

Sherpack Final Workshop



The science behind the project: 3 key innovative technologies

Wet-lamination of cellulose fibrils

Fleur Rol | CTP



Wet lamination of Cellulose fibrils

Fleur Rol

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Horizon 2020
European Union Funding
for Research & Innovation



Introduction

- The **packaging** material market is undergoing a major turn in its history
- Food packaging industry is looking for **alternatives to petrobased** products which are
 - Biobased, Biodegradable, Recyclable
 - Barrier to grease, water, oxygen,...



- **Cellulosic** materials can be a solution and especially **MicroFibrillated Cellulose (MFC)**
- A new process to combine Paper/Board and MFC was hence developed and patented by **CTP** in 2015

MFC Wet lamination process

Presentation outline

1. Introduction to the MFC wet lamination

- Concept of MFC wet lamination
- Advantages and drawbacks compared to other MFC deposition methods
- Intellectual property

2. Performances of MFC wet laminated papers

- Barrier properties
- Mechanical properties / Adhesion of MFC on the papers

3. CTP's facilities for MFC wet lamination

- Lab scale: production of A4 samples
- Pilot scale: production of rolls

4. Conclusions

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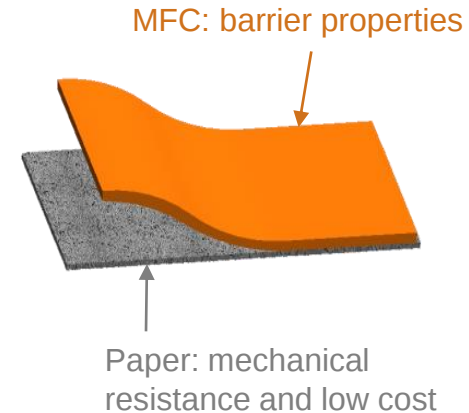
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Concept of MFC wet lamination

- MFC film: good **barrier properties** to grease, contaminants and oxygen
- **Biodegradable**, biobased, **recyclable**

But... MFC films are **very brittle** and MFC **cost** is high

- Associate a **thin layer** of **MFC** with paper or board
- MFC layer should be thin enough for being **economically** relevant and thick enough to get the **barrier** properties
- **100% cellulosic** material, recyclable and biodegradable

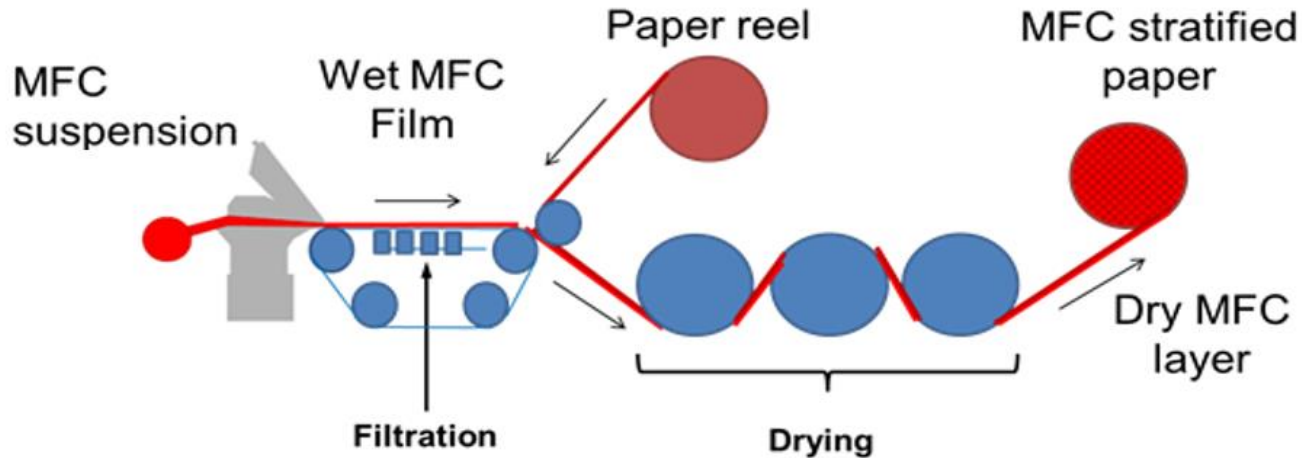


New process: MFC Wet lamination

Concept of MFC wet lamination

A **wet MFC film** (5 to 18% of solids) is dry enough to be viewed as a solid like **self-standing** material that can be picked up whereas it is wet enough to keep its **adhesion** ability and adhere onto a base paper **without any glue**

