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STUDY OF UNCONVENTIONAL TEXTILES USED AS INSERTION FOR CLOTHES IN TERMS OF ITS DYNAMIC TENSILE STREGHT

OANA Dorina [1], OANA Ioan-Pavel[1], KENYERES Florentina[1]

[1]University of Oradea, Romania, Department of Textiles – Leatherwork and Industrial Management in Faculty of Energy Engineering and Industrial Management, Str. B.Şt Delavrancea nr.4, 410087, Oradea, Bihor, Romania, E-mail:textile@uoradea.ro

Corresponding author: Oana. Ioan-Pavel, E-mail: oanaioanpavel@yahoo.com

Abstract: *Unconventional textiles are manufactured different from those obtained by the classic spinning weaving and knitting. They are obtained by mechanical or chemical consolidation of a textile backing up of fibrous layers or combinations of layers of fiber and yarn, fabrics and yarns, fabrics or knitted fabrics and fibers.*
For the apparel industry has expanded the use of unconventional fabrics especially in auxiliary materials they replace traditional materials such as woven tassel and buckram.
Application of reinforcement layers have very important role in increasing the stability of form and material exploitation basic characteristics.
Using unconventional fabrics used as insertions for clothing presents a desosibit advantage in terms of possible replacement joints bonded by heat sealed seam, thus saving time and using technology more accessible.
For unconventional fabrics used as auxiliaries in the apparel industry is usually determined flexural stiffness, tensile strength, resistance to repeated stretches but more efficient in terms of proximity to the real conditions of the clothing is dynamic tensile resistance.
Unconventional textile materials have a certain anisotropy in terms of the performed measurements. So, we followed the conducted research to highlight the anisotropy of several samples and characterization of best of unconventional materials in this regard, to be used under conditions effective as clothing industry.

Key words: anisotropy, coefficient of variation, clothing, dispersion, bulk density.

1. INTRODUCTION

Article 1 contains 75% polyester fibers, 1.5 dtex / 38mm and 25% adhesive solution Romacril LN2 [1, 2]. In Table 1 are shown the average weight, average thickness and bulk density.

Table 1. *Average values of mass determinations, the average thickness and bulk density.*

Number of determinations	Di [g]	Mi=ni/0.01 [g/m^2]	D [mm]	T=M/d [kg/m^2]
1	0.2676	26,76	0.33	81.09
2	0.2612	26.12	0.33	79.15
3	0.2651	26.51	0.345	76.84
4	0.2700	27	0.36	75
5	0.2920	29.2	0.36	81.1
6	0.2613	26.13	0.338	77.307
7	0.2643	16.43	0.34	77.73
8	0.2537	25.37	0.35	72.48
9	0.2620	26.2	0.332	78.91
10	0.2912	29.12	0.351	82.96
	-	26.88	0.3436	78.25

After we obtained an average mass determinations of the article of 1 26,98g / m2. To determine the coefficient of variation we require the following amounts:

T^2- dispersion

$$T^2 = \frac{\sum(Mi - M)}{n-1} \quad (1)$$

T – the standard deviation

$$T^2 = \sqrt{T^2} \quad (2)$$

$$T^2 = \frac{\sum(Mi - M)}{n-1} = 1{,}2758$$

$$T \quad = \frac{\sum(Mi - M)2}{n-1} = 1{,}295$$

The coefficient of variation: Cv = 4,202%

Article 2 is an unconventional textile reinforced with curable powder respectively a copolyamide thermo ADEROM. [1] The weight, thickness and apparent density are shown in Table 2.

Table 2 *The values of average mass determinations, average thickness and bulk density.*

Number of determinations	Di [g]	Mi=ni/0.01 [g/m^2]	D [mm]	T=M/d [kg/m^2]
1	0,3692	36,92	0,351	105,18
2	0,3702	37,02	0,362	102,2
3	0,3631	36,31	0,35	103,7
4	0,3602	36,02	0,37	97,35
5	0,3326	33,26	0,35	95,02
6	0,3512	35,12	0,35	100,3
7	0,3441	34,41	0,358	96,11
8	0,3156	31,56	0,35	90,17
9	0,3500	35	0,361	96,95
10	0,3405	34,05	0,35	97,28
		34,96	0,3551	98,44

The dispersion - $T \quad = \frac{\sum(Mi-M)2}{n-1} = 1{,}7204$

The standard deviation T$= \sqrt{T^2} = 1{,}3116$

The coefficient of variation is Cv=3,75%

It was observed that the article 2 we have a coefficient of variation of mass lower than for Article 1, so it can be concluded that it has a better uniformity in terms of unconventional fabric and adhesive.

