

STRUTO AND ITS INDUSTRIAL APPLICATIONS
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Abstract

Struto is classed as a thermally bonded vertically lapped Nonwoven whereby the basic carded web is orientated in the vertical and not the normal crosslaid horizontal plane. This gives many advantages in fields of use - for example - increased resilience to initial compression, increased recovery properties after repeated compression.

It is also a structure which it is possible to make in thickness from 15 to 60 mm and slit to structures as thin as 3 mm, to replace foams and add previously unavailable technical attributes to composite fabrics.

The paper will discuss commercial applications as applied to the Automotive, filtration, mattress, furniture and other applications related to structures of high bulk and relatively low fiber content.

Introduction

We can see an increase of production of Nonwoven Textiles all around world at this time. This is principally because of the economic advantages of Nonwovens when you compare these products with most standard types of textile.

An additional point is the development of new products with special properties which can find end uses in many areas of technical textiles.

A large part of Nonwoven Textiles is based on the use of Highloft Nonwoven structures.

What is a Highloft Textile?

This is defined as a fibrous structure with very low density and proportion between thickness and basic weight is large. The fibers may be as a staple or filament fiber structure and can be bonded or nonbonded. Highloft textiles generally contain less than 10 percent of fiber compared to air content and the thickness of these products is more than 3 mm.

As highloft textiles there are many kinds of mechanical or aerodynamical laid structures with mechanical, chemical or thermobonding by lowmelt fibers or powder.

In almost all highloft structures the basic fibres are oriented mainly in horizontal plane of product.

There is now available a new structure of voluminous Nonwoven product with fibers oriented mainly in vertical plane and this new range of product with this basic vertical structure is called STRUTO®.

What is STRUTO®?

STRUTO® is vertical lapped Nonwoven fabric of new outstanding properties giving many new opportunities.

STRUTO® in the basic system consists of a STRUTO® Vertical Vibration Lapper and Through-air Thermobonding Chamber.

What is a Vertically Lapped Fabric?

The diagram below – Figure 1 – shows a very simple layout of a STRUTO® line and the notes describe the simple workings of the process.

A carding machine processes a properly mixed blend of basic and bonding fibers. (1). The carded web is formed into a STRUTO® using a Vibration Lapper (2) to form a fiber batt on the conveyor belt of the Through-air Thermobonding Chamber (3). After passing through the chamber the STRUTO® fabric is cooled and wound up (4).

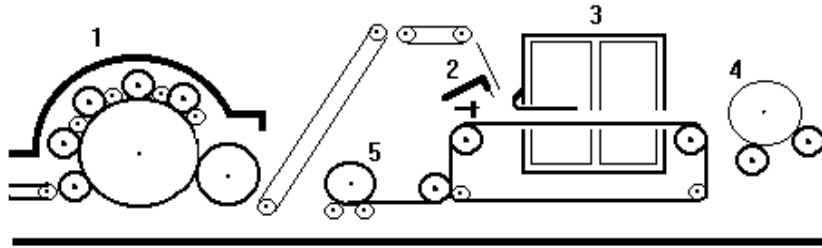


Figure 1. Scheme of the STRUTO® Line.

In addition a supporting layer (5) can be brought from below onto the conveyor belt of the bonding chamber. The layer is then linked together with the STRUTO® textile during the bonding process. Thus, a composite material is produced in one process.

So a new style of bulky fabric is now formed using conventional opening, blending and carding equipment to give a structure where the vast majority of the fibers are orientated in the Vertical Plane.

What is Different when you Compare Vertically Laid with a Traditional Laid Textile?

The standard type of highloft Nonwoven textile as already discussed has the fibers in the horizontal plane due to the action of the crosslapper web which is then sprayed or thermobonded using thermobonding lowmelt or Bicomponent fiber or even bonding powder.

There is no difference in the web, which is used for the STRUTO® product, but there is big difference in how the web is laid and thanks to the Vertical Vibration lapper we can make an absolutely different structure.

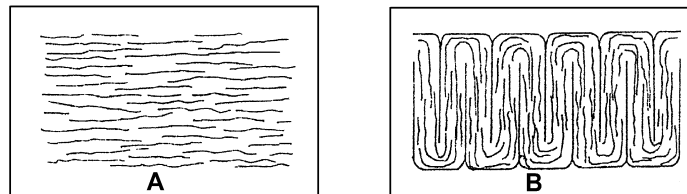


Figure 2. A) Horizontally (crosslapped) and B) Vertically Lapped Textile.

