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Improving retention and sheet planarity with advanced SSB fabric

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The design of a new forming fabric, regardless of the type of paper to be produced, starts by considering the type of machine and the typical features of the product.

For the development of the new OptiFlyer™, the design team started with the analysis of the customers' and paper machine needs. An in-depth market study indicated the three most frequent customers' demands as being:

1) Planarity of the paper sheet
2) Homogeneity of the paper sheet
3) Cost reduction

Sheet planarity was undoubtedly one of the main concerns. OptiFlyer™ characteristics are the best solution to meet this need. Compared to the classic SSB (surface stitch binding) approach, the design team took an innovative direction, opposite to the latest developments of this family of forming fabrics.

OptiFlyer™ was developed on a high-speed weaving loom with reduced number of shafts, to afford the maximum binding and thus the best dimensional stability.

In fact, the structure binds two longitudinal yarns to each design pattern interval, as opposed to just one of the traditional SSBs (Fig.1).

This revolution undoubtedly satisfies the first of the three most common concerns as regards the new ever-wider and faster paper machines: paper sheet planarity.

It is easy to note how the transversal stiffness value of the new concept is comparable to the best currently available on the market, normally found in triple weft designs (Fig. 2).

The Taber Index of OptiFlyer™ is steadily around 80 gr/cm for the fine papers design and in excess of 200 gr/cm for the packaging grades design.

Additionally, the double longitudinal binding yarn considerably limits the stretching of the fabric under operating tension, to about 30% less than standard SSBs. In fact, this type of construction also contributes to satisfying the other two demands of the market.

With two longitudinal yarns inside the strand of perpendicular yarns, the machine side floating yarn goes over six MD yarns. Compared to the standard SSBs with shorter floating yarn, OptiFlyer™ offers a double advantage: the fabric has a naturally very small inner empty volume, thus a natural and easy dewatering capability (Fig.3).

In fact, with an equal degree of permeability required by the paper machine position, the new design offers a higher number of CMD yarns on paper side, which enhances fines and fibre retention and consequently improves paper sheet homogeneity, hence reducing the consumption of raw materials.

OptiFlyer™ also offers a true one-on-one fabric pattern, but is the only one with all knuckles actually aligned on the same plane. This factor maximises the fibre support index, erasing any possible marking of the sheet.

With a very even surface, fibre distribution is very regular, with a consequent high degree of homogeneity in paper sheet formation.

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OptiFlyer™'s fibre support index is probably the highest in the industry, with values up to 198 FSI (Beran) total for fabrics dedicated to hybrid machines with top formers and greater than 240 FSI total for gap formers (Fig.4).

If the customer needs to work with higher dilution in the headbox, the fabric naturally suits this purpose.

OptiFlyer™'s excellent dewatering system, combined with fabric transversal stiffness and limited empty volume, is one of the keys to its success.

This was a not easy task, reached thanks to the development and use, for the first time, of OCT (Optical Computed Tomography)* (Fig.5)

Each peak in the bottom of the fabric represents a natural water passage channel, while the top part shows with great precision the fabric 3D topography.

