AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

4de opvolgvergadering BREPLA

01/12/2022

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driving industry by technology

overzicht

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

- Projectdoelstelling
- Werkplan
- Kennisoverdracht rond vezels, matrices and prepregs (WP2,3,4)
- Kennisoverdracht verwerking tot composieten (WP5)
- Recyclage en LCA (WP7)
- Demonstratoren (WP1, 5 en 6)

BREPLA project/doelstelling

COOCK project HBC.2020.2567

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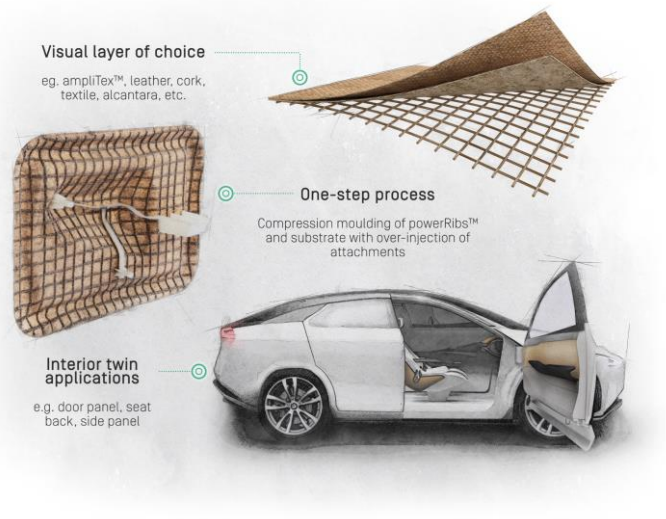
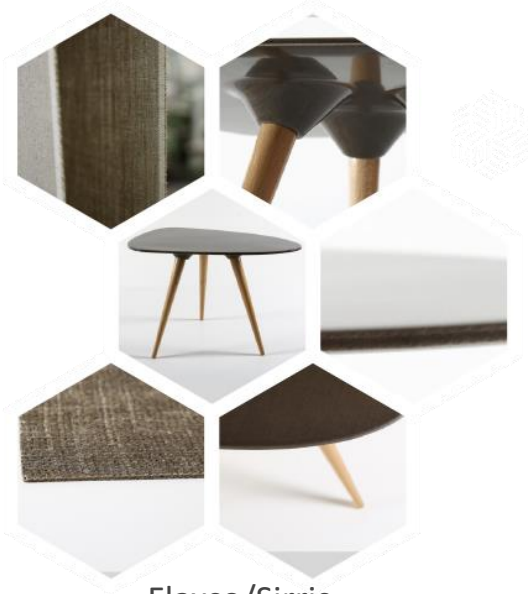
de transitie van petrochemische naar biogebaseerde composietproducten versnellen voor 3 sectoren:

- Meubelindustrie, automotive, consumentengoederen



Bcomp (material supplier)



Flaxco/Sirris

McLAREN IS PIONEERING THE USE OF SUSTAINABLE COMPOSITES IN F1

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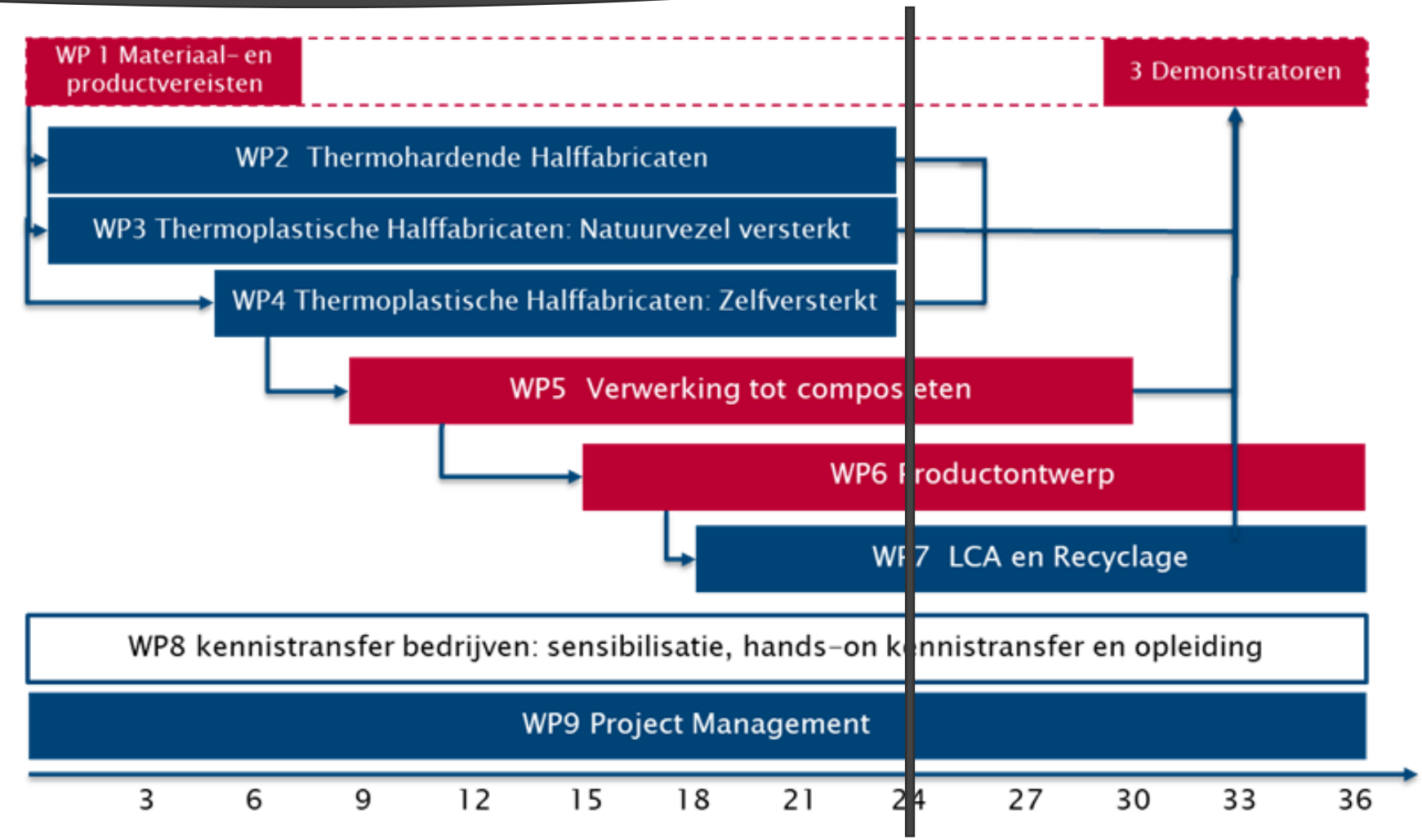
Werkplan


