# DEVELOPMENT TRENDS AND POSSIBILITIES OF SPUNMELT TECHNOLOGY, SPECIAL TREATMENTS OF NONWOVENS USING SPUNLAID TECHNOLOGY

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**Abstract :**
In the last several years, we have been witness to significant growth in the area of spunmelt nonwoven textiles. Thanks to the rapid developments in the area of spinning technologies and polymers, the advantage of standard staple and short fibre nonwoven textiles, which are able to draw from a large variety of available raw fibres in a multitude of options has been eliminated.
The mentioned development has been made possible primarily thanks to the progressive nature of the market segment where these products are used (personal use products and personal hygiene products). This market is constantly developing and is one of the few markets that is not particularly sensitive to economic recessions.
Current spunbond and meltblown technologies achieve significantly higher throughput rates and allow the production of new types of nonwoven textiles in a single production step with lower cost compared to other technologies, especially carded.
Spinning systems have improved, which together with further developments in new homopolymers and copolymers have enable the production of nonwoven textiles with unique characteristics.
Spinning systems have made it possible to produce increasingly finer fibres, which has subsequently lead to reductions in the basic weight while maintaining the textile's utility characteristics.
Thanks to the BICO fibre structure, it is possible to produce bulkier and softer fibre layers.
Special copolymers allow for the shift of mechanical characteristics, for example, towards a textile's elasticity.
Thanks to new spinnable thermoplastic biopolymers, development of new nonwoven textiles with fibre content made from renewable resources has been started, offering the possibility of natural decomposition.
Development is also taking place in the area of spunlaid nonwoven textile treatments, where new demands require new methodologies, e.g. plasmatic activation of the surface.

## 1. The Nonwovens market overview

Production of nonwovens is still a very progressive textile segment for technical and hygienic applications. Particularly the hygiene market (diapers, napkins, adult incontinence products) is one of the continuously growing market segments demanding rapid innovations and very good quality. Today, the major suppliers of nonwovens for these final applications are primarily spunlaid and carded NW producers [1; 2; 3].