Process based on **3 steps**

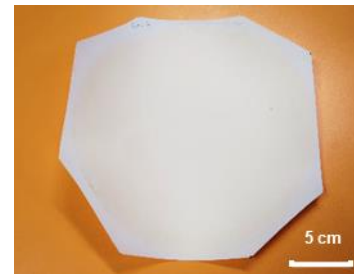


Concept of MFC wet lamination

Conclusion

MFC wet lamination allows to produce a **MFC covered paper**

- Targeted coat weight **5 to 50 g/m²**
 - To get the benefit of MFC for barrier
- Combined filtration, replication and drying for MFC layer
 - Optimize process costs
- Adhesion **without** the use of **glue**
 - 100% cellulosic material, recyclable and biodegradable



Advantages and drawbacks compared to other MFC deposition methods

Technology	MFC deposit	Advantages	Drawbacks
Coating (spray, slot die, blade)	0.5 to 3 g/m ²	-Easy to use, (even if some process adjustments are needed (pumps, backflow))	-CW>1g/m ² overpasses conventional coaters drying capabilities -Drying cost -Poor barrier at low coat weight
Lamination	>25 g/m ²	-Excellent barrier	-Brittleness of MFC films -Use of glue -Material/Energy cost - % of cellulose in the multilayer
Deposition at the wet end	0 to 10 g/m ²	-Use of the dewatering capability of the Fourdrinier	-Filtration through the wet mat -Adhesion on the press rolls -Decrease of the press section dewatering
Wet lamination technology	5 to 50 g/m ²	-No glue -Relevant thickness vs barrier -Limit the drying cost	-Require a dedicated process

- Process and device for manufacturing a laminated material comprising a fibrillated cellulose layer
- **WO 2016174348 A1 - PCT/FR2016/050986**
 - Priority 28 Avril 2015
 - Publication 3 Nov. 2016
- Inventors
 - David Guerin, Yahia Rharbi, Patrick Huber, Valérie Meyer
 - CTP/CNRS
- Exploitation rights
 - CTP



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Performances of MFC laminated papers

Reference Materials

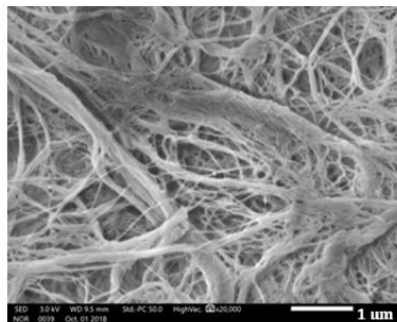
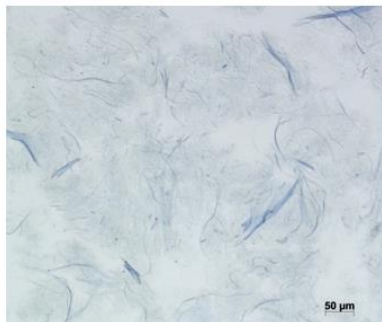
➤ Gerstar HDS paper 60g/m² - Ahlstrom Munksjö

- Mineral coated on one side and calendered
- Thickness: 54µm



➤ MFC: Exilva – Borregaard

- 2wt% concentration



Morfi analysis

Fibres	Fibre content, millions/g of pulp	18,0
	Mean fibre arithmetic length, µm	150,5
	Mean fibre width, µm	16,9
	Mean fibre coarseness, mg/m	0,2
	Mean fibre curl index, %	2,1
Shives	Shive content, nb/g of pulp	0,0
Fines	Fines content, millions/g of pulp	461,2
	Mean fine area, µm ²	401,5
	Mean fine length, µm	30,5
	Fibers content, % in area	51,6

