where, under optimum conditions, it is necessary for the treated materials to have resistance to high temperatures such that under cooling polymer modifications should be reversible [1] .

## 2. GENERAL INFORMATION

The undesirable phenomena related to the differentiated contraction of thermal materials are conditioned, besides the improper choice of the thermofusion parameters, also by the selection of a qualitatively unsuitable insertion, basic material, product or destination. The tendency for twisting the edges of parts of textile garments, due to the method of doubling the base material with a chemicalized insert, manifests itself under these conditions as an undesirable effect [2,3].

This phenomenon, called twisting, bending, or shrivelling, is more pronounced in small-surface thermofused assemblies. In certain variants of heat treatment, this unwanted phenomenon is so obvious that the assembly becomes twisted in the shape of a pipe. For large parts, the differentiated contraction manifests itself in the form of bubbles.

In this paper we highlight some results obtained on systems doubled by thermofusing, where the directions of the warp threads of the two materials coincide [4,5].

### 2.1. Methodology. Results

For the assessment run, thermofused samples were used in the form of a disc with an area of 100 cm². After conditioning in standard atmosphere (φ = 65 % and T = 20 ± 2°C), the samples were moistened until reaching a mass of 150 % of the initial mass, then the excess moisture was removed using filter paper. The drying was carried out in the oven at a temperature of 100 - 150 °C for 60 minutes.

In order to measure the twisting phenomenon, it is necessary to measure the geometric shape of the sample in the process of wetting - drying [5].

The geometric form can be measured across the twisting radius or across the surface of the projection of the sample. The measurement of the twisting as an unwanted effect after thermofusing was made by measuring the projection of the twisted sample.

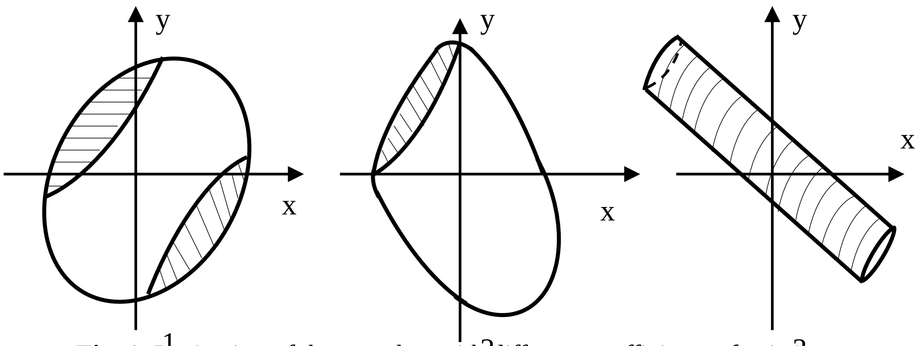


***Fig. 1.*** *Projection of the samples, with different coefficients of twisting.*

The surface of samples of various shapes was determined by planimetry and the intensity of its twist was expressed mathematically by the coefficient of rotation K.

$$K=S/S_0 \quad (1)$$

where: S – represents the surface of the projection of the material disk, after twisting (cm²);
$S_0$ – represents the initial surface of the sample which is 100 cm².

Experimental research has shown that the value of the coefficient for most textile systems ranges from 0.2 to 1. Systems with a coefficient $K < 0.5$ are considered unstable systems. A value of the coefficient between 0.5 and 0.8 represents moderately stable systems, and those with a coefficient value $K > 0.8$ are stable systems that do not exhibit an essential deviation from the circle shape.

The twist is positive when it is toward the chemicalized insert (the chemicalized insert has a higher contraction coefficient than the base material) and is considered negative when it is toward the outer layer (base material contracts more than the chemicalized insertion layer) [5] .

The intensity of the twist is in accordance with the thickness of the base material layer.