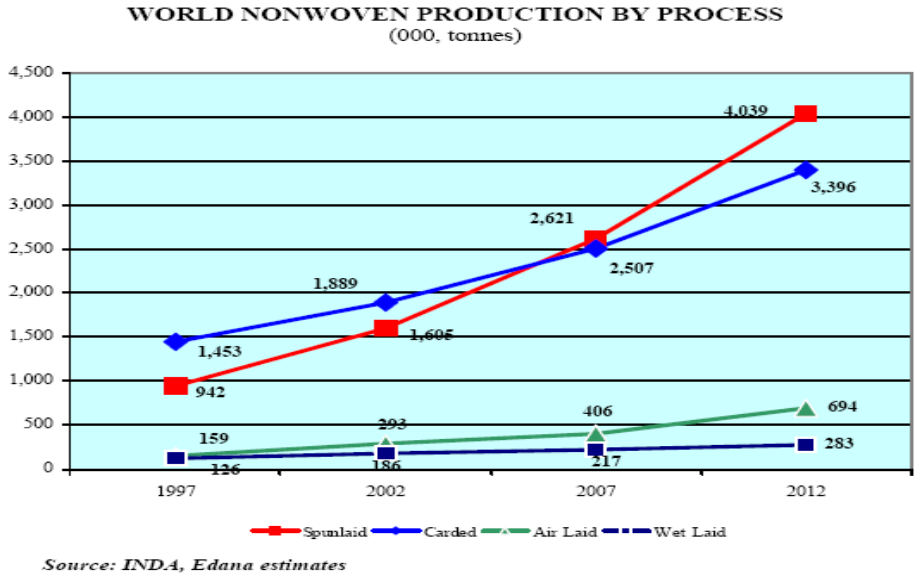


**Figure 1:** World NW production by process [3]

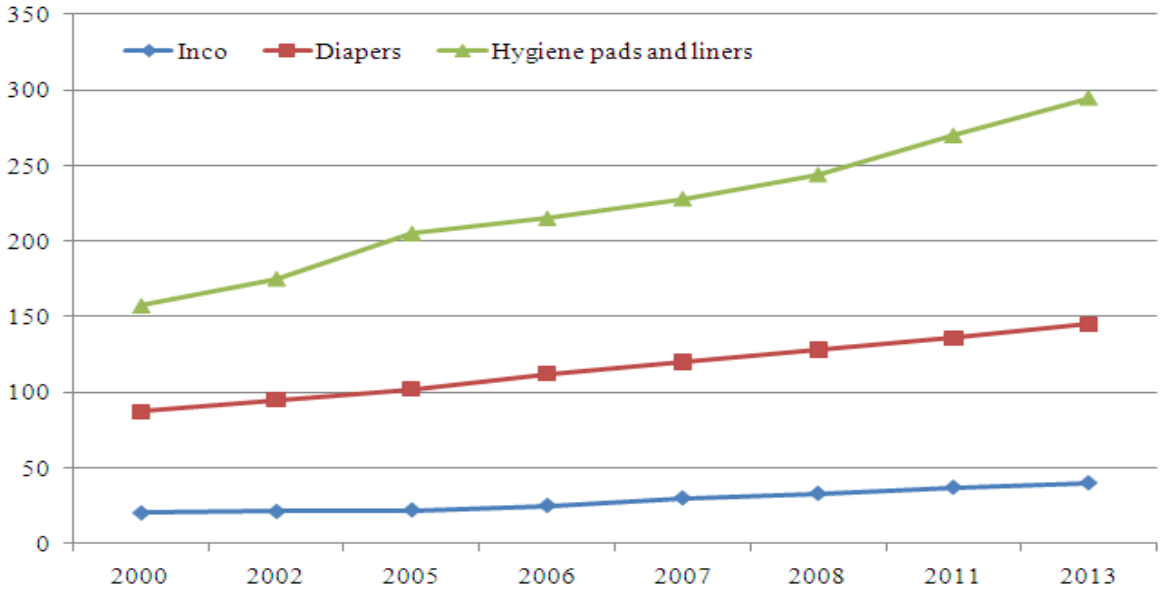


**Figure 2:** Structure of the Hygiene market [4; 5]

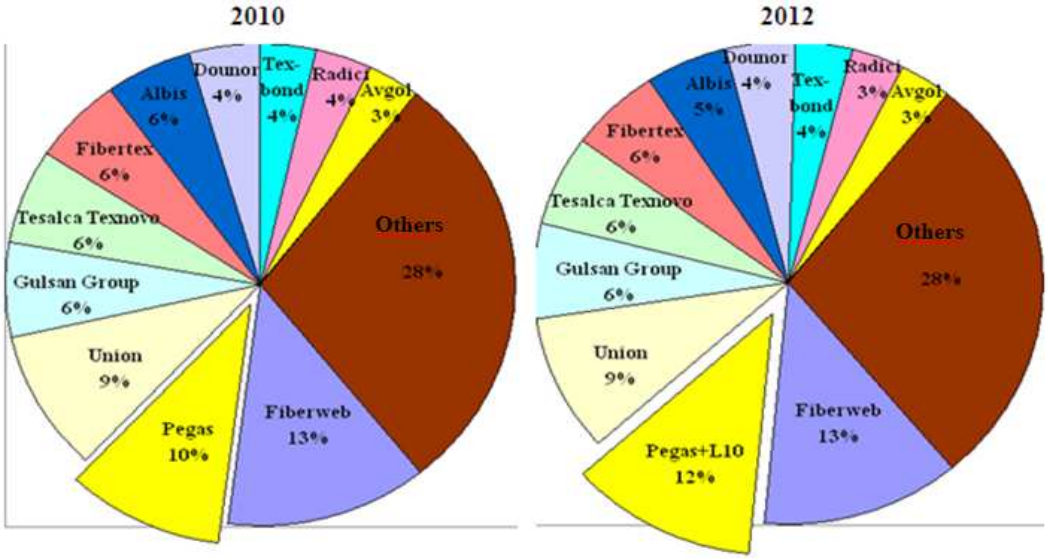


**Figure 3:** Main Spunlaid Producers – European Market Share [6; 7]

Is very obvious that the European market is very fragmented and needs a certain level of consolidation as has already occurred in other regions.

## 2. PEGAS NONWOVENS introduction

The primary activity of PEGAS NONWOVENS is the production of synthetic nonwoven textiles from polypropylene and/or polyethylene filaments. The Company's headquarters are located at Přímětická 86, Znojmo in the south of the Czech Republic, where the executive management, commercial administration and technical departments are based.