Performances of MFC laminated papers

Wet lamination



- Filtration
- A4 handsheet former
 - Wire/membrane
 - Vacuum



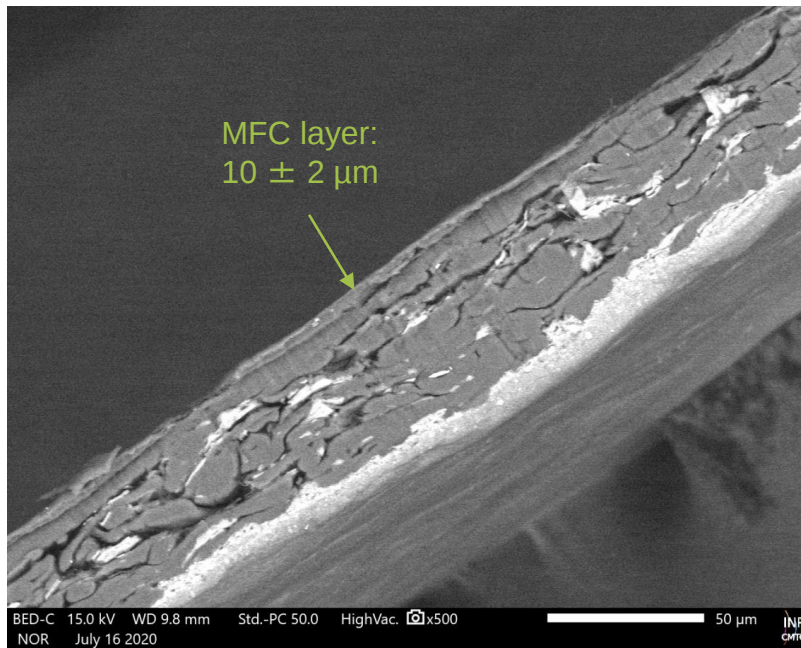
Manual pick up,
Replication and
Pressing



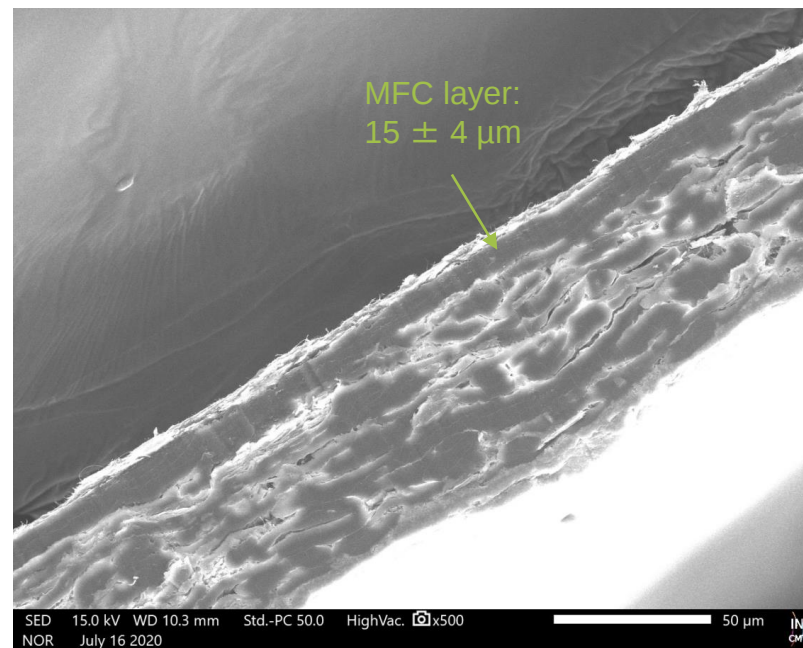
- Drying
- Conductive
drying under
stress

