THE INFLUENCE OF ASSEMBLIES ON THE PERFORMANCE OF KNITTED MATERIALS INTENDED FOR SPORTSWEAR

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EXTENDED ABSTRACT

Key Words: Knitted fabric, Polyester, Hand, Bonding, Sewing

1. INTRODUCTION

Assuring the comfort of wearer′s body is one of the most important functions required to sportswear products. Knitted fabrics should demonstrate excellent elasticity as well as feature with perfect hand ensuring the softness and smoothness for the inner garment surface.
The aim of this research was to evaluate the influence of assemblies on the hand property of knitted fabrics.

2. MATERIALS AND METHODS

2.1 Materials

Knitted fabrics selected for hand testing are suitable for the manufacture of active sportswear using both adhesive bonding and sewing technology. Tests were performed with eight commercially available knitted fabrics mainly composed of polyester fibers (PES) with a small amount of elastane (EL) (Table 1). Fabric surface density was determined according to the standard LST EN 12127. The determination of both course and wale densities of knitted fabrics was done according to the standard EN ISO 14971.

Table 1. Characteristics of the investigated knitted fabrics

Fabric code	Knıt type	Fibre content	Course / Wale density, cm^{-1}	Surface density, g/m^2	Thickness δ, mm at 0.5 kPa pressure / at 2.5 kPa pressure
K1	Interlock	96 % PES, 4 % EL	(18.0±0.5) / (22.0±0.5)	251.6±2.0	0.89 / 0.82
K2	Plain jersey	84 % PES, 16 % EL	(21.0±0.5) / (33.0±0.5)	218.8±2.0	0.67 / 0.59
K3	Plain jersey	90 % PES, 10 % EL	(14.0±0.5) / (28.0±0.5)	235.5±1.8	0.54 /0.51
K4	Plain knitted	87 % PES, 13 % EL	(22.0±0.5) / (27.0±0.5)	254.0±4.0	0.59 / 0.57
K5	Warp knitted	80 % PES, 20 % EL	(30.0±0.5) / (47.0±0.5)	218.0±2.1	0.45 / 0.40
K6	Plain jersey	81 %, PES, 9 % EL	(19.0±0.5) / (20.0±0.5)	207.1±4.9	0.90 / 0.76
K7	Plain jersey	80 % PES, 20 % EL	(20.0±0.5) / (23.0±0.5)	262.3±2.5	0.67 / 0.64
K8	Plain jersey	82 % PES, 18 % EL	(20.0±0.5) / (26.0±0.5)	195.0±5.0	0.60/ 0.54

2.2 Testing methods

Hand tests were carried out with control textile specimens as well as with assembled ones after the application of both bonding and sewing. Bonds were laminated applying polyurethane thermo-adhesive film of 0.175 mm thickness and 8 mm width at 5.6 kPa pressure at 140˚C temperature for 40 s duration. Seams were sewn with (607) covering chain stitches and (512) over edge chain stitches. The prepared disc-shaped specimens of 56.5 mm

radius were cut from both control and assembled samples and were conditioned according to the standard LST EN ISO 139 in the standard atmosphere conditions.
The device KTU-Griff-Tester [1-4] (Figure 1) which was fixed in the clamps of a computerized CRE type machine H10KT was used to investigate objectively the changes in textile hand due to its assembling into a garment.

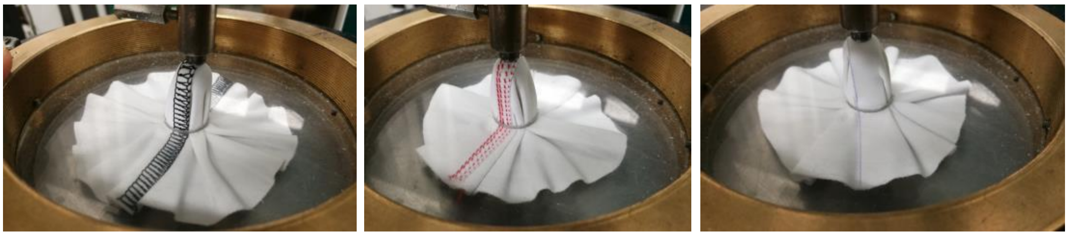

Figure 1. General views of hand test applying the device KTU-Griff-Tester

For the evaluation of the influence of assemblies on knitted fabric hand, the five different parameters were determined: maximum pulling force F_{max} (N), the tangent of the slope angle of typical pulling curve $tg\alpha$, pulling work A (N·cm), deformation at the end of pulling process H_{max} (mm), and the difference of the textile thicknesses determined at two different pressures $\Delta\delta$ (%). From these parameters the complex hand criterion Q was calculated [2].

3. RESULTS AND DISCUSSION

During hand testing the pulling curve *H-F* was registered. The values of the hand parameters F_{max}, $tg\alpha$, A and H_{max} were determined from the typical pulling curves. The pulling work the value of which is equal to the area occupied by the curve *H–F* is the only parameter that evaluates fabric resistance to pulling and depends on fabric deformation H_{max} [2].
The pulling work varies from 1.216 (K5) up to 3.438 (K8) for the control specimens. The pulling work for (512) sewn seams has increased from 5.5 % for PES plain knitted fabric containing 18 % EL up to 44.2 % for PES interlock knitted fabric containing 4 % EL compared with the control ones (Figure 2). Changes in the pulling work for (512) sewn seams were higher than for both (607) stitch seams and bonds. The pulling work varied from 1.314 (K5) up to 3.335 (K8) for the (607) sewn seams and for the bonded seams – varied from 1.136 (K5) up to 3.382 (K8).