This structure (B) we call STRUTO®.



An example of a STRUTO® product.

History of STRUTO®

This system was developed in 1988 – 1992 by group of people of the Technical University in Liberec. The first commercial lines were working from the early 1990's in the Czech Republic.

In the late 1990's the machines were introduced to the USA by Georgia Textile Machinery Inc and the first USA commercial line put into operation in late 1998. Since that date other lines have been installed in the USA, UK, China, Australia, Malaysia and Venezuela.

STRUTO® is a registered trademark of STRUTO LLC – a Georgia based company, which has the STRUTO® patents assigned to it.

Advantages of STRUTO® Compared to Traditional Technologies

1. Better functional properties – bulkiness, compressional resistance, and resilience to loading, heat and sound insulation, filling and hygiene properties.
2. Lower raw material consumption for the same performance. Up to 20% material savings over conventional highloft.
3. Ability to process all types of synthetic and natural fiber materials including recycled and waste fibers.
4. STRUTO® is easily recycled.
5. Lower capital cost for machinery, lower energy consumption, small production installation and better space utilization when compared with a traditional production line consisting of crosslapper and needleloom or sprayer with drying oven.
6. There is only one STRUTO® system regardless of the fiber to be used or material to be made. The only variable on a STRUTO® system to consider is width of machine.

Other STRUTO® Attributes: Bulk, Compression Resistance, Resilience

Perpendicular laid textiles show excellent compressional rigidity and elastic recovery due to their specific design. Vertically laid textile STRUTO® is deformed not so much as crosslaid – horizontally laid textiles. This advantage grows with density of products and is shown in diagrams 3 and 4.

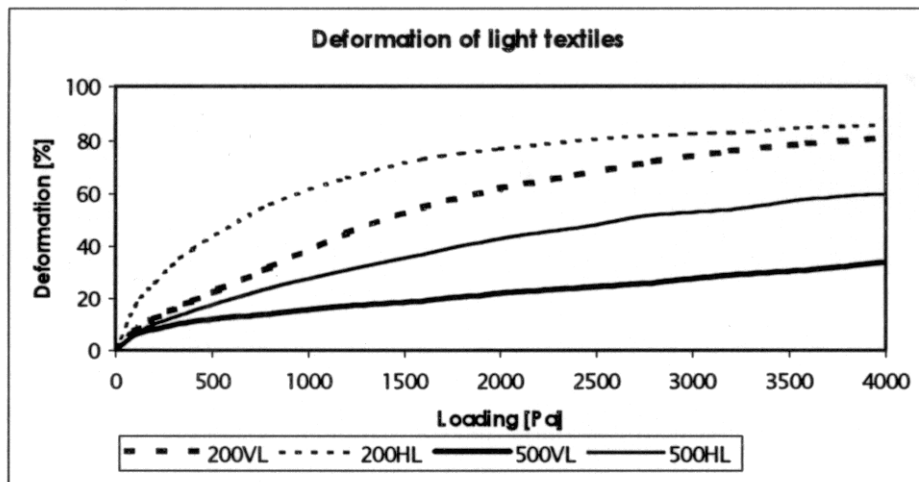


Diagram 3 shows a comparison between Vertical and Horizontally lapped materials at both 200 and 500 grams square meter.

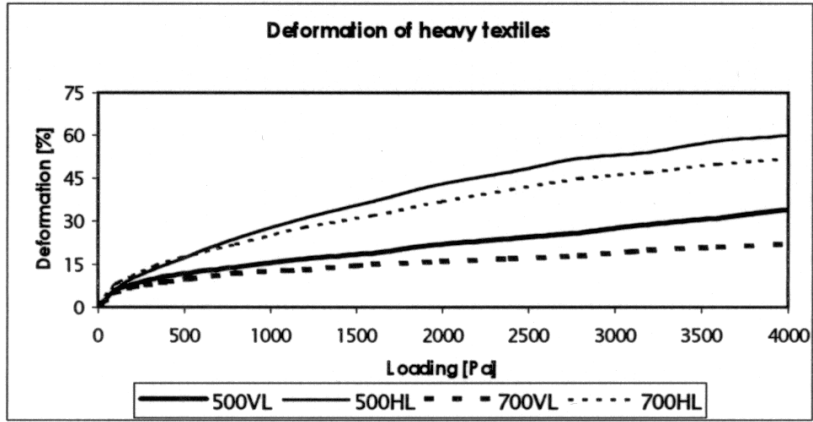


Diagram 4 shows a comparison between Vertical and Horizontally lapped materials at both 500 and 700 grams square meter.