WP 1 Materiaal- en productvereisten
3 Demonstratoren
WP2 Thermohardende Halffabricaten
WP3 Thermoplastische Halffabricaten: Natuurvezel versterkt
WP4 Thermoplastische Halffabricaten: Zelfversterkt
WP5 Verwerking tot composieten
WP6 Productontwerp
WP7 LCA en Recyclage
WP8 kennistransfer bedrijven: sensibilisatie, hands-on kennistransfer en opleiding
WP9 Project Management
3
6
9
12
15
18
21
24
27
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33
36

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Vlaanderen is ondernemen

Kennisoverdracht

Thermoset matrices, prepregs (WP2)

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Brepla website

- https://www.centexbelpresents.be/en/brepla
- Rapporten vrij te downloaden
- Rond thermoset:
  - 1) rond vezels
  - 2) harsen
  - 3) in voorbereiding prepregs

Thermoset matrix formuleringen

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

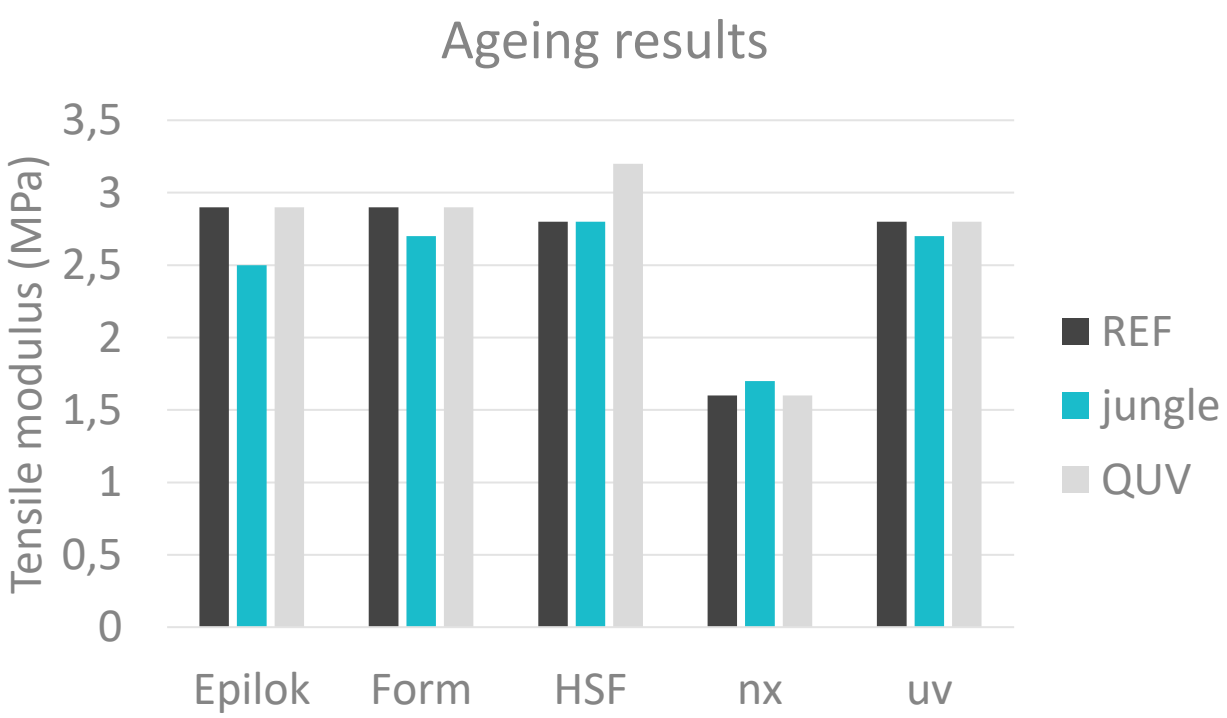
- Bepaling UV en vochtresistentie
  - QUV: ISO 4892-3;
    - Gebruikte methode A: Type 1A (UVA-340) lampen
    - Cyclus 24 u droog, BS temperatuur 60±3°C
    - Blootstelling (uren) 240
  - Jungle test: ISO 1419-C (2019)
    - 3 weken op 70°C bij 95% RH
- 5 harsen getest op treksterkte voor en na veroudering
  - Epilok (Anric/Bitrez)
  - Formulite (Cardolite)
  - Formulite ultra
  - Formulite NX
  - Formulite + UV absorber

