gruppo x di x gruppo srl
research & development
Parco Scientifico VEGA, Via delle Industrie 25-8, 30175 Venice-Italy, phone +39 041 5093431, fax +39 041 5093648 marion.sterner@gruppox.it

Innovative technologies for tailor-made dimensional variations and mechanical properties in fibrous webs

specialty papers
TAPPI
SMITHERS PIRA
September 15-17, 2015
The Pfister Hotel, Milwaukee, Wisconsin

Who we are

gruppo X di X gruppo srl, based in Venice/Italy is a company which

- generates patents on innovations mainly in the paper sector,
- develops them with industrial partners, and
- licenses patents, know how and technology.

Our starting point for the new technologies

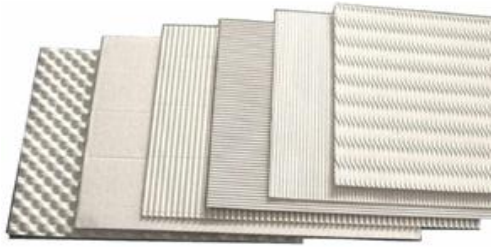
In the past we had developped a technology based on a pure mechanical treatment and using only 100% fibre material with no particular chemical additives for the production of a paper with up to 20% strechability in MD and up to 16% stretchability in CD, combined to a very high breaking load deriving from pure vergin pulp.

“Mould Paper”, as we called it, should have been a sustainable and cost saving alternative to plastics in 3D packaging.

Some examples of applications

Paper comes in reels, can be printed, coated and otherwise processed on traditional lines for plastics

Trays and pharmaceutical blisters



New corrugates for more stiffness and advertizing

3D paper cups

3D liquid containers

mould paper

Deco foil for furniture

Market presence

The before mentioned technology has been licensed on an exclusive basis for Europe to Billerudkorsnas AB. The product is on the market under the tradename FiberForm

Problems of existing technologies for strech in paper:

- Traditionally available technologies for MD-elongation do work only in MD (about 15%), potential CD elongation derives from pure vergin pulp and costly high refining and does usually not exceed 8%, limiting such technologies to a total symmetric performance of 8% in each direction

- Our own previous technology provides less CD-elongation (16%) respect to MD-elongation (20%)

How to reach symmetry in paper elongation?

as much or as little it may be…..

Let's assume potential examples of market requirements

Cross direction = Machine direction

10% and 10% for sack paper
20% and 20% for 3D packaging or deco foil
Tissue, Deco Foil and all grades for industrial applications where high and/or symmetric elongations are required

We needed first of all a system for separately adjusting CD-elongation. Then we could combine this system for CD-elongation to historical but also new systems of MD-elongation

How to reach more symmetry in general?

Æquilibrium in paper by customizing CD and MD values separately

either % **CD** = % **MD** **or** TEA(**CD**) = TEA(**MD**)

% of elongation in CD and MD,
it can be symmetric if desired

Tensile energy absorption in CD and MD,
it can't be symmetric but more balanced

concept:

"**TEA**$_{(work)}$ **= AVERAGE LOAD**$_{(force)}$ **x ELONGATION AT BREAK**$_{(distance)}$"

Inserting the relative values of the paper to be adjusted, ideal/balanced values for TEA and/or elongations can be tuned

our new process

It is well known that mechanical properties/average load in paper depend on fiber choice, refining and headbox properties.
Having defined those, in our purely mechanical inline-process for all kinds of fibers:

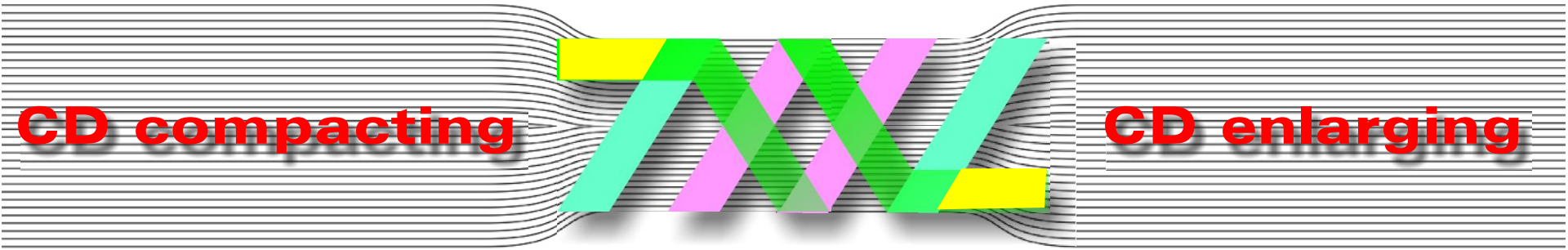
either both CD and MD elongation can be adjusted separately from each other (6%, 8%, 10%, 12%, 14% or more)

