Annals of DAAAM for 2010 & Proceedings of the 21st International DAAAM Symposium, Volume 21, No. 1, ISSN 1726-9679
ISBN 978-3-901509-73-5, Editor B. Katalinic, Published by DAAAM International, Vienna, Austria, EU, 2010
Make Harmony Between Technology and Nature, and Your Mind will Fly Free as a Bird
Annals of DAAAM International

RESEARCHES REGARDING THE USING NEW TEXTILE PARTS IN THE AUTOMOTIVE INDUSTRY

COMAN, D[iana]; NEAGU, I[oan] I.; VLAD, D[orin] & MATRAN, C[ristian]

Abstract: *The aim of the present work was the study of the properties modification of automotive textiles in order to improve their physical and mechanical properties and to decrease the contraction capacity of the material, as well. The present paper relates various investigations for textile such as airbags which are complex products that could be manufactured using polyester or other chemical yarns - with new structural properties instead of polyamide yarns. There is a comparison between different types of yarns using standards belongs to the automotive industry.*
The paper proposes an approach of different automotive textiles currently or possible used and tested by their specific characteristics.
Key words: *performance, polyester, polyamide, yarns, physical and mechanical properties*

1. INTRODUCTION

From a large variety of raw materials used for airbags, the most used is a nylon 6.6 fabric. This isn't a surprising thing because it has some special characteristics. The most recent researches on different raw materials indicate the possibility to use polyester yarns.
The key factors of development and the airbag's success are:

- to maximize the protection of vehicles passengers and to reduce the hurt risk;
- the performances;
- the impact absorbtion capacity;
- the energy absorbtion and the hardness;
- the stability over time;
- the cost benefit.

Airbags, used as safety devices, are one of the latest types of textiles in automobiles and have a potential market for technical textiles that has a considerable scope for growth and development. Because of government legislation and consumer interest, the applications have been extremely successful over the last fifteen to twenty years. Generally, the airbag is woven by nylon 6,6 filament yarns, which are in demand in huge quantities because of their high strength-to-weight ratio, favorable elongation, adequate thermal properties and relatively low cost of production (Wulfhorst et all, 2006).
The aim of the present work is to investigate possibility of using alternative materials for producing such fabric bag. To fulfill its protective function, each component of the airbag system must demonstrate reliability and predictability. Essential function of the cushion, they enter a hot high pressure gas mixture, to allow safe and efficient vehicle deceleration in a collision.

The elasticity of the fabric's yarns allows controlled deformation and hot gas flow efficiency. The performances of the airbag cushion behavior are expected to remain unchanged during this period and therefore the reliability and predictability of raw materials are essential components of the original material This work is focused on textile materials consist of elements, such as: constant fireproof properties, increased superior mechanical resistances (high module, high tenacity), resistance to splice, ursting strength, resistance to delaminating, and comfort characteristics depending on the user's requirements (Coman & Neagu, 2007).

The novelty lies in the possibility of using the study of alternative materials derived from native Romanian PES threads, knowing it until now, more studies on imported synthetic materials.

2. EXPERIMENTAL

This study used PA 6.6 and PES filament yarns with different yarn counts, obtained by Romanian manufacturers.

Focused characteristics are tensile strength and extension at break. These characteristics have been measured through two testing methods according to different customers required. The conditioned samples are employed before the preparation stage technology.

The tenacity and the breaking elongation of the yarns were determined using a dynamometer type Titan2 - Universal Strength Tester, based on two standards from automotive industry: ASTM D2256 - Tensile Properties of Yarns by the Single-Strand Method and EN ISO 2062 -Yarns from packages. Determination of single-end breaking force and elongation at break. In both cases the following parameters have been met:

Jaw Separation 250.00mm, pretension 0.500cN/tex, break detection: 50.00%, specimens 20, different sppeds.

3. RESULTS AND DISCUSSION

For some time, another type of yarn for cushions of the airbag demonstrates outstanding performance, is reliable to be part of the supply of cars, such as polyester yarns. We can say that polyester materials are significantly likely to use, replacing those of nylon 6.6 yarns and that their use would be efficient and benefits, there are well-established conditions for airbag products (table 1) and for absorption of impact energy by PES materials, too (http://www.freepatentsonline.com, 2010).

Yarn	Yarn count [dtex]	Filament count [dtex]	Tenacity [cN/tex]	Elongation [%]	Fabric weight [g/cm^3]	Fabric thickness [mm]	Fabric pattern
Polyester	250-700	3.2- 4	≤ 65	≤ 20	≥190	≥ 0.30	canvas, twill, crepe
± Elastomeric coating 20 – 40 g/m^2							

Tab. 1. Opportunities for obtaining technical PES yarn fabrics airbags

Now are presented some comparative results obtained by replacing the 6.6 polyamide yarns with native polyester yarns. Tables 2 and 3 show the comparative results obtained by testing PA 6.6 and Romanian PES yarns.