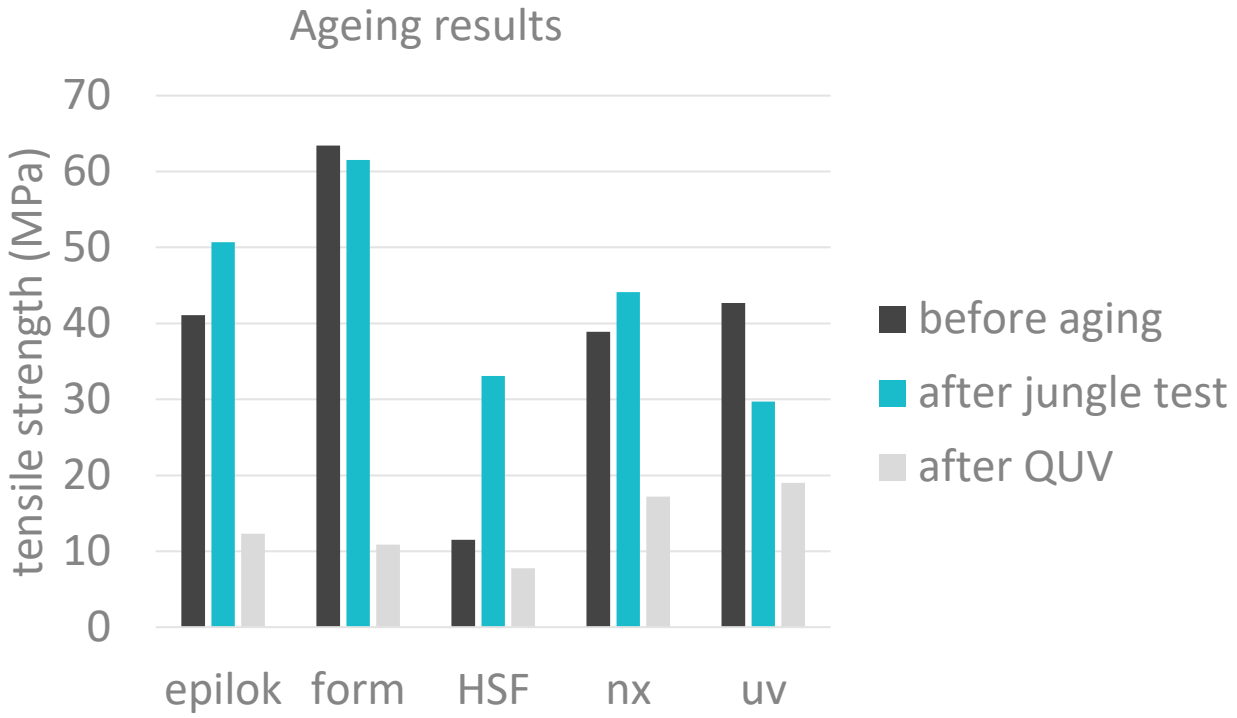
Thermoset matrix formuleringen

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN Vlaanderen is ondernemen

- UV en vochtresistentie (modulus ok, UV-blootstelling lijkt de treksterkte te verminderen)





Bemerking: enkel een beperkt aantal stalen getest, wordt nog eens herhaald

Andere opties

SURF CLEAR EVO

- Provides the highest UV resistance count of all the Sicomin clear resins.
- High gloss appearance for transparent laminates, clear carbon parts and decorative goods.
- Self levelling, sandable and scratch resistant.

DOWNLOAD THIS

http://sicomin.com/datasheets/product-pdf74.pdf

Highest Performance Bio-Epoxy

- A Resin Revolution!

NaturePoxy is a true Revolution in the World of Epoxy Resins. NaturePoxy Resin combines unique characteristics in compressive and tensile strength, with hardness, flexibility and UV Resistance.
NaturePoxy adds great workability combined with strong adhesion making it a great choice for Bio-Composites and Bio-Coatings with excellent mechanical properties.

https://www.naturepoxy.com/

Geen vergeling of cracks, maar geen vermelding van mechanische eigenschappen na UV blootstelling

Thermoset matrix formuleringen

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

- Brandvertragende additieven (FR)
- Toevoegen van guanidine fosfaat (30%) aan bio epoxy
- LOI test resultaat: 25% (t.o.v. 20% zonder) lichtjes brandvertragend, ter vergelijking bij toevoegen van APP wordt een LOI gehaald van 30%.
- Andere mogelijkheid werken met intumescent coating

SGi 128

- A bio friendly intumescent gelcoat.
- Up to 38% bio-based carbon content.
- Exceptional fire performance.
- Halogen free with low smoke toxicity.
- Hardwearing weatherproofed finish for exterior applications.
- Available in industrial volumes with short lead times.
- Tested to EN 13501 (EUROCLASS B-S1-d0) and ASTM E84 (Class A).

DOWNLOAD THIS

SR Firegreen 37

- A more sustainable fire retardant hand laminating system.
- Intumescent epoxy resin system with 25% bio-based carbon content.
- Halogen free with low smoke opacity and toxicity.
- Range of hardeners to adjust cure times.

DOWNLOAD THIS

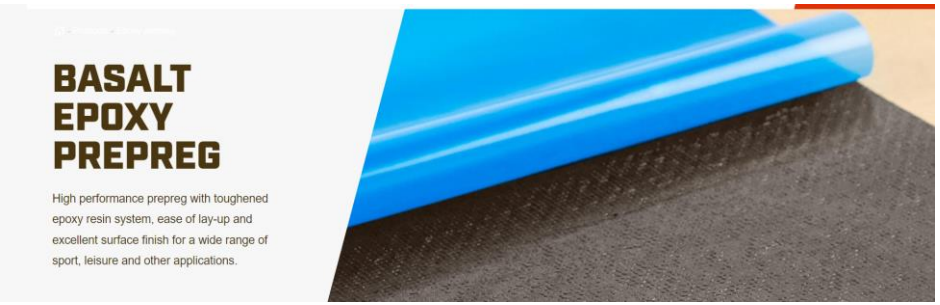
Thermoset prepregs

- Voorgeïmpregneerde textielversterkingen
- Hars typisch aangebracht via Foulard of coating
- Verwerking tot composiet: autoclaaf, vacuüm bagging, persen
- Voordelen:
  - juiste verhouding vezel/hars
  - hoge vezel/matrix verhouding (goede mechanische eigenschappen)
  - Je moet zelf niet meer impregneren

FlaxPreg T-UD material

https://media.easycomposites.co.uk/datasheets/FLAXPREG-110g-UD-Pre-Preg-Flax-TDS.pdf