MEB analysis of wet laminated paper

MFC weight : 12 g/m²



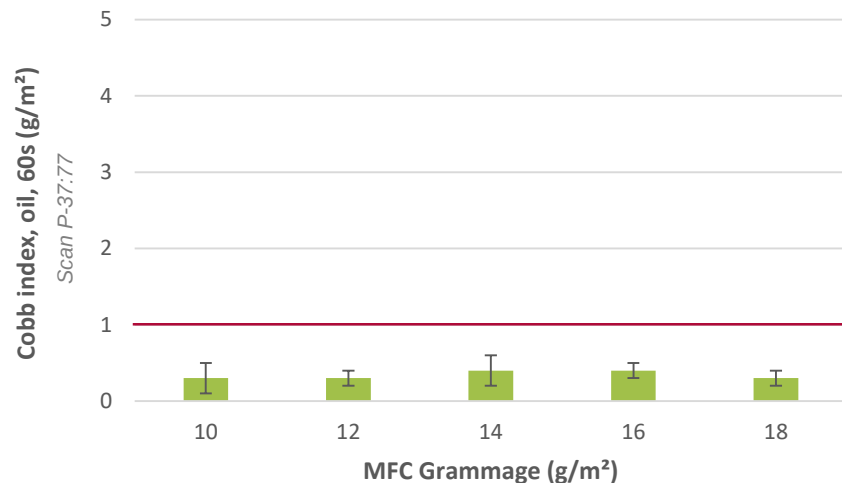
MFC weight : 16 g/m²



Barrier properties: Grease

Sherpack
objectives

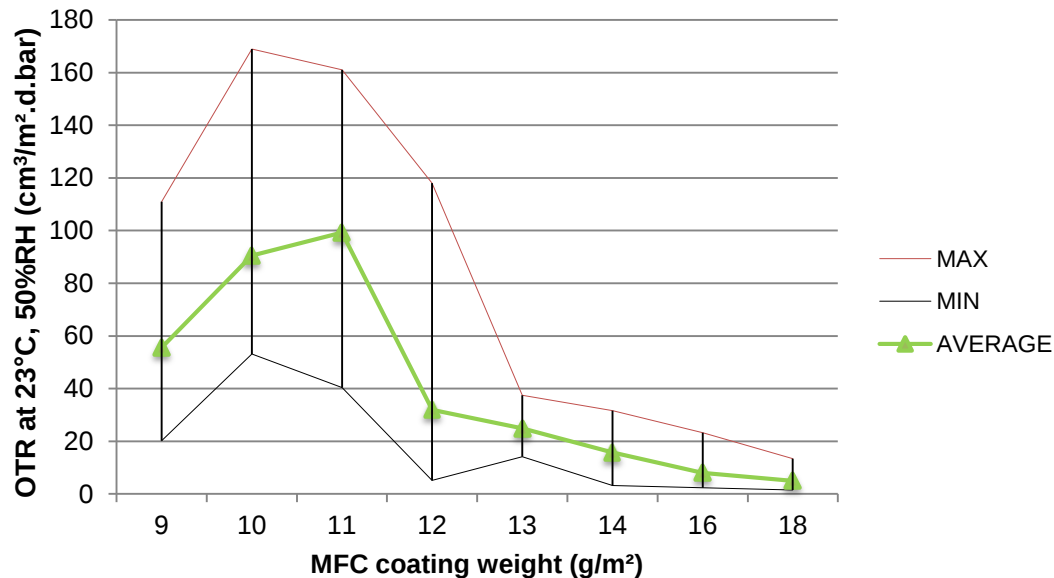
MFC grammage (g/m ²)	18	16	14	12	10	3-15
Material total grammage (g/m ²)	78	76	74	72	70	63-75
Thickness (μm)	80	76 ± 1	72 ± 1	71 ± 2	69 ± 2	-



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objectives

- MFC confer **grease barrier** to the material whatever the MFC grammage
- Water and water vapour barrier should be developed using other process