or both CD and MD elongation can be adjusted separately from each other for more balanced TEA values and response to mechanical stimuli in paper

…. or just and extra 2% or 3% or 4% CD-stretch (in absolute terms) can be added to what a paper already has….

papermorphosis®

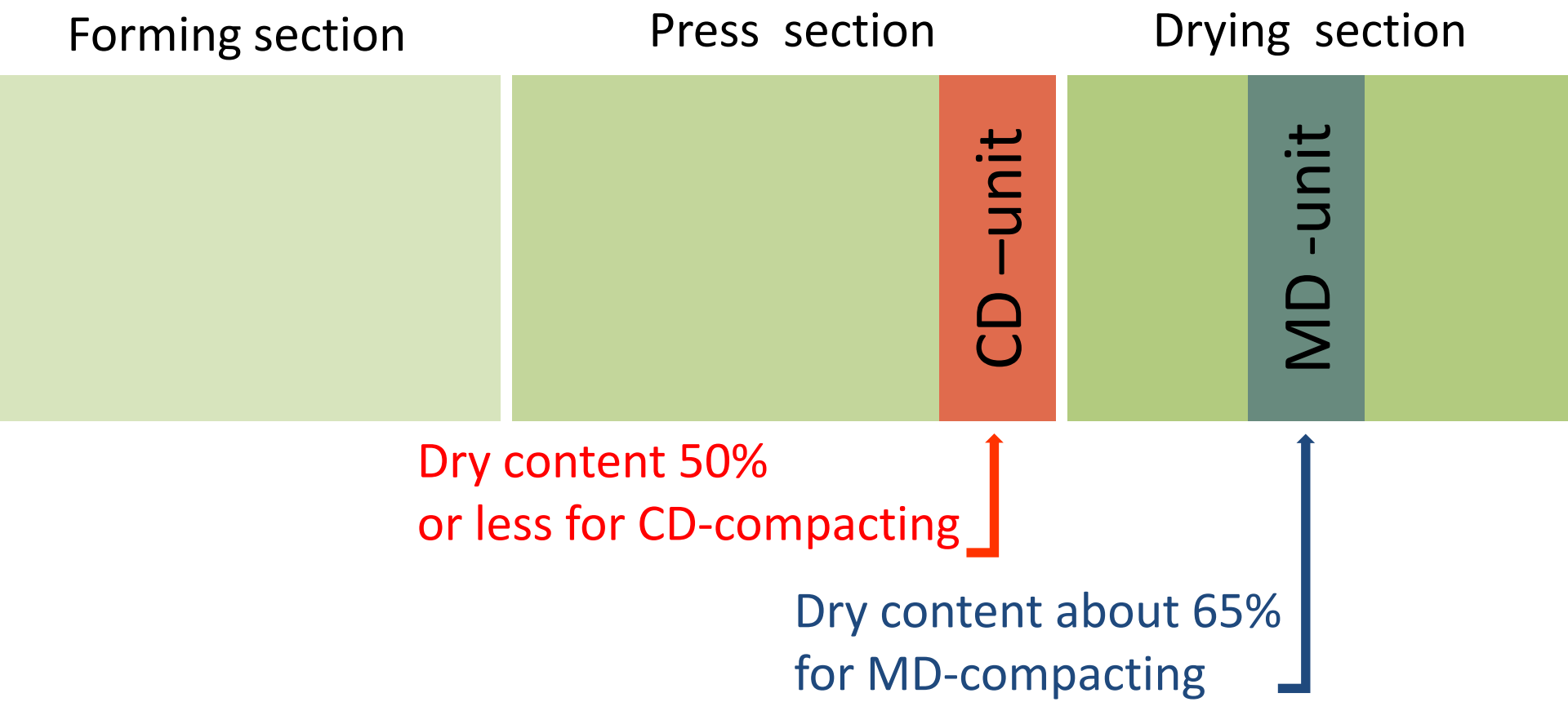
the system consists in two separate units:



Forming a system:

- to be installed, or one or both, in existing production lines
- to be excluded if not needed for other productions
- easy to set for required **CD** or **MD** elongation value
- offering a new way of inserting additives into the web

Where to install the units in a paper machine

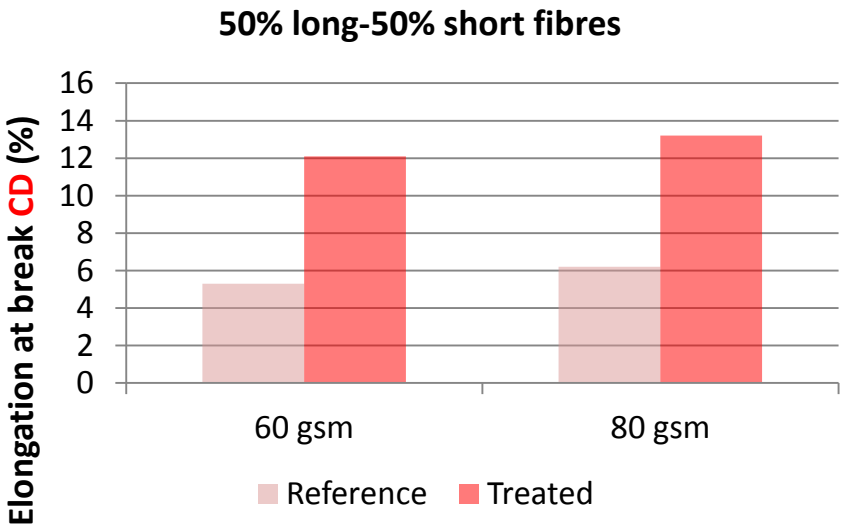


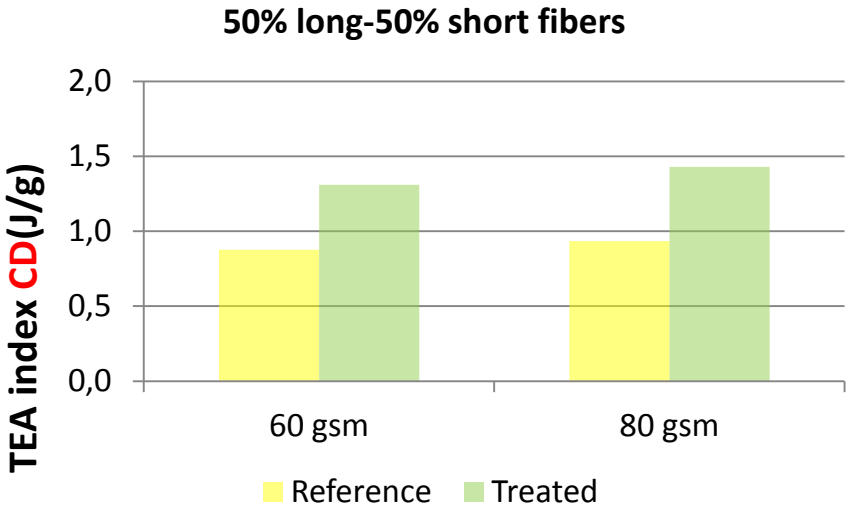
Actual status of our development

Whereas for our past development of extensible paper we could develop it at full industrial scale on a 2,50m wide papermachine at and together with the Cariolaro mill in Northern Italy, today we have installed our units at the “FEX”-pilot paper line at the paper research institute Innventia AB/Stockholm/Sweden. The pilot line is split between press and drying section. There we are processing the standard available machine width (240 mm).