Submission of ADEROM polyamide thermal adhesive powders can be traced in the technological process adopted in Figure 1.[3]

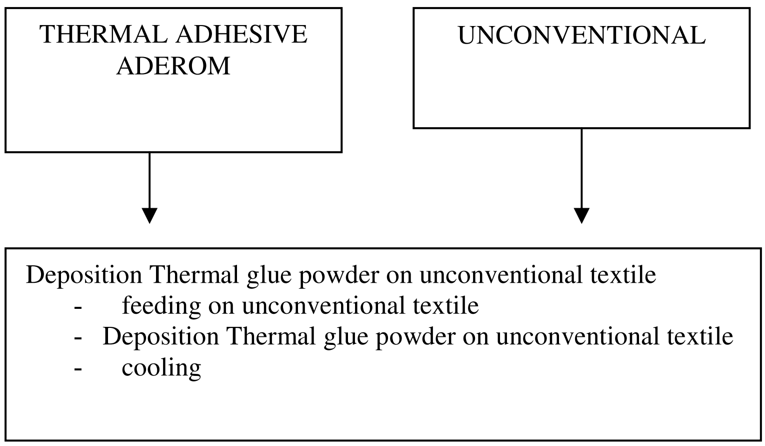

Fig. 1: *The technological process*

Article 3 is a PULVOTEX type 4 with a low mass per unit area. Realizing some samples of 10/10 cm, can cause weight variation, thickness and bulk density, then calculating the coefficient of variation for determining masses m^2.

***Table 3:** The average mass determinations, the average thickness and bulk density*

Number of determinations	Di [g]	Mi=ni/0.01 [g/m^2]	D [mm]	T=M/d [kg/m^2]
1	0,3310	33,1	0,31	100,32
2	0,3318	33,18	0,301	110,2
3	0,3414	33,14	0,33	103,4
4	0,3135	33,35	0,3342	91,66
5	0,3546	33,46	0,296	119,7
6	0,3302	33,02	0,302	109,3
7	0,3251	33,51	0,34	98,55
8	0,3354	33,54	0,35	95,82
9	0,3209	33,09	0,31	103,5
10	0,3422	33,22	0,31	110,38
		33,16	0,317	104,31

The dispersion - $T = \frac{\Sigma(Mi-M)2}{n-1} = 1{,}3468$

The standard deviation $T=\sqrt{T^2} = 1{,}1605$

The coefficient of variation is Cv=3,499%

Comparing the three coefficients of variation observed that Article 3 presents the lowest coefficient of variation, so the homogeneous spreading of the adhesive on the surface unconventional, so by filing a pasty adhesive to obtain a homogeneous mass insertion. [4,5,6]

2. THE DYNAMIC TENSILE TESTING OF UNCONVENTIONAL MATERIALS

2.1 The dynamic tensile test of unconventional material in Article 1

Respecting operating mode, we obtain the following values for the angle β, for an angle $\alpha=88^0$

Table 4: The dynamic tension values obtained for Article 1

Nr.det/dir	0^0-180^0	30^0-120^0	60^0-240^0	90^0-270^0	120^0-300^0	150^0-330^0
1	83	85,5	86,5	85,5	85,5	85
2	84	86	86,3	85,2	85	84,5
3	83,5	86,5	86	85	85	83,8
4	85	84,5	86,6	87	85,2	84,6
5	84	86	86,2	85	85,1	85,5

The obtained values shown in Table 4 will calculate the work in dynamic tensile rupture stress values summarized in Table 5.

$$W_u = G \cdot R(\cos\beta - \cos\alpha)[Nm] \tag{3}$$

G=42,63 N, R=0,22 m, $\alpha=88^0$

***Table 5:** The values for the mechanical work at rupture of dynamic tensile stress*

Nr.det/dir	0^0-180^0	30^0-120^0	60^0-240^0	90^0-270^0	120^0-300^0	150^0-330^0
1	8,18156	0,408	0,2452	0,4085	0,4085	0,49008
2	0,65301	0,326	0,2779	0,4576	0,49008	0,5155
3	0,7343	0,245	0,3269	0,326	0,49008	0,6855
4	0,49008	0,515	0,1962	0,1635	0,4576	0,5552
5	0,65301	0,3269	0,2964	0,3269	0,3105	0,4085
Wu	0,6692	0,3749	0,2789	0,3347	0,4313	0,53309
T^2	0,0145	0,0104	0,024	0,0119	0,0056	0,0103
T	0,1207	0,1022	0,0498	0,1093	0,0753	0,1017
Cv	18,03%	27,26%	17,85%	32,65%	17,45%	19,07%