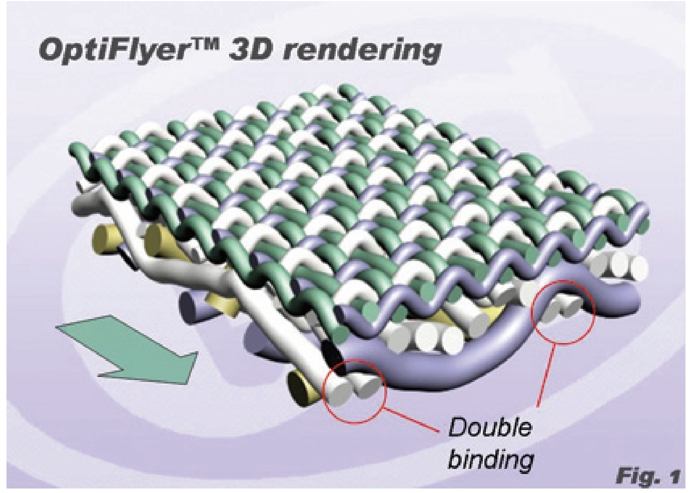

Figure 1

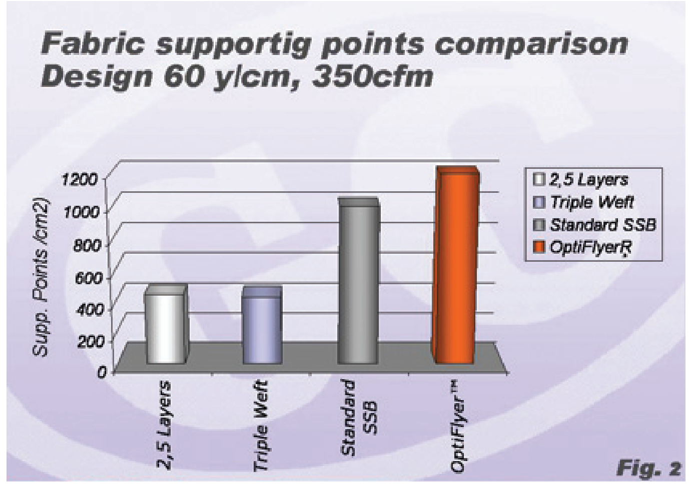

Figure 2

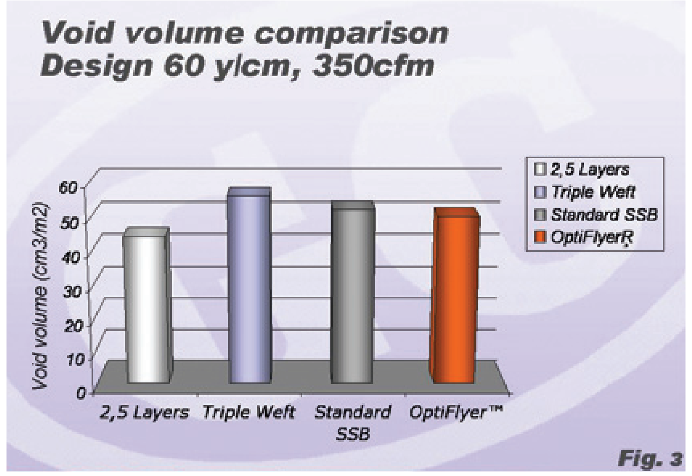

Figure 3

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OptiFlyer™ superior dewatering is obvious compared to SSB designs with similar weaving density.

This characteristic translates to excellent dewatering capacity, with no water dragging issues, while the high surface FSI increases retention, resulting in a better coating of the paper sheet.

A better paper sheet coating means reduced costs of pulp preparation (eg refining) and reduced consumption of chemical products (eg retention agents). The OptiFlyer™ application allows optimising the consumption of chemical products by up to 8% on papers using fillers.

WHAT IS OCT?

OCT (Optical Computed Tomography) is an innovative technology, developed by the OptiFlyer™ research team.

It consists of producing an axial tomography of the fabric, trough the use of a high definition scanner and a powerful customized microscope, with micro controls on the 3 axis, connected to a PC running dedicated software.

The sample is placed under the scanner, where a laser provides the accurate measurement of the surface topography (with resolution of 1/1000 of a mm), and thousands of pictures taken at different distances from the sample. A specially developed software then assembles all the pictures with the 3D pattern detected by the laser scanner, and produces 3D images and animations of the fabric's surface (Fig.6).

OCT allows an accurate measurement of the fabric surface topography, yarn dimensions and yarns deformations connected with the weaving process.

Through additional software calculations, OCT can predict and measure with excellent precision the surface deformation of the paper sheet forming on the fabric surface.

OCT also allows an accurate evaluation of the fabric dewatering capabilities, to measure accurately the dimensions, volume and precise scattering of the dewatering channels.

Thanks to OCT, it is possible for the first time to precisely predict the effective fabric dewatering and void volume. The scanner is now used extensively in the quality assurance control, thanks to the extremely precise 3D mapping of the fabric surface.