Actual status – CD-behaviour

let's have a look on results from a trial with a furnish of 50% long fiber, 50% short fiber, refining 30° SR in terms of elongations and TEA in CD

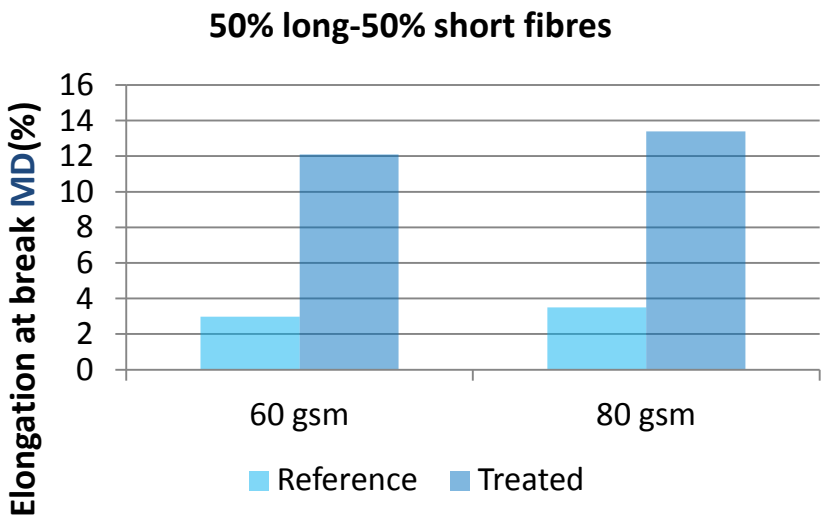


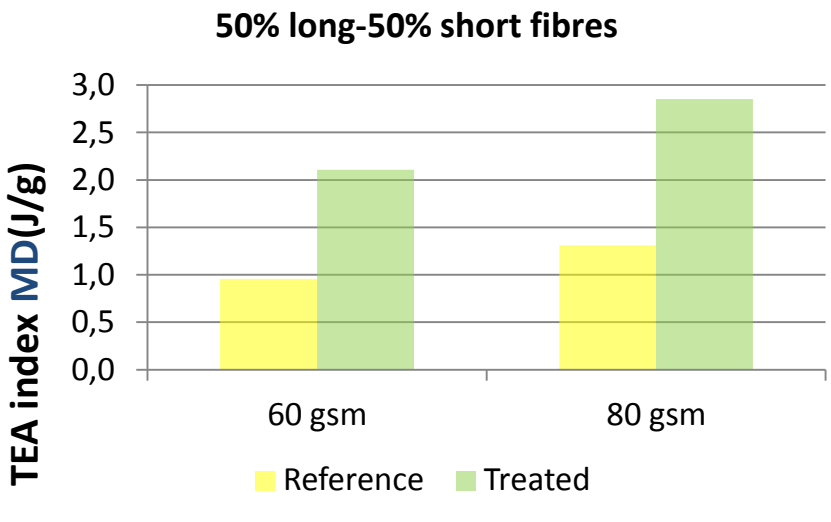


No significant influence of paper basis weight on results after treatment

Actual status – MD-behaviour

let's have a look on results from a trial with a furnish of 50% long fiber, 50% short fiber, refining 30° SR in terms of elongations and TEA in MD