- Nadelen:
  - Duurder
  - Temperatuur en druk nodig voor optimale hechting
  - Bewaartijd/temperatuur



https://www.basaltex.com/products/epoxy-prepreg

Commerciële prepregs

name	supplier	fibres	matrix	link
FIRE-BARRIER PREPREG	Basaltex	Basalt	PFA	https://www.basaltex.com/products/firebarrier-prepreg
Evopreg	Composite Evolution	carbon, glass, basalt, aramid, flax	PFA	https://compositesevolution.com/products/fire-resistant-pfa-prepregs/
MTB350	SHD	Various	bio-epoxy	https://shdcomposites.com/admin/resources/shdbrochureoct22.pdf
FR308	SHD	carbon, glass	PFA	https://shdcomposites.com/admin/resources/shdbrochureoct22.pdf
PS 200	SHD	carbon, glass	PFA	https://shdcomposites.com/admin/resources/shdbrochureoct22.pdf
Furolite	TFC	/	PFA	https://www.transfurans.be/products
BioRez	TFC	/	PFA	https://www.transfurans.be/products
Bio resin	Fiberpreg	basalt, flax	bio-epoxy	http://www.fiberpreg.com/news/bio-resin/
Basalt Epoxy prepreg	Basaltex	Basalt	epoxy	https://www.basaltex.com/products/epoxy-prepreg
Coral prpereg	Elmira industrial supplies	carbon, glass, flax	bio-epoxy	https://elmira.co.uk/coral-prepreg
FLAXPREG-T-UD	EcoTechnilin	flax	epoxy	https://eco-technilin.com/fr/16-flaxpreg-t-ud
NX-4000 series	Cardolite	/	bio-content phenolic resins	https://www.cardolite.com/markets/1k-epoxy-composites/
Bio Benzoxazine	Bitrez	glass	bio-benzoxazine	https://www.bitrez.com/

SHD offers a range of reinforcements, but if these do not meet your specifications they offer a Toll Impregnation service which enables the bespoke processes to be customised to your specific requirements.: https://shdcomposites.com/prepregs

Thermoset prepregs

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Vlaanderen is ondernemen

- Test met Oribond resin:
- Impregnatie van vlas met oribond resins, nadien verpersen tot composiet
- Onmiddellijk op kamertemperatuur: ok
- Na één dag op kamertemperatuur: ok
- Na 10 dagen op kamertemperatuur: nok
- 30 dagen op -18: kan nog verperst worden tot composiet

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

Kennisoverdracht

Thermoplastisch

Rapporten WP3

- Beschikbaar op website:
  - D3.1 – PLA formulaties met instelbaar smeltpunt en specifieke functionalisaties

- Binnenkort beschikbaar op website (eind december):
  - D3.2 – Aanmaak van intieme mengingen en verbeterde impregnatietechnieken
  - D3.3 – Potentiële alternatieve biopolymeren

UV resistentie

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Vlaanderen is ondernemen

- QUV ISO 4892-3, 60°C
- PLA L130
  - Geen trektest meer mogelijk
  - Herhalen bij lagere temperatuur

1) Continuous UVA irradiation:

- Intensity: 0,76 $W \cdot m^{-2} \times nm^{-1}$
- wavelength: 340 nm

2) Continuous 12 hour-cycle

- 8 hours UVA irradiation
- 15 minutes spraying with water
- 3.45 hours condensation

3h **51h** **79h** **318h**

Vlas – PLA prepregs

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AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

Combination of flax and PLA yarns

PLA hotmelt coating on flax

PLA coating on flax

PLA powder + flax

PLA foil + flax

Flax/PLA compound

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Rapporten WP4

- Beschikbaar op website:
  - D4.1 – hoge sterkte PLA filamenten en tapes voor SRPC

- Binnenkort beschikbaar op website (eind december):
  - D4.2 – bicomponent filamenten en tapes

Bicomponent filamenten

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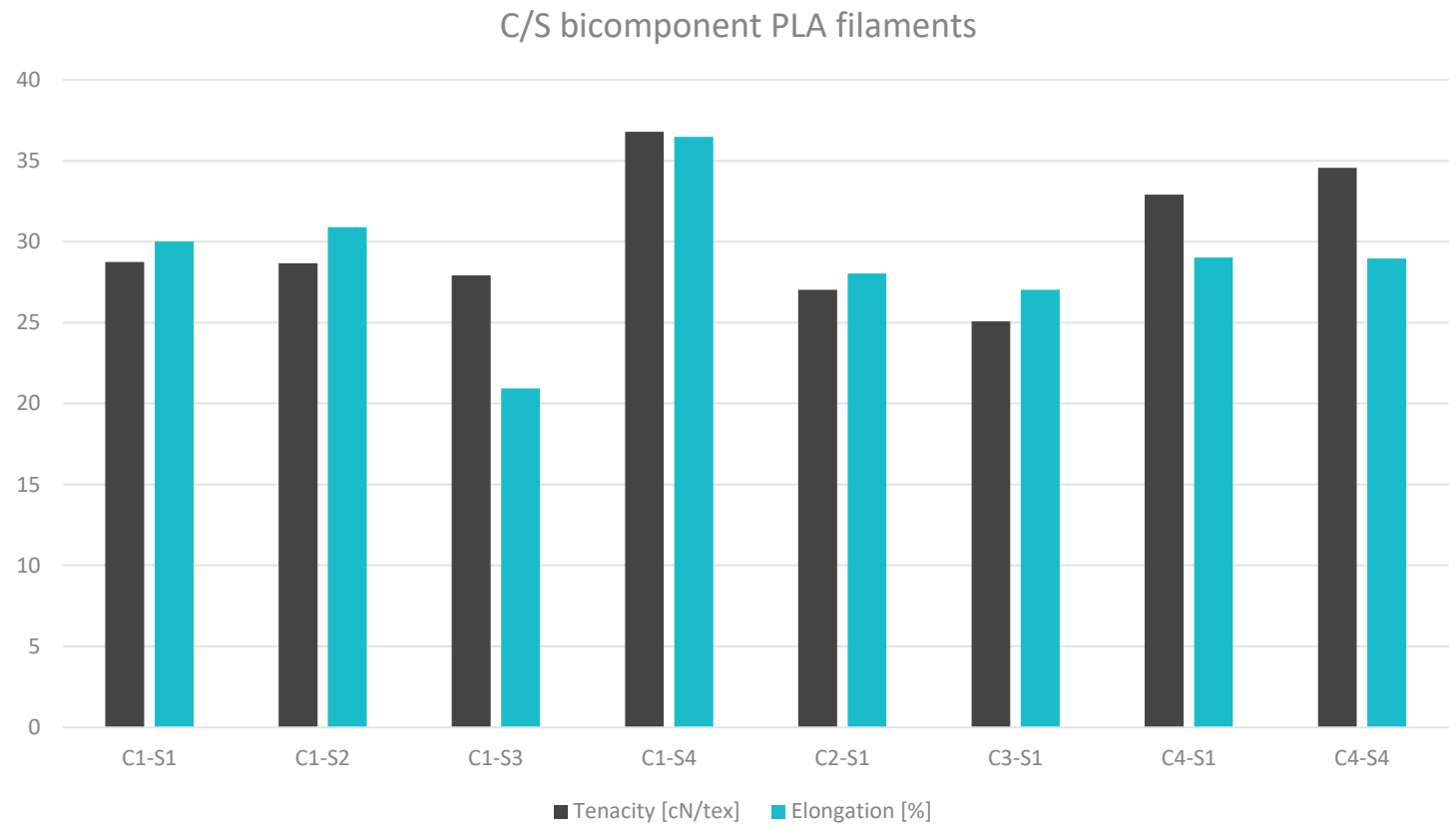
Vlaanderen is ondernemen