The production of nonwoven textiles is carried out at two plants, one in Znojmo – Přímětice and the other in Bučovice.

PEGAS is Europe's No.2 manufacturer of spunmelt PP/PE-based nonwovens:

- Two production facilities in the Czech Republic
- 70kT capacity in 2009, BiCo capacity 21kT
- 8 production lines, 384 employees
- Hygiene (Baby Diapers, FemCare, Adult Inco) – 89% of total sales in 2009
- 165M EUR Market Capitalization
- 123.4M EUR Revenues in 2009
- 38.8M EUR EBITDA in 2009
- 20.8M EUR Net Profit in 2009
- Net Debt/EBITDA ratio 2.5

## 3. New spunmelt technologies

Spunmelt or spunlaid technologies for processing of polyolefins are developing progressively and continuously. Today's leading technology is the Reicofil REIFENHAUSER production system, which is fully qualified for the demanding production of hygiene nonwovens.
There also co-exist other technologies like Neumag, Andritz- Rieter, Fare and others.
But in practice the REICOFIL system has proven itself to be the leader in terms of reliability and progress.
Today Reicofil has about a 70% market share.
Continues in the innovation of technologies, installations of the newest Reicofil systems leads to a reduction of previous versions of Reicofil lines R1, R2
Benefits of the latest R4 spunbond technology are the following:

- higher throughput (for PP 160-240 kg/h/m)
- independent new cooling and stretching channel leading to higher speed of filaments and finer filaments (for PP around 1 Tden)
- higher amount of filament (better coverage and filament distributions) - 6800 filaments per meter compared to 5000 filaments of the previous version making it possible to make extra lightweight NW – below 10 gsm commercially
- higher production line speed – for composite SMS or SSMMMS close to 1000 m/min.

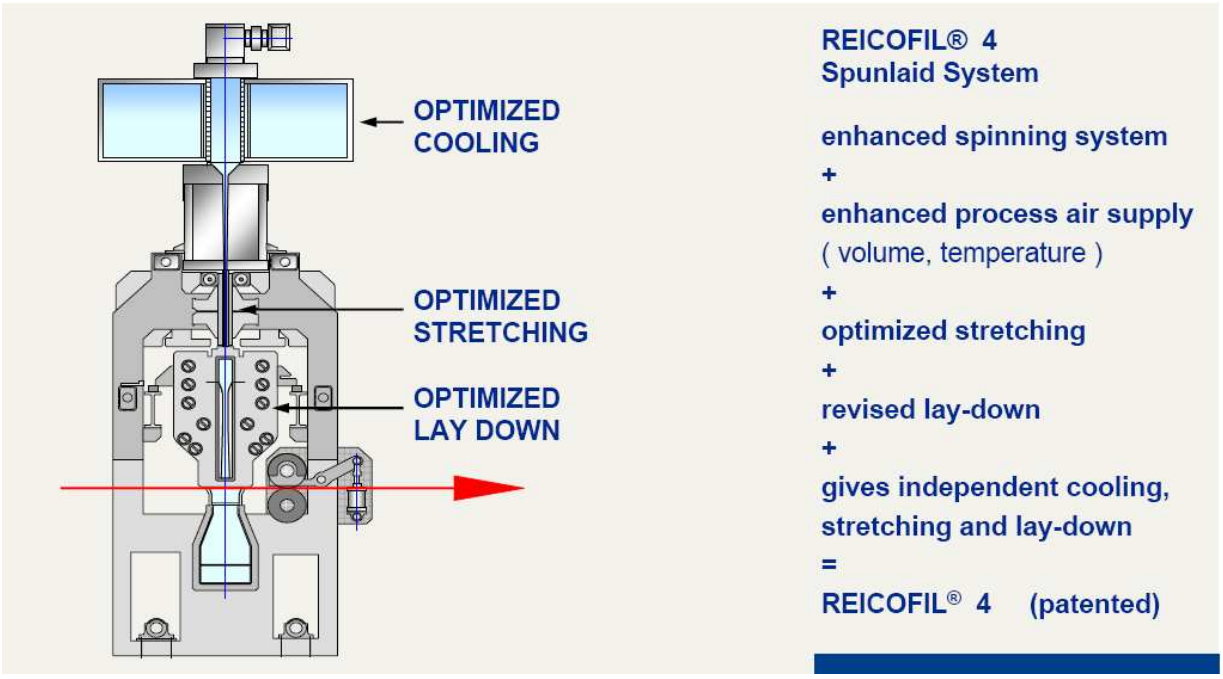


**Figure 4:** Reicofil 4 Spunbond Process [8]

The new design of the R4 meltblown technology can improve the following parameters:

- throughput from 40 kg/h/m to 70 kg/h/m thanks to a higher density of holes – from 25 to 35 holes per inch (at Oerlikon Neumag technology up to 50 hpi)
- better barrier properties of meltblown layer because of better fibre lay down and uniformity
- better fibre formation and dust reduction due to secondary air and a new closed spinning system

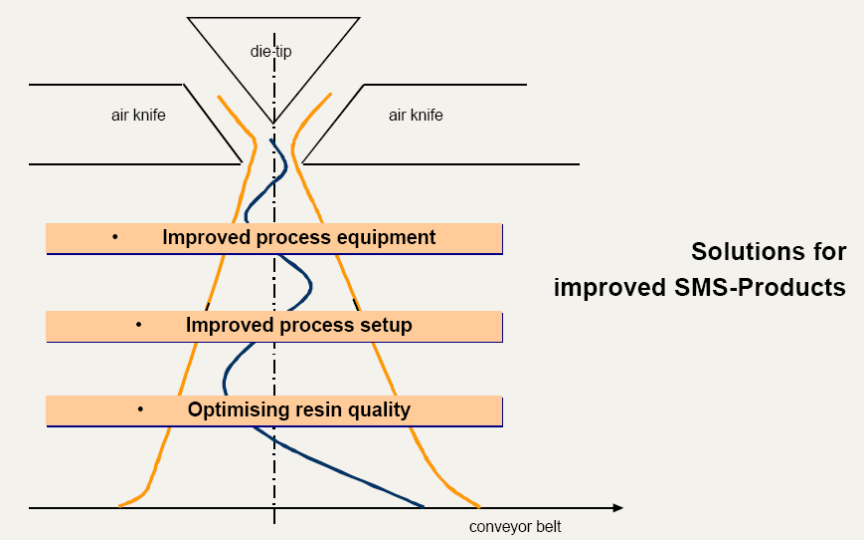


**Figure 5:** Reicofil 4 Meltblown Process [8]

## 4. Bicomponent spinning systems

Reicofil in cooperation with Hills has developed a unique bi-component spinning system which is used in systems R3 or R4 – respectively for 5000 holes per metre or 6800 holes per metre.

New BICO system operates together with R4 technology bringing benefits such as:

- high throughput of up to 220 kg/m/h
- more precise ratio between Core and Sheath – possible to adjust 90/10
- perfect regularity and sheath coverage of every single filament

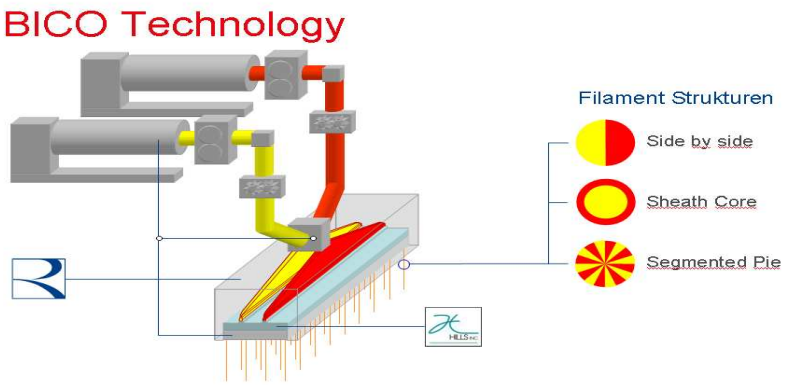


**Figure 6:** Bicomponent Technology [8]

## 5. Bulky NW BICO S/S

The use of BICO technology can contribute to changing the structure of nonwovens. The aim of this is to develop bulky NW consisting of crimped filaments as a potential hygiene product – a version of ADL (Acquisition Distribution Layer) for baby diapers. This bulky NW should

be soft, with good resilience against stress, with partly anisotropic properties, hot air bonded and produced using spunbond technology.
Its curly structure is achieved by a side by side BICO structure where different polymers are used to generate shrinkage of one component. [9]
Parameters used to control the process are the following:

- polymer properties (crystallinity, MFR, distribution of molecular weight)
- filament speed
- ratio of polymers in the BICO composition
- cooling of filaments

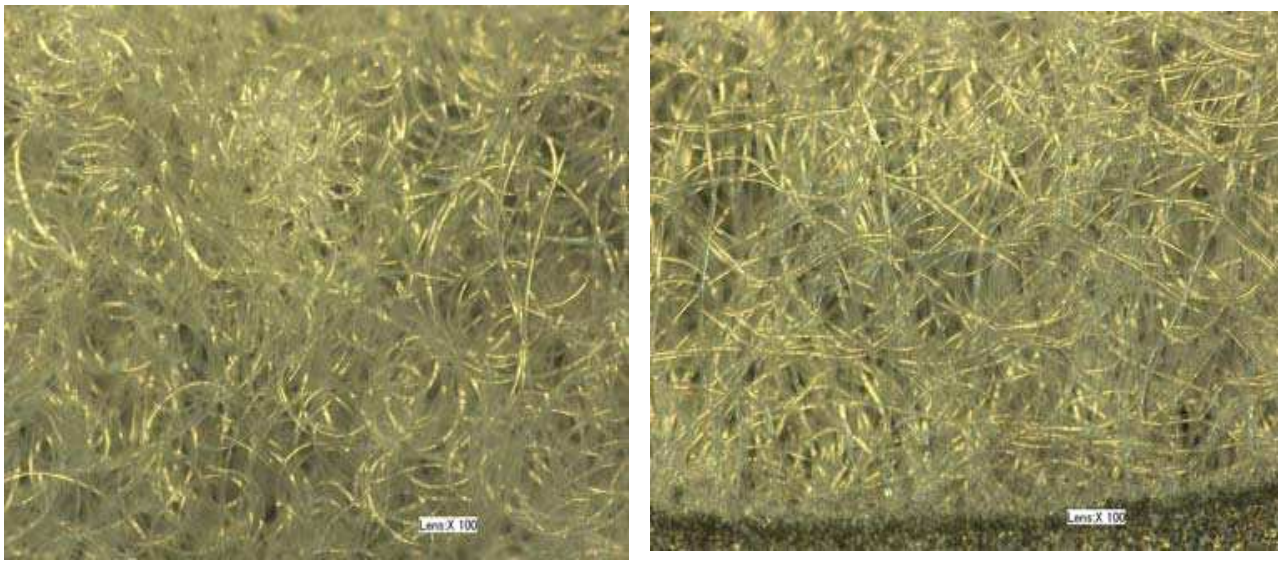

**Figure 7:** Low and High Crimped Filaments

## 6. Elastic NW

The current spunbond NW made from polyolefins are as a rule very rigid, with limited extensibility and elasticity.
New modern hygiene and medical products such as diapers, protective garments etc. require a certain level of elasticity and extensibility to support body comfort.
We believe we can achieve such NW behaviour using new types of polymers and copolymers with existing technology through reasonable and affordable upgrades of the commercial lines, without a significant cost increase.
New recently developed polymer grades can provide such special extensibility with a certain degree of returnable forces (elasticity). These polymers are called TPE – Thermo Plastic Elastomers [9]

Overview of TPE – Thermo Plastic Elastomers
New types of polymers for fibre and film formation:

| Polymer type | Trade name | Producer |
|---|---|---|
| SBS (Styrenic Block Copolymers) | Kraton | Kraton |
| POE (Polyolefin Elastomers) | | |
| Ethylene- Propylene copolymer | Vistamaxx | Exxon |
| Propylene – Ethylene copolymer | Versify | Dow |
| OBC – Olefin Block Copolymers | Infuse | Dow |
| LMPO – Low Molecule Polyolefin | LMPP | Idemitsu |
| TPU – Thermoplastic Polyurethanes | Elastollan | BASF |