No significant influence of paper basis weight on results after treatment

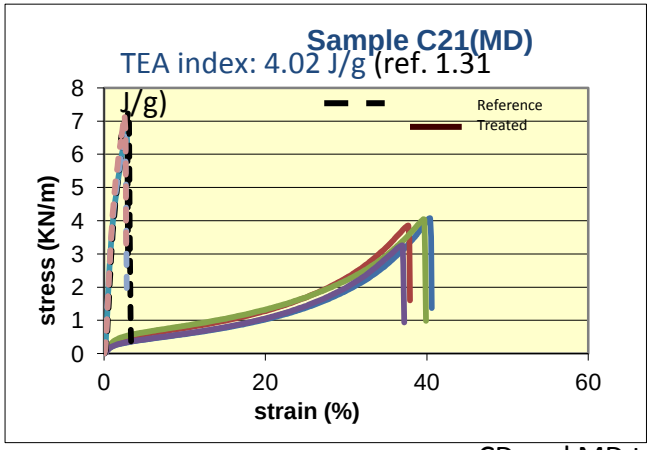
Hypothesis on costs for sack paper

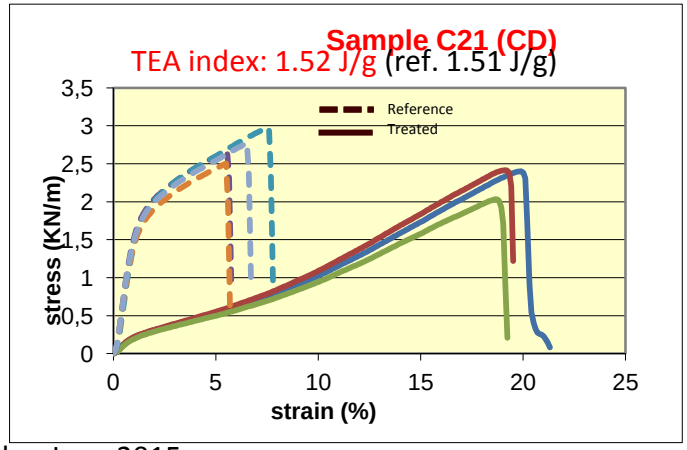
Example of an Italian paper mill for sack paper: production 70.000 ton/year of paper of pure virgin long fibre.
Our system allows to partially substitute long vergin fibre with long recycling fiber, maintaining same elongation performance

A)	Cost 100% long vergin fibre	600 €/ton	
	General costs	200 €/ton	
	Tot	800 €/ton x 70.000 ton	= 56.000.000 € cost
B)	Cost 90% long vergin fibre	540 €/ton	
	Cost 10% long recycling fibre	30 €/ton	
		570 €/ton	
	General cost	200 €/ton	
	Tot	770 €/ton x 70.000 ton	= 53.900.000 € cost
			= **2.100.000 €**saving/profit
C)	Cost 50% long vergin fibre	300 €/ton	
	Cost 50% long recycling fibre	150 €/ton	
		450 €/ton	
	General costs	200 €/ton	
	Tot	650 €/ton x 70.000 ton	= 45.550.000 cost
			=**10.450.000€** saving/profit

Next trials

Our last trials were of course trying to exasperate the systems and to do as much as possible on high elongations/TEA in order to show where we can arrive. Probably no sack producer would want or have machines for material with 20% or more strech in each direction.





CD and MD treated sample from trials in Sweden June 2015

But the system works, it has given the proof of concept, and our very next trials instead will be aiming to do fine tunings, to add just what is needed, even talking about a percentage of 2% or 3% or 4 % in absolute terms, i.e. in CD from 6% to 7, 8, 9, 10%.

The CD-unit

On the only CD-unit we can today compact a fibrous web from standard values up to around 15%

Picture taken during the last trial from the automatic width measuring system, starting from 240 mm

The CD-unit can instead be used also the other way round and we can increase width in a fibrous web (2%, 3%, 4%) in order to compensate some of the shrinkage due to drying in a paper process. The result is an increased width of the final jumbo roll.

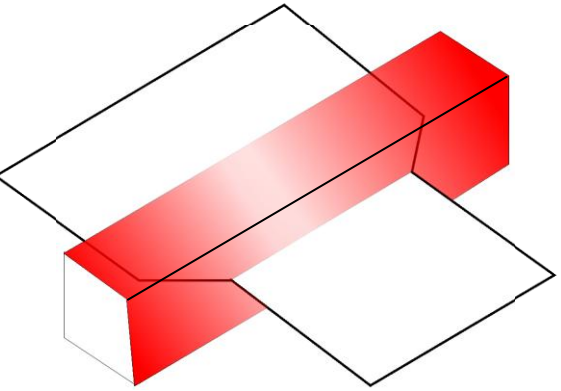
A preliminary trial has encouraged the concept and more specific trials will be scheduled on this issue within the next semester