Barrier properties: oxygen

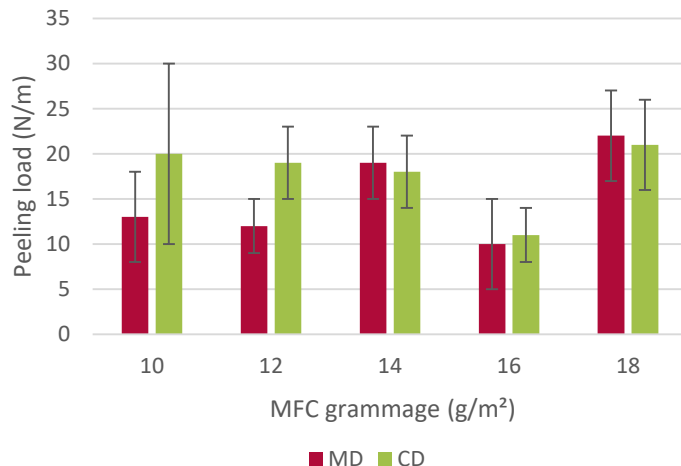
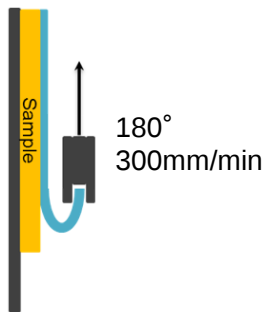


- Good and very encouraging values of OTR for samples with **12g/m² of MFC**
- But the high standard deviation indicated that this was **not robust**.
- The oxygen barrier is not currently linearly correlated with the grammage in the tested range
- Below 9g/m², the OTR is out of range

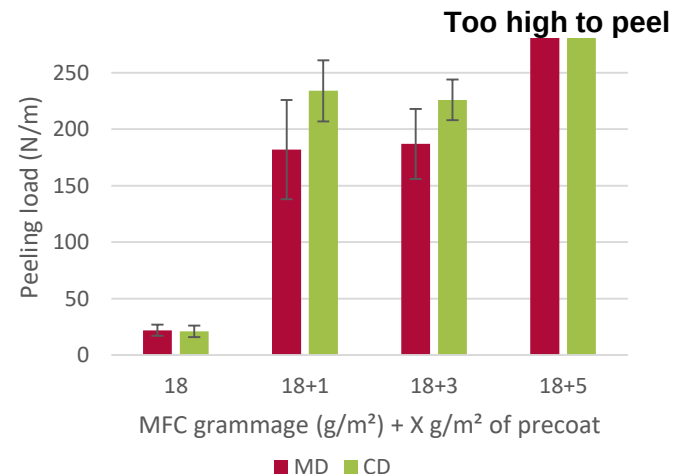
Adhesion of the MFC layer on the paper

Peeling test

Finat Test method 1



Paper
precoating
with starch



➤ The MFC layer adhesion is similar for MFC weights between 10 and 18g/m²

- MFC brings **grease barrier** and **oxygen barrier** to paper
 - Surface homogeneity is primordial
 - No influence of the MFC weight on the oil barrier property between 10 and 18 g/m² of MFC
- The MFC layer **adhesion** on the paper can be improved by paper **precoating**
- **100% cellulosic** materials
 - Biodegradable
 - Recyclable

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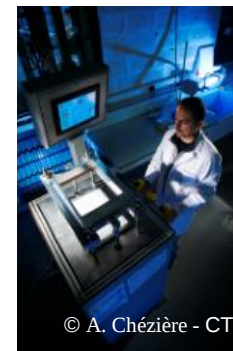
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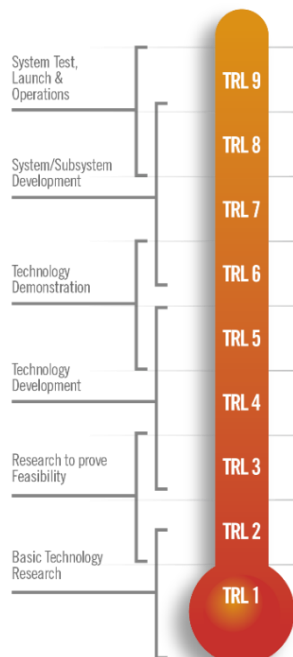
CTP's facilities for MFC wet lamination