It is noted that resistance is best 0-1800 direction because we have the lowest coefficient of variation of the directions that have the highest values of mechanical work 0-180 and 150-330 respectively at rupture. By drawing polar diagram there is a relatively uniform distribution in all directions, therefore a relatively low degree of anisotropy.

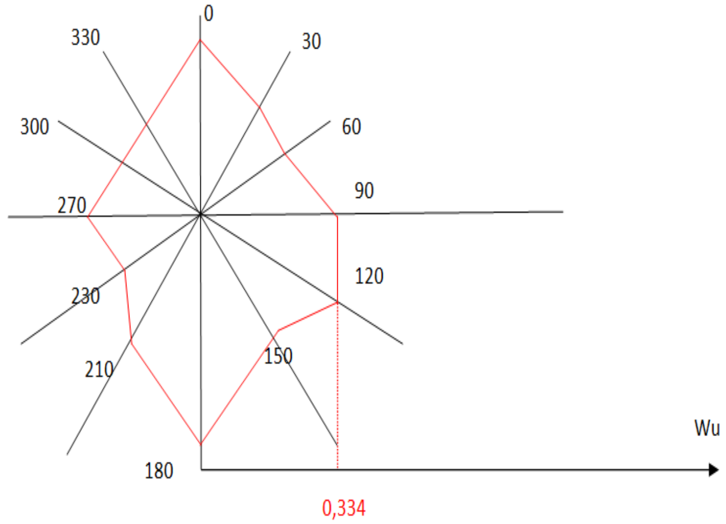

Fig.2: *The polar diagram for Article 1*

2.2 The tensile test of unconventional dynamic material for Article 2

Applying the same procedure as in Article 1, we obtain values for the angle β, for the same angle $\alpha=88^0$ previously determined.

Table 6: *Values for the angle β*

nr.det/dir	0^0-180^0	30^0-120^0	60^0-240^0	90^0-270^0	120^0-300^0	150^0-330^0
1	82	86	86,2	86,9	87,2	86
2	79,5	86,5	86,5	87	87	85,9
3	80	86	87	86,4	86,2	87
4	79,5	86,6	86	87	86,5	86,1
5	83	87	86,7	87,1	87	86

The obtained values will calculate the mechanical work at rupture for the dynamic tensile stress, the values are summarized in Table 7.

Table 7: *The values of mechanical work at ruptures for dynamic tensile loads*

nr.det/dir	0^0-180^0	30^0-120^0	60^0-240^0	90^0-270^0	120^0-300^0	150^0-330^0
1	0,9779	0,3269	0,2942	0,1917	0,1308	0,3269
2	1,38	0,2452	0,2452	0,1635	0,1635	0,3432
3	0,32	0,3269	0,1635	0,2789	0,2942	0,1632
4	1,3818	0,2288	0,3269	0,1635	0,2452	0,3105
5	0,8156	0,1635	0,2125	0,1471	0,1635	0,3269
Wu	1,17	0,2582	0,2484	0,188	0,1944	0,3942
T^2	0,0673	0,0048	0,036	0,0012	0,036	0,0043
T	0,2595	0,0697	0,0606	0,0354	0,0606	0,0662
Cv	22,14%	26,99	24,39	18,7	30,3	22,5

As for Article 1 the best tensile strength is the direction 00-1800 which is relatively high compared to the resistance in other directions because of the way thermoadhesive powder deposition and the targeting of unconventional textile fiber support structure [7]. By drawing polar diagram is observed that increased anisotropy compared to Article 1 the distribution on the 6 nominal ways of dynamic tensile strength is less homogeneous.