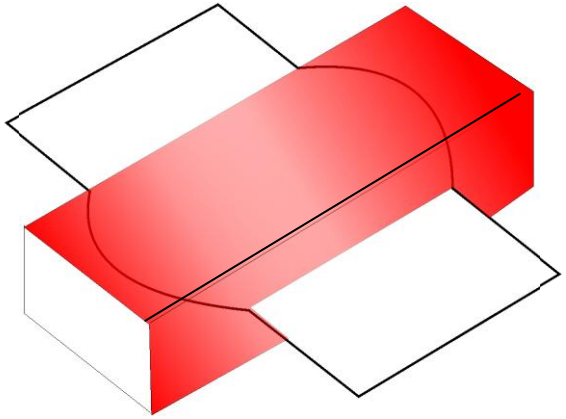
The MD-unit

MD-units are today available on the market and might potentially be combined to our CD-unit.
Nevertheless we have developped a new MD- unit ourselves, having 4 parameters to be adjusted according to needs and so far improving traditional devices:

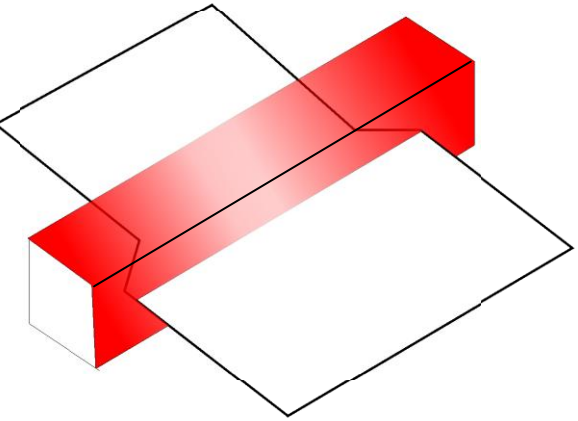
- Having adjustable nip size and paper contact area for treatment
- Being runnable in different modes
- Uniformity of treatment over whole width
- Being less outwearing for spare parts, no need of chemicals

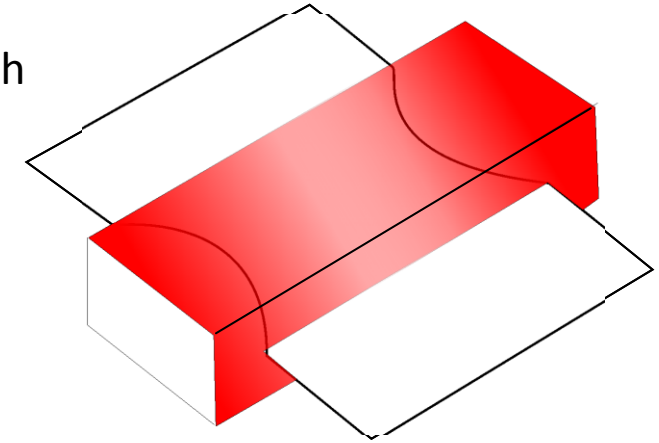
Objectives of the units





- Compacting/imparting strechability
- Enlarging/stabilizing the web
- Creation of bulkiness
- Balancing TEA
- Producing same elongations with less expensive furnish