The above diagrams clearly show the advantage of STRUTO® over normal crosslaid batts weight for weight and at various weights.

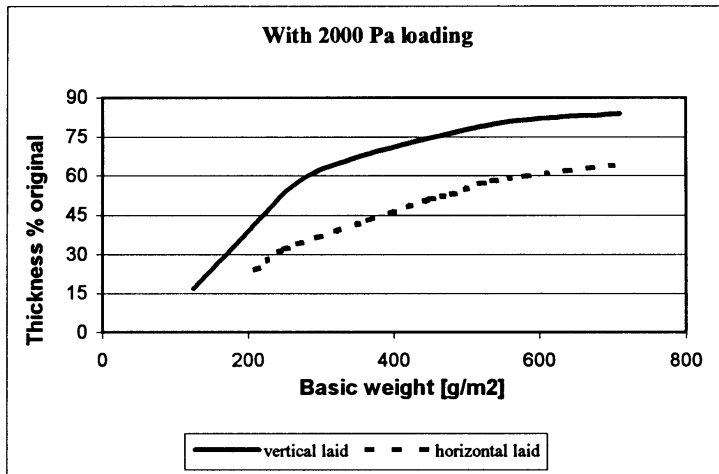


Diagram 5 above shows % of original thickness of various weights at a constant loading of 2000 Pa.

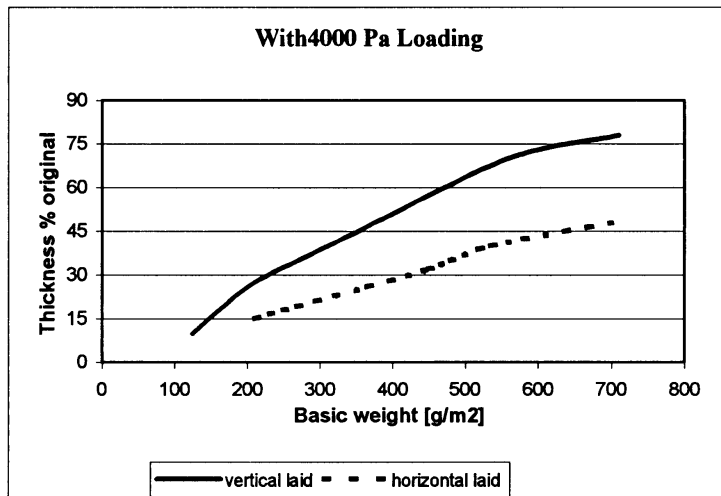


Diagram 6. This diagram shows the effect of loading at 4000 Pa at various weights.

The above diagrams clearly show that STRUTO® has advantages over conventional structures. Not only can it be seen that at equal weights the STRUTO® structure has superior performance but also shows that to obtain the same performance then a STRUTO® structure would use a considerably lower amount of fiber.

STRUTO® Applications for Various Industries

Now to discuss STRUTO® in its application to particular industries.

STRUTO® in the Automotive Industry

STRUTO® has proved to be very succesful already in the Automotive Industry. It is specified and being used as an OEM product for both Headliners and Door Panel Insulation applications and has been approved for model years 2003 and 2004.

It has a number of potential uses in Automotive as the layouts below show very clearly.

Automotive Applications

Further Applications in Automotive for STRUTO®

Seating and Trim Applications Headliners Seating and Trim Applications



All of the above areas have practical uses for STRUTO®.

This can be with specialized coarse denier fibers for seat backs or use of Natural fibers with Polypropylene for Package Tray materials.

What can be seen to the right side are examples of STRUTO® slit to thin products very suitable for some of the above applications.