CONCLUSIONS

In summary, OptiFlyer™ clearly allows:
1) Improved planarity of the paper sheet: the binding of two longitudinal yarns and the gap of six produce the highest cross stiffness known today in the SSB approach, resulting in the best maintenance of paper sheet profiles for the entire life span of the fabric.
2) Improved homogeneity of the paper sheet: thanks to an enhanced dewatering capacity and high FSI, a better fibre distribution and maximum sheet coating are obtained with an equal number of wefts.
3) Cost reduction: the reduced empty volume of the OptiFlyer™ concept offers improved drying of the paper sheet and the reduction of energy costs typical of press and dryer sections.
The immediate success of this new design confirms the validity of the initial project and design approach.

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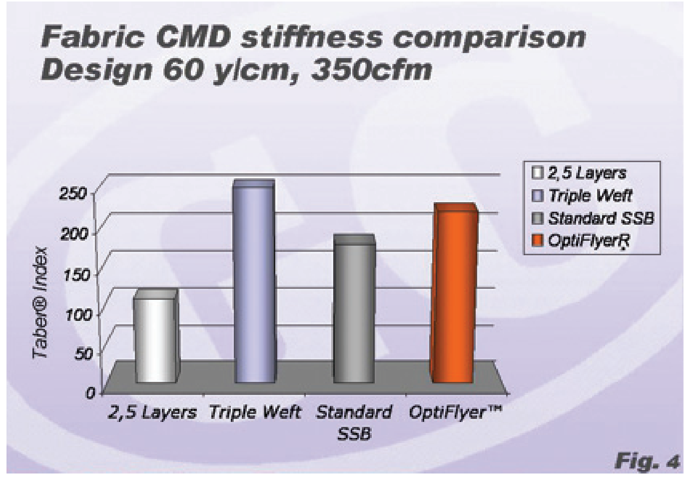

Figure 4

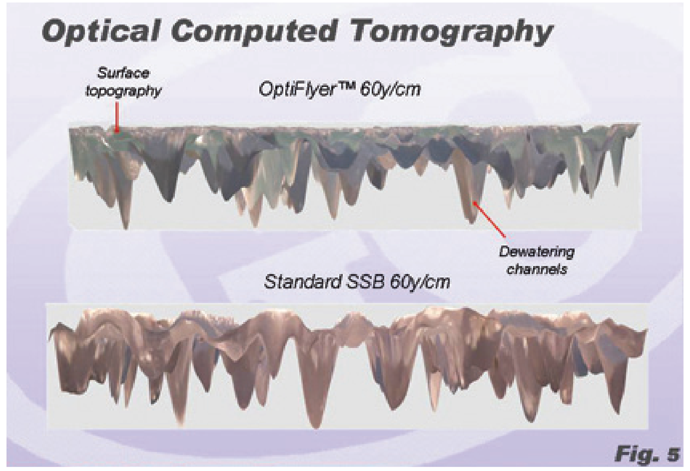

Figure 5

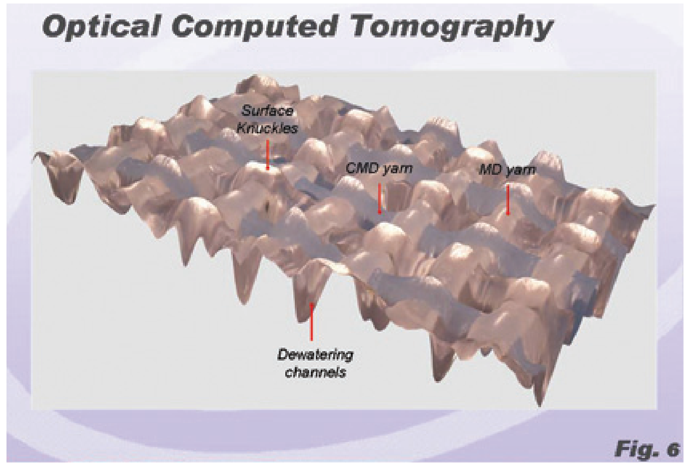

Figure 6