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Bicomponent tapes

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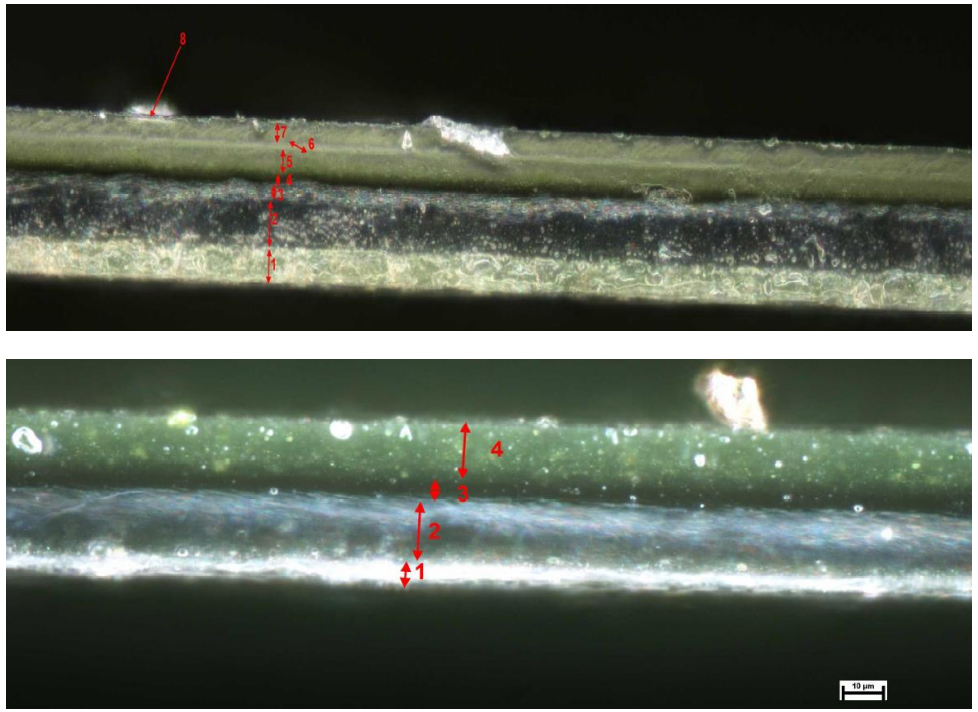