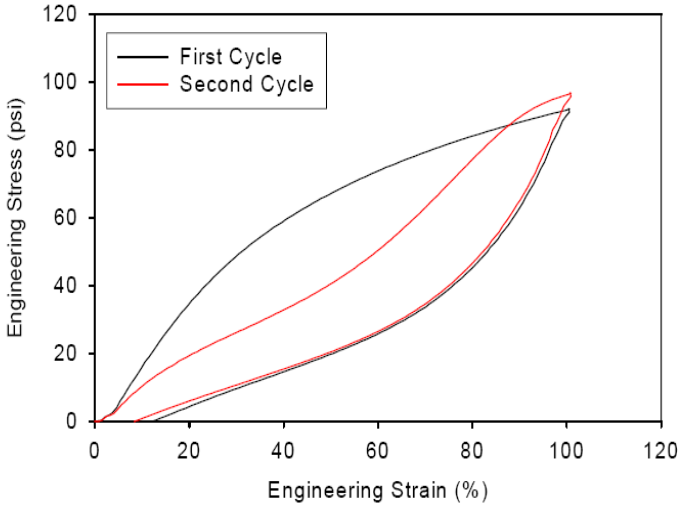


**Figure 8:** Testing of Elasticity [9]

## 7. Biopolymers in spunmelt technology

Today, new developments in the chemistry of non-oil based polymers are offering biopolymer alternatives to standard naphtha-based synthetic polymers. Today the new sustainable approach is demanding new products, which consist of polymers from renewable sources, are biodegradable and more environmentally friendly. Currently, biopolymers are used in the packaging and foil industry and also in nonwovens production, where they present a challenge in the application of these bio-nonwovens in the real world.

Our current approach is to use biopolymers in combination with polyolefins, to offer our customers materials made partly from renewable sources. BICO technology is the right engineering approach for the proper design of NW materials.

The next step should be fully 100% Bio- nonwovens made using spunmelt technology [9].

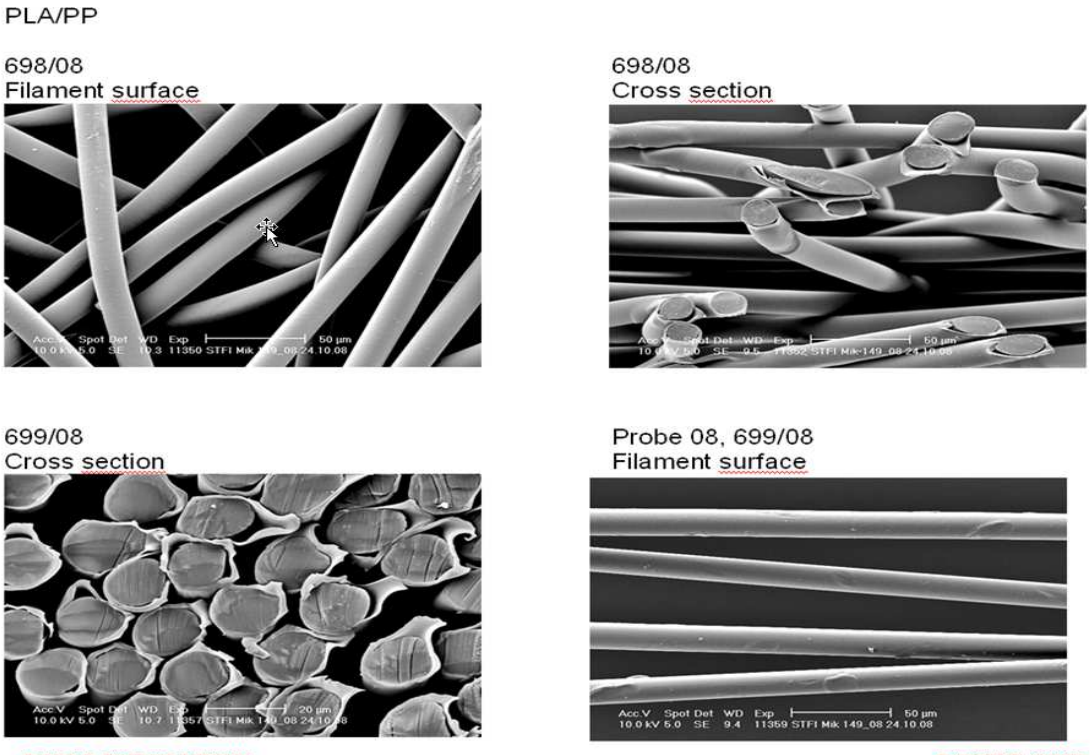


**Figure 9**: Filament Surface and Cross Section of PLA/PP BICO [9]

## 8. Plasma treatment of NW

Physical treatment – activation by plasma can help to activate the surface of NW to better absorb functional chemicals during topical treatment. This results in better adhesion of liquids in the activated surface and can lead to chemical bonding of applied chemicals with free radicals on the filament surface.