To bring excellent grease, oxygen, and contaminants barriers to papers and boards

- Dedicated equipment to develop the process and produce samples for testing and proofs of concept
- Sample size compatible with further surface treatments
 - Coating
 - Laminating



....From lab scale to pilot scale



Small Pilot Machine - 2019



Lab equipment - 2018



Invention - 2015



Lab scale: production of A4 samples

TRL3 - 2018

Filtration

- A4 handsheet former
- Wire/membrane
- Vacuum



Manual pick up, Replication and Pressing



Drying

- Conductive drying under stress
- Flat or half-moon



Pilot scale: production of rolls

TRL5 – 2019



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- Useful width: 305mm
- MFC coating weight: 10 to 50 g/m²
- Paper grammage: 30 to 300 g/m²
- MFC max feed rate: 6L/min
- Speed: 1 to 10m/min
- Roll diameter (max): 500mm

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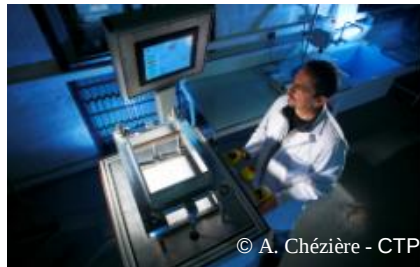
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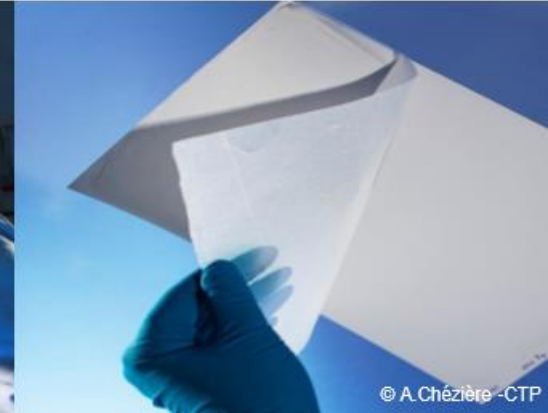
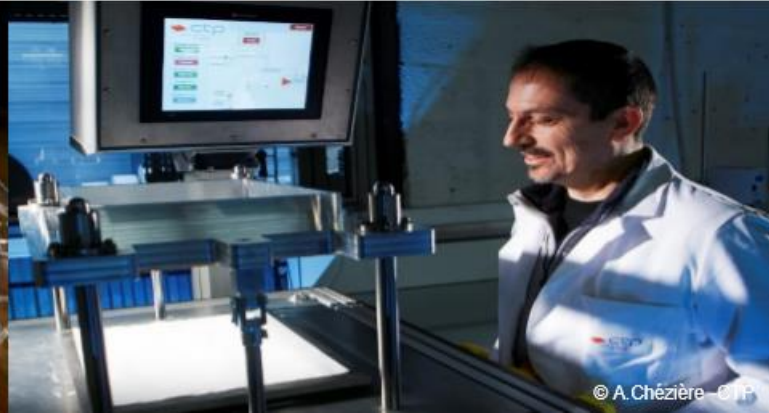
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- Cost **efficient process** to combine a conventional paper/board with a layer of MFC
- **100% cellulosic material** recyclable and biodegradable can be produced
- MFC wet laminated paper/board present **good barrier properties** to grease, contaminants and oxygen
- **Patented** by the **CTP** in 2015
- CTP's facilities
 - **Lab scale**: Production of A4 samples – Already possible
 - **Pilot scale**: Production of rolls – Available for external trials Q1/Q2 - 2021





Thank you for your attention

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Questions?