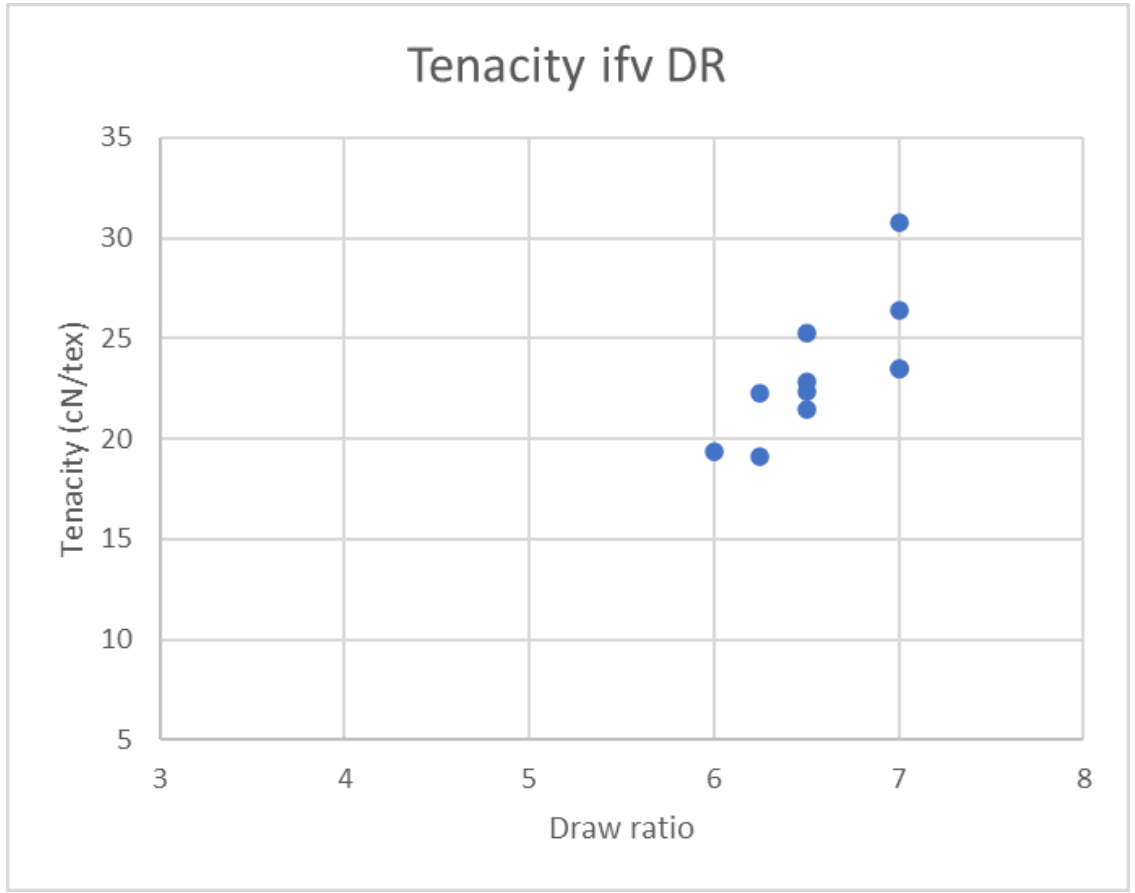

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Bicomponent weefsels

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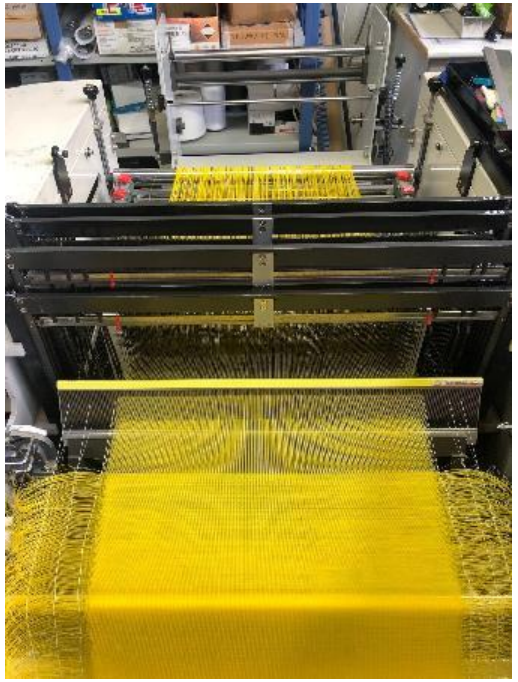
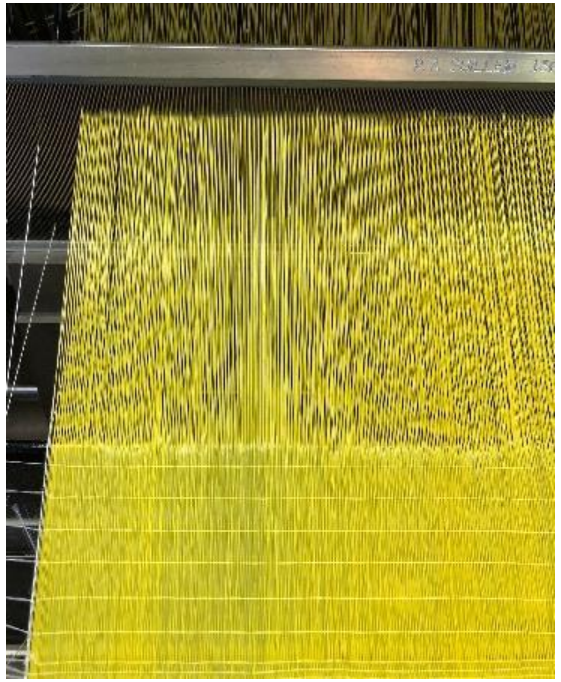
Vlaanderen is ondernemen