New combinations of these treatments are generating much better permanency and durability of required properties such as hydrophilicity, etc. [9]

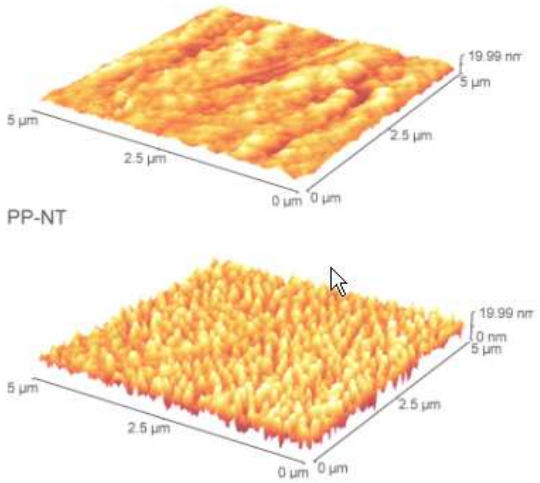


**Figure 10:** AFM – Non-Activated and Activated PP NW

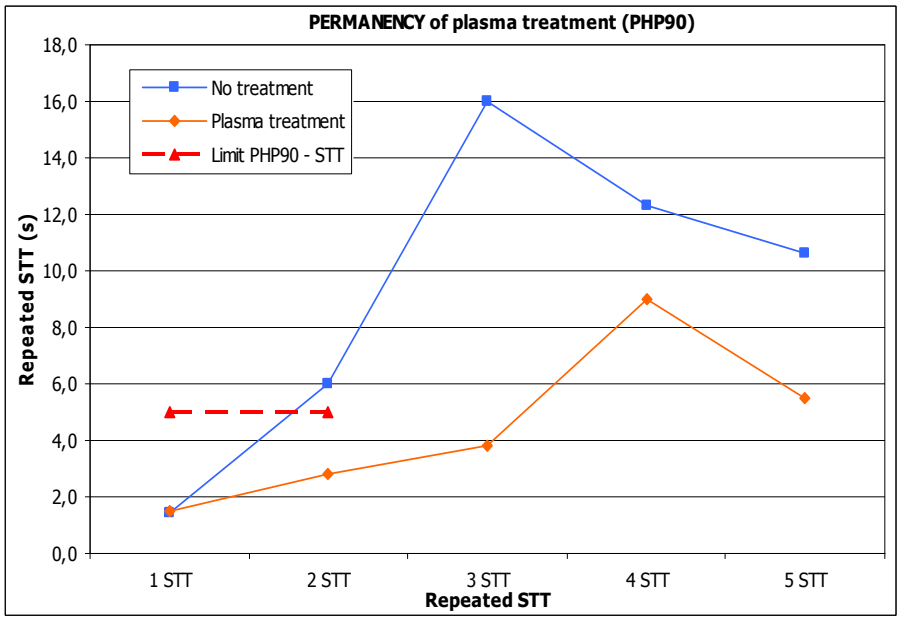


**Figure 11:** Permanency of Liquid Absorption (Rep.STT)

## Conclusion

Today, Spunmelt technology is a rapidly developing segment of nonwovens production. This technology has always been very competitive in terms of continuous "on line" processing with high throughput and good efficiency. Further improvements can be achieved through the combination of the following three major factors:

- new polymers, biopolymers, copolymers and internal additives generating elasticity, softness, biodegradability etc.
- new technological platforms like new spinning systems, BICO technology, multilayer designed structure etc.
- new types of combined nonwovens treatments, for example combination of plasma and topical treatment

Together with its suppliers, external partners and final customers PEGAS NONWOVENS s.r.o. is trying to follow these new trends in order to serve market better.
We must keep in mind that it is our children who are our key customers and they deserve the best products which we are able to deliver!!

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