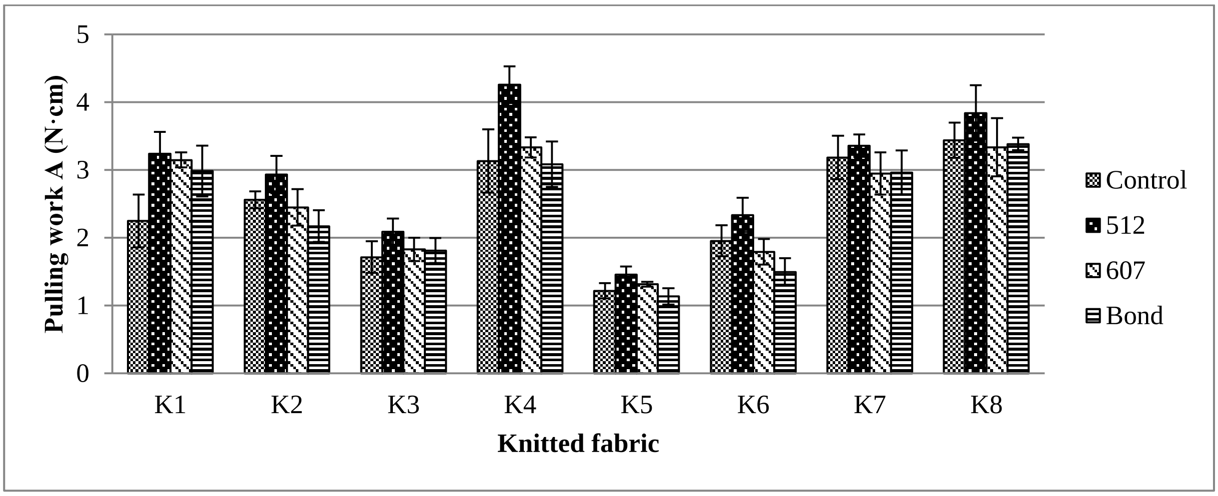

Figure 2. Pulling work *A* of the investigated knitted fabrics

The maximum pulling deformation, the pulling work, the tangent of slope angle, and the maximum pulling force describes only the certain aspects of textile hand. The complex hand criterion *Q* expresses completely fabric tactile and wearing properties not only of textiles, but and their assemblies (Figure 3) [2].

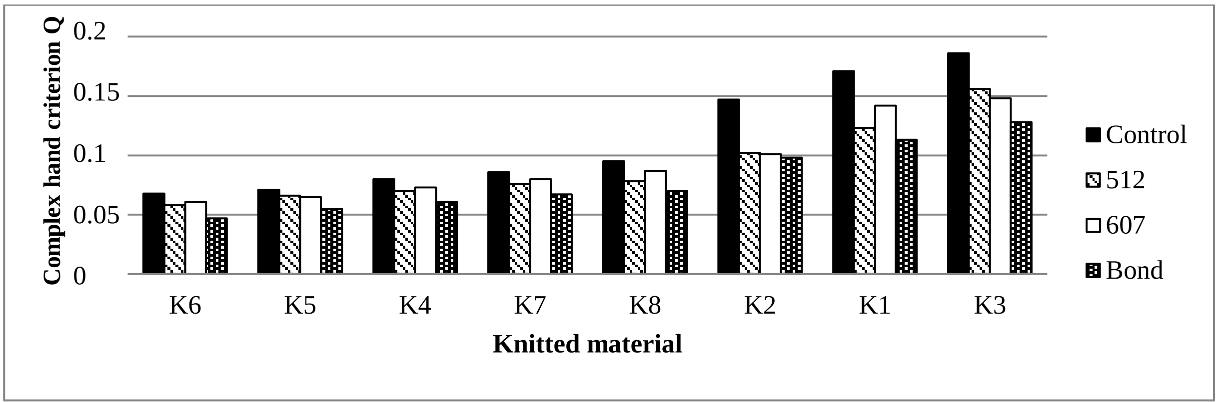

Figure 3. Complex hand criterion *Q* of the investigated knitted fabrics and their assemblies

The complex hand criterion *Q* varied from 0.068 (K6) up to 0.186 (K3) for the control specimens. For the (512) overedge chain seams it varied from 0.058 (K4) up to 0.156 (K2). The complex hand criterion *Q* varied from 0.061 (K6) up to 0.148 (K2) for the (607) covering chain seams. The complex criterion *Q* for the bonded seams varied from 0.047 (K4) up to 0.128 (K2), and it decreased from 5.6 % (K5) up to 42.7 % (K1) compared with the control specimen.

K6 plain jersey knitted polyester fabric containing 6 % elastane fiber was determined having the best hand (*Q* = 0.068) (Figure 3). The worst complex hand criterion *Q* was determined for the K3 plain jersey knitted material containing 10 % elastane fibre (Q = 0.186).

4. CONCLUSION

Research results revealed that the fabric assemblies make a significant influence on textile hand and influence its deterioration dependently on both textile structure and assembly type. Based on the determined results, it was shown that the hand of joined textiles is worse than one of the control specimens.

5. REFERENCES

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