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Vlaanderen
is ondernemen

BREPLA-WP7

Recyclage en LCA

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Recyclage strategieën

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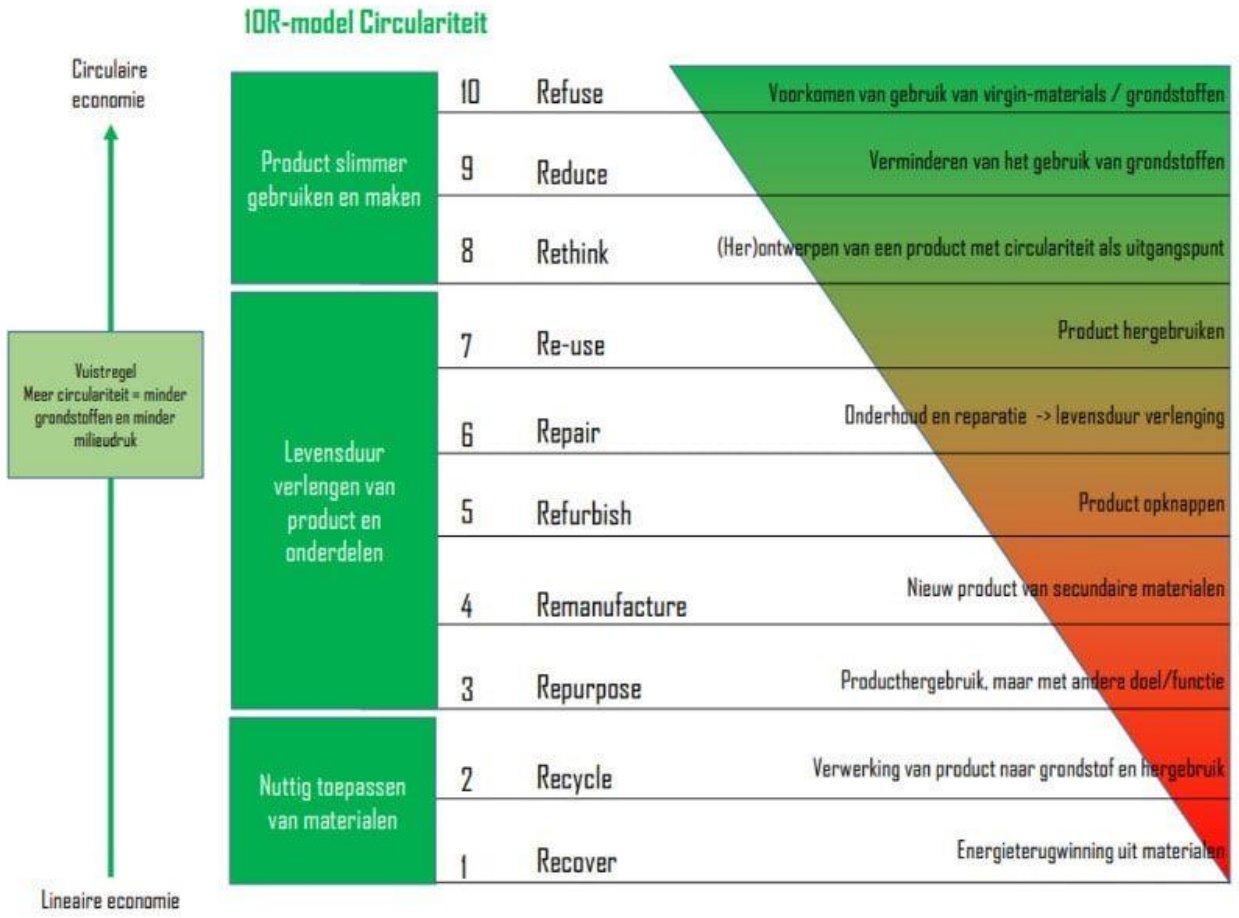
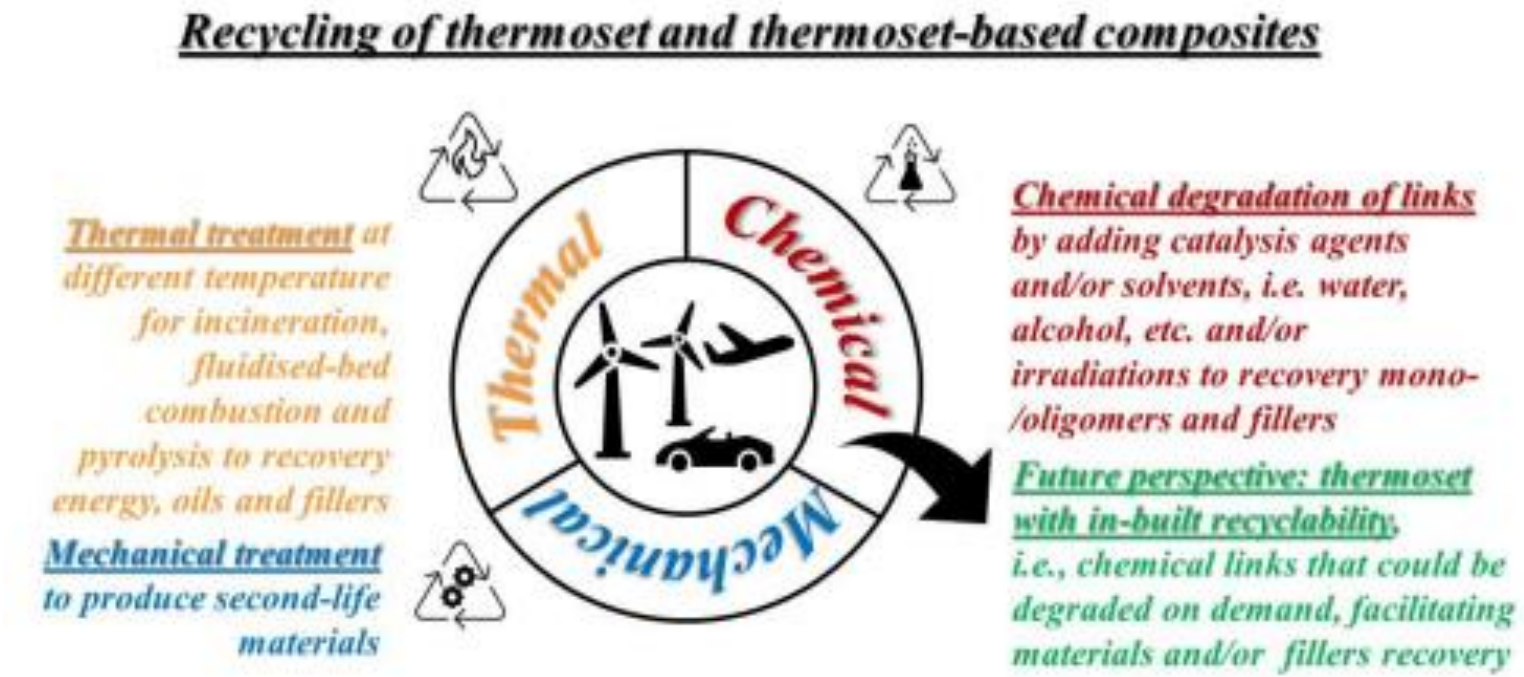
Vlaanderen is ondernemen