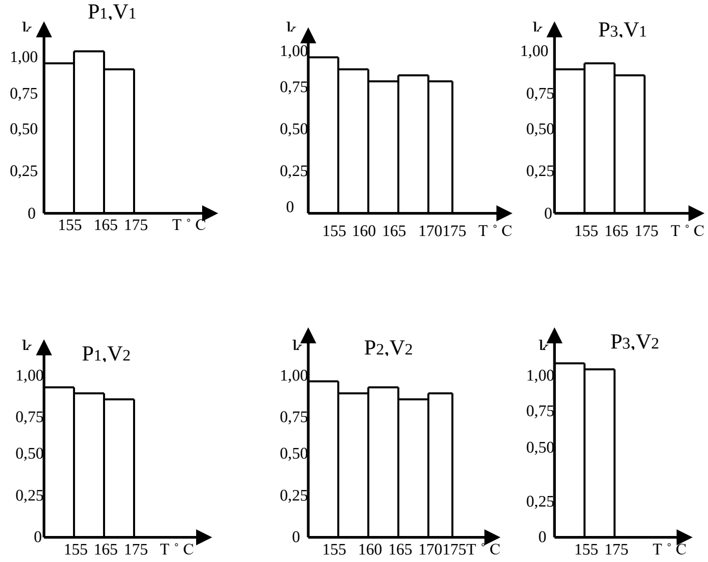


***Fig.2.*** *The relation between the twist coefficient, the thickness of the base material and the parameters of the thermofusing operation [6]*

The thinner the fabric of the base layer, the the less it opposes the contraction of the insertion. Experiments were conducted on contractions along the warp ($C_u$) and weft directions ($C_u$) in the basic material, and in the chemicalized insert, respectively [6] .

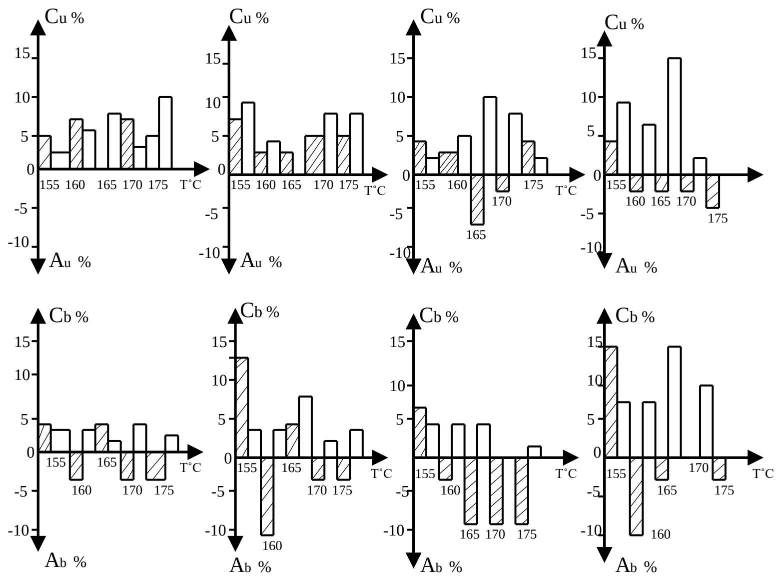


***Fig. 3.*** *Experimental data obtained from the analysis of contractions in the U and B directions of the two thermofused materials [6]*

The hashed portion corresponds to the base material, and the unhashed portion corresponds to the insert with thermoadhesive [6].

## 3. CONCLUSIONS

Considering the experiments and the obtained results, the following conclusions can be drawn:

- At a suitable choice of the thermofusion parameters, as well as a correct correlation of the particularities of the materials in the system, the value of the twisting coefficient K is higher than 0.8, the system being considered stable, without an essential deviation of the shape from the disc;
- Keeping the pressure (P) constant and varying the treatment time or speed (V) of movement of the system in the treatment area, or maintaining a constant speed and varying the pressure,
the value of coefficient K changes essentially for the temperatures of 155 °C, 165 °C and 175 °C;
- By analyzing the results it can be concluded that in these cases, the optimal parameters of thermofusion corresponds to the values: T = 165 °C; V = 30 m/min; P = 3.5 bar.
- The contraction of the materials in the system is 2.27% for the base material and 0% for the insertion with thermoadhesive. The differential contraction coefficient is 0.9708, the system being considered stable. The groups of treatment parameters are chosen so that this condition is met.

The combination of variants is inexhaustible, because the sensitivity of the materials to the thermal and humidothermal treatments can be noticed even from the laboratory phase, on the basis of which appropriate settings for treatment parameters are selected .

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