Mattress and Furniture Production using STRUTO®

STRUTO® is also in use in the mattress industry – in fact the Venezuela operation uses the STRUTO® line there exclusivley for mattresses it manufactures itself.



STRUTO® is extremely resilient and has extremely good recovery as has already been shown.

STRUTO® shows very good characteristics of recovery after repeated compression loadings – much better than that of conventional highloft materials and much closer to those of foams.

The use of cotton in mattress applications using STRUTO® produces some unique materials.

Heavier structures incorporating cotton are now in use in Europe for mattress applications.

By adding a very strong scrim as the STRUTO® is formed it is also possible to create a structure which will support across the mattress spring structure without the addition of further protection layers.

An example of this structure and a mattress using it are shown below.



A picture of a mattress using a STRUTO® material for the mattress pad as well as for the interior of quilted surface material.

The mattress main material is all bonded together on the STRUTO® system as the STRUTO® material is formed.

STRUTO® and Filtration Applications

STRUTO® has applications for both wet and dry filtration. It can be used in pre-filter applications or as a filter media in its own right.

The efficiency of filters using STRUTO® as the main component show excellent qualities and advantages in 3 significant areas as so far experienced by those companies using and testing STRUTO® materials for such media.

1. Higher efficiency when compared with other materials. When tested with dust particles of the same size, STRUTO® shows consistently higher efficiency figures than virtually any other media.
2. Superior dust holding capability. The structure of STRUTO® allows it to hold a much larger amount of dust than other materials as has been shown in a number of tests.
3. Very low pressure drop. The STRUTO® structure is extremely organized and allows air to pass much more freely through it than conventional structures BUT still traps dust particles. The result is a very low-pressure drop BUT still excellent dust holding capability.

The picture below shows a STRUTO® material used as a filter product. What can be clearly seen is the way in which the STRUTO® material traps the coarse particles on the top 1/3rd of the material whilst the finer particles travel much further into the structure.



STRUTO® filter media – top 1/3rd shows the coarse particles trapped – and finer particles are trapped below this using the whole structure.

The base is still very clean showing air condition at that point.

By varying the fiber denier, web weight, total weight, thickness or combinations of all the above virtually any filter characteristic specified can be manufactured on the STRUTO® system.

STRUTO® using Recycled Fibers and Recycling of STRUTO®

STRUTO® uses recycled fibers just as easily as any virgin or natural fibers. As long as the carding system in use can make a web the the STRUTO® Vibration Lapper will form it into a vertically lapped structure.

To date over 98% of all fibers tried have been formed into a STRUTO® structure succesfully.

For example below is shown a STRUTO® structure using just Carpet Waste from the mills in Dalton and a bonding fiber only. This low cost fiber makes an excellent STRUTO® structure.



This material is just torn up Carpet edge trim ex-mill. At present this is sent to the landfill in quantities as little use has been found for it.

STRUTO® gives an option for the use of such materials for the future.

Easy of Recyclability of STRUTO® Materials

It is extremely easy to reclaim STRUTO® product using standard opening machines.

In addition STRUTO® material can actually be taken 100% and reused to make certain materials without the addition of further bonding fibers.

This system of reclaiming still produces structures with excellent properties compared to the original product.

This allows for example – for mattresses or materials used in the Automotive Industry to be taken back for reclaiming in a very simple manner. This is very easy when compared with foam or other Nonwovens treated by chemical impregnation or heavy needling etc.

Other Parameters of STRUTO®

Thickness

STRUTO® can be made as a true vertical product in thickness from 12 to 40 mm.

There is also an option to make a very bulky material on at the same STRUTO® machine up to 65 mm in thickness.

In addition many STRUTO® materials can be slit too much thinner structures – as low as 3 mm dependent on fibers and amounts of bonding fibers used.

Density

STRUTO® structures generally vary between 120 grams and 1600 grams sq mtr.

It is also possible to make materials as heavy as 3000 grams per sq mtr using such as recycled materials.

All of the above materials and options as discussed here made on only one type of STRUTO® vibration lapper.

Visit the website – www.STRUTO.com

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Georgia Textile Machinery Inc.

STRUTO® stands alone.



Acknowledgements

Pr. Radko Krcma.

Dr. Oldrich Jirsak.

Ing. Radka Kotisova.

Ing. Milan Schnatzer.

Ing. Petra Prochazkova.