Type of yarns [dtex]	Yarn Counts [dtex]	Physico-mechanical properties determined	Standards used	
			EN ISO2062	ASTM D2256
470/68	470	Tensile strength [cN]	3337	3417
		Tenacity [cN/tex]	71	72.7
		Extension [%]	25	25.3
467/74	467	Tensile strength [cN]	3955	3792
		Tenacity [cN/tex]	84.7	81,2
		Extension [%]	20	21
235/34	235	Tensile strength [cN]	2107	2100
		Tenacity [cN/tex]	89.7	89.4
		Extension [%]	23	23.5

Tab. 2. Table with some parameters of testing with fire PA 6.6 polyfilaments

Type of yarns [dtex]	Yarn Counts [dtex]	Physico-mechanical properties determined	Standards used	
			EN ISO2062	ASTM D2256
550/28/130	571	Tensile strength [cN]	3363	3386
		Tenacity [cN/tex]	58.9	59.3
		Extension [%]	26.7	28.2
470/120	468	Tensile strength [cN]	3098	3159
		Tenacity [cN/tex]	66.2	67.5
		Extension [%]	15.9	15.6
460/72	460	Tensile strength [cN]	3008	3062
		Tenacity [cN/tex]	65,4	66.58
		Extension [%]	16.01	16.04

Tab.3. Table with some parameters of testing PES yarns

In figure 1 is the graphs determinations of resistance and elongation at break for technical yarns PES local production, with similar results of PA yarns.

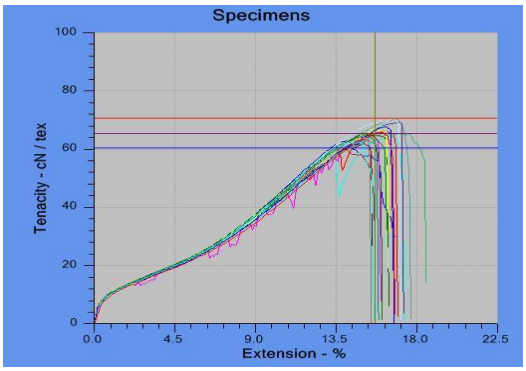

Fig. 1. Resistance and elongation at break for PES Technical yarn, 470 dtex

The features of the two types of threads are comparable, there is the possibility of replacing those (PA fabrics) with those of PES but there is a condition of absorption of fabrics, but there is a condition of absorption of impact energy by PES material (http://www2.dupont.com, 2010). In figure 2 is observed differences tenacity for different types of yarns used in experimental measurements.

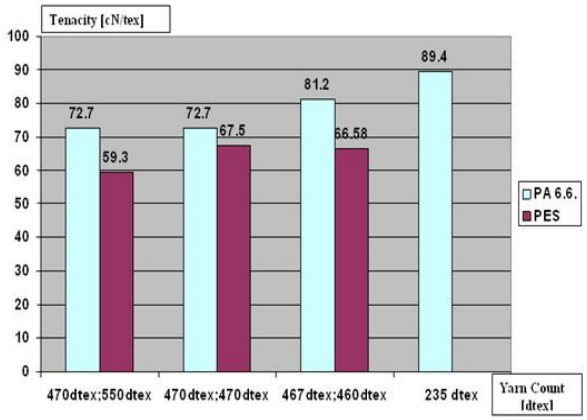

Fig. 2. Variation of tenacity for PA 6.6. and PES yarns

The comparison of both types of threads shows that polyester yarn will generally satisfy the air bag specifications established for nylon fabrics (Dragu & Coman, 2009).

4. CONCLUSIONS

The test methods have been revealed and show that the tenacity of 460 dtex and 470 dtex PES yarns presents the best fits of performance requirements of automotive components like airbags.

The following problems are the most significant:

- It is obvious that the changing the PA 6.6 yarns with native technical PES yarns, will induces some change in performance of the textile parts, resulting from modifications of tenacity and breaking elongation.
- Increased impact energy absorption characteristics due to changes in technical yarns of PES will lead to a controlled improvement of performance properties (tenacity, strength and break elongation).
- Changes in the observed performance characteristics may be attributed to the used yarns and to the obtained alternative materials.
- The use of alternative materials (PES) for airbags will be an economic and sustainable handy technique for worldwide airbag manufacturers.

The aim of further experiments will be the optimization of the physical and mechanical characteristics of the airbags raw materials in order to increase performance of these types of textiles.

5. REFERENCES

Coman D.; Neagu I. (2007). Comparative study on the testing of textile materials used in the automotive industry, *Annals of DAAAM for 2007 & Proceedings of the 18th International DAAAM Symposium "Intelligent Manufacturing & Automation: Focus on Creativity, Responsability, and Ethics of Engineers"*, Katalinic.B, (Ed.), pp 167-168. ISSN 1726-9679, ISBN 3-901509-58-5, Published by DAAAM International, 2007, Vienna

Dragu L.; Coman D., (2009). Possibilities of assessment for textile automotive structures, *Acta Universitatis Cibiniensis Technical series*, vol.LIX, 2009, pp.150-155, ISSN 1583-7149, Sibiu.

Wulfhorst, B.; Gries, T.; Veit, D. (2006). *Textile Technology*, Hanser Gardner Pubns, ISBN 1569903719, Aachen

***(2010)http://www2.dupont.com/Automotive/en_US/assets/downloads/materialssselectionairbagfabrics.pdf „Materials Selection for Airbag Fabrics., *Accessed on 2010-06-15*

***(2010)http://www.freepatentsonline.com/result.html?query_txt=polyester%2Bairbag&sort=relevance&srch=top&search, Polyester filament woven fabric for airbags, patent US 7, 498,280 B2, 2009, *Accessed on 2010-07-20.*