Recyclage thermoset composieten

- Recyclagemogelijkheden

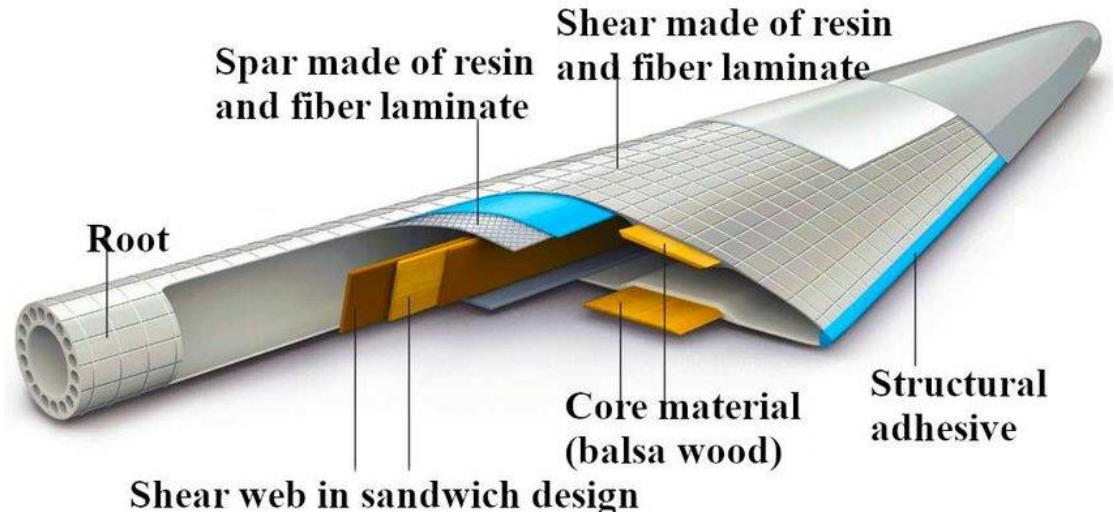


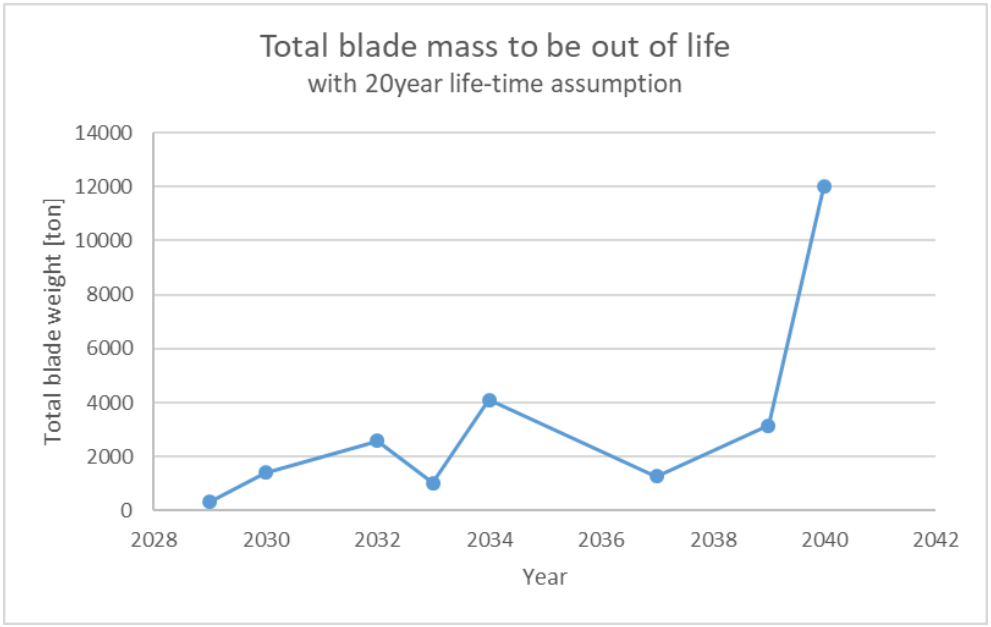
https://www.mdpi.com/2073-4360/14/19/4153/pdf

OVAM studie: https://publicaties.vlaanderen.be/view-file/20492

Wind turbine blades: facts and volumes

- 10-15wt% of total wind turbine
- >90% of blade is traditionally GFRP: glass fiber + polyester/epoxy
- Trends: use of carbon fiber, hybrid materials, research towards thermoplastics
- 12 kton offshore annual waste in 2040 from Belgian wind parks:





Predicted volumes in Europe

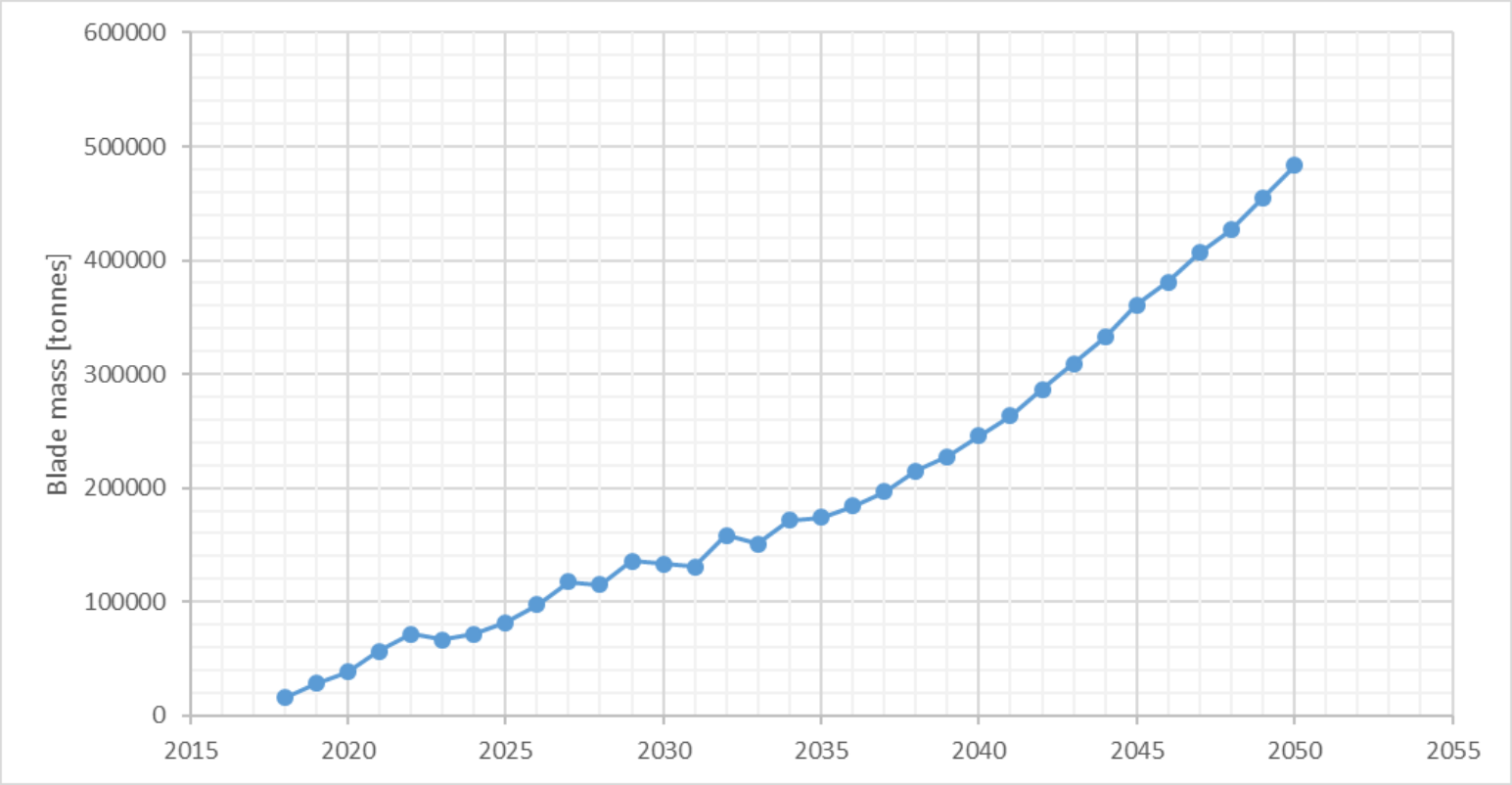


Figure 28. Predicted blade waste volumes in Europe until 2050 (reproduced from (Pu Liu, 2017))