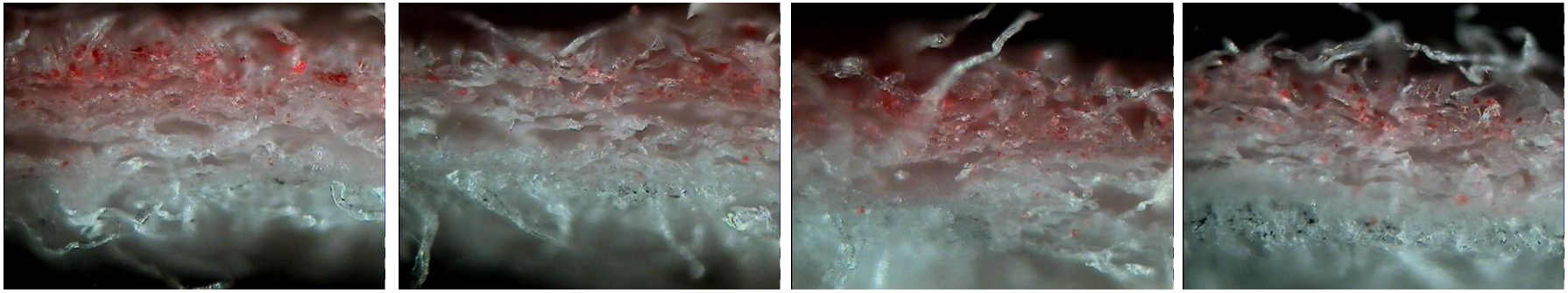




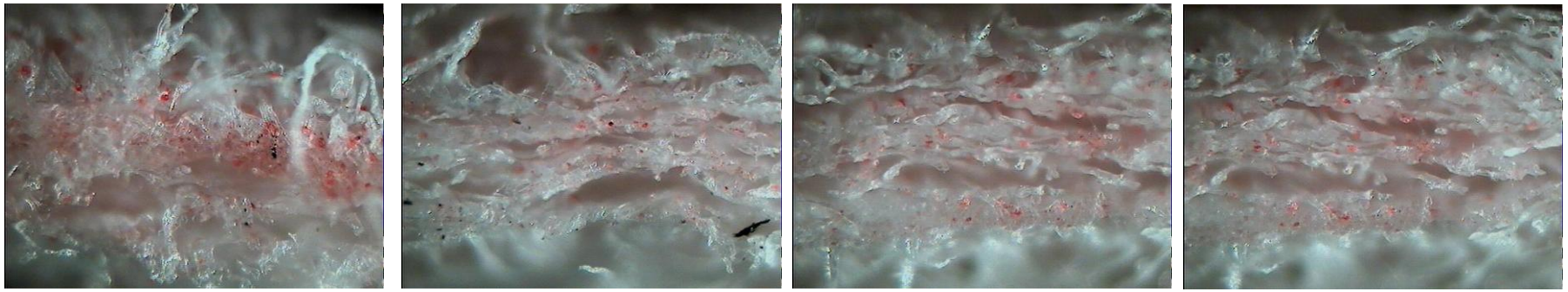
In the pipeline: additivation via the UNITS

A lab trial has encouraged the idea of additivating or pigmentating a web locally, off the wet end or a size-press, but arriving to the very center of a web

Sample 13, 2 gr cellulose on 1 l water, layed on surface, sprayed with pigment solution, pressed under plexiglass

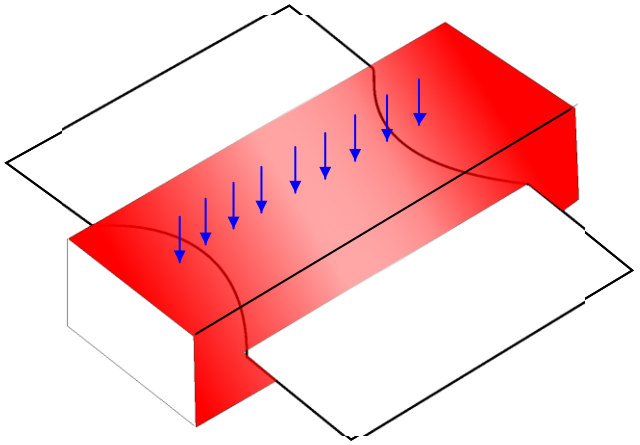


Sample 11, 2 gr cellulose on 1 l water, layed surface, sprayed with pigment solution, treated with CD- lab test rack under pressure with plexiglass



Potential multiple treatment for i.e. bicomponent additives…..

In the pipeline: additivation via the UNITS



Facilitating the potentially also multiple incorporation of classical and new additives or pigments locally in a more flexible, economic and fine-tuned, and hopefully also sustainable, way. Imparting potential and properties to paper which did not exist in the past

Outlook

We hope, via our system, to be useful in the future for a huge variety of papers, even where high performances are not visible to the final customer but important for a paper maker.

Of course we are aware that time is money and it would be difficult to stop a production simply for implementing and trying something really new. For this reason the units are installed at a pilot facility where any sort of pulp can be processed and tried.

From our side we have reached certainties over our years long experience and know how, having become really specialists of CD and MD behaviour and everything which is part of it, and now we feel time is mature to make you aware of this novelty.

Our goal for the near future is to license our international patents and their technologies worldwide

Thanks for your attention