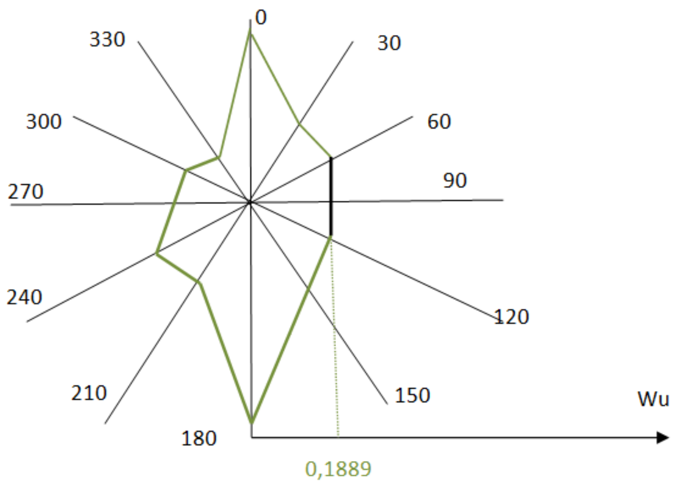

Fig.3: *The polar diagram for Article 2*

2.3 Testing the dynamic unconventional material at tensile for Article 3

Applying the same procedure as in Article 1 and 2, we obtain values for the angle β, α = 880 for the same angle previously determined.

Table 8: *Value for the angle β*

nr.det/dir	0^0-180^0	30^0-120^0	60^0-240^0	90^0-270^0	120^0-300^0	150^0-330^0
1	61	86	86,1	87	87,8	86
2	60,2	86,8	86	86	88	85
3	61	86,2	86,3	86,8	87	84,8
4	60,8	86,5	86,5	86,7	87,3	86,1
5	62	87	86,3	86,4	87,5	86,2

With the values obtained will calculate the mechanical work for rupture for dynamic tensile stress values are summarized in Table 9.

Table 9: *Values for the mechanical work to rupture of dynamic tensile stress*

nr.det/dir	0^0-180^0	30^0-120^0	60^0-240^0	90^0-270^0	120^0-300^0	150^0-330^0
1	4,219	0,3269	0,3105	0,1635	0,0327	0,3269
2	4,333	0,1962	0,3269	0,2452	0	0,49008
3	4,219	0,2942	0,2779	0,1962	0,1635	0,5439
4	4,24	0,2452	0,2452	0,2125	0,1144	0,3105
5	4,075	0,1635	0,2779	0,2615	0,0817	0,2942
Wu	4,217	0,2452	0,2876	0,2157	0,0784	0,3897
T^2	0,0068	0,0045	0,008	0,0012	0,0033	0,0096
T	0,82	0,067	0,0284	0,0348	0,05798	0,0982
Cv	1,95%	27,47%	9,9%	%	73,9%	25,2%

It is noted that the best direction is the direction 00-1800 and also a minimum of resistance in the direction 120-300. Also 00-1800 direction is very small and the coefficient of variation so this will be a priority direction used for inserts used in protective clothing and products that can be frequently subjected to various stresses. Tracing polar diagram there is an uneven distribution of the 6 directions nominal maximum and minimum values very remote, article showing a high degree of unevenness thus large anisotropy.

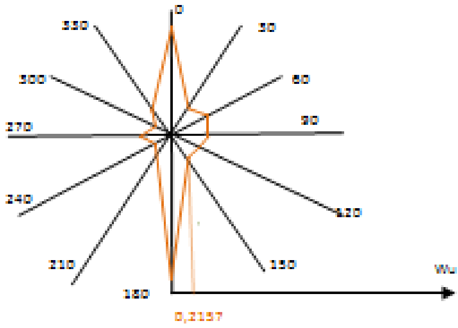

Fig.4: *The polar diagram for Article 3*

3. CONCLUSIONS

The analysis of polar diagrams made from measurements performed can be seen that there are some directions for dynamic tensile strength value is high. Although it is unusual that the deposition thermal resistance of materials to grow adhesives are directions in which the resistance value falls below the average resistance of Article 1 300-1200 oblique directions; 1200-3000; 150-3300 900-2700 transverse direction. This is explained by the fact that the fibers are mainly oriented in the longitudinal direction and supported thermoadhesive unconventional arrangement when it is subjected to dynamic traction, the emergence of lines of least resistance through the points of submission of thermal adhesives.

Article 3 is noted for extreme values, reaching both maximum and minimum tensile strength as dynamic, characterized by a high degree of anisotropy. Its use in the apparel industry would be recommended only if it can be used only 00-1800 direction that is where we have a very high dynamic tensile strength. Although consumption of material would be quite high due respect this direction, it is recommended especially for outdoor clothing products intended for manners that the circumstances in which it carries, are frequently subjected to various stresses that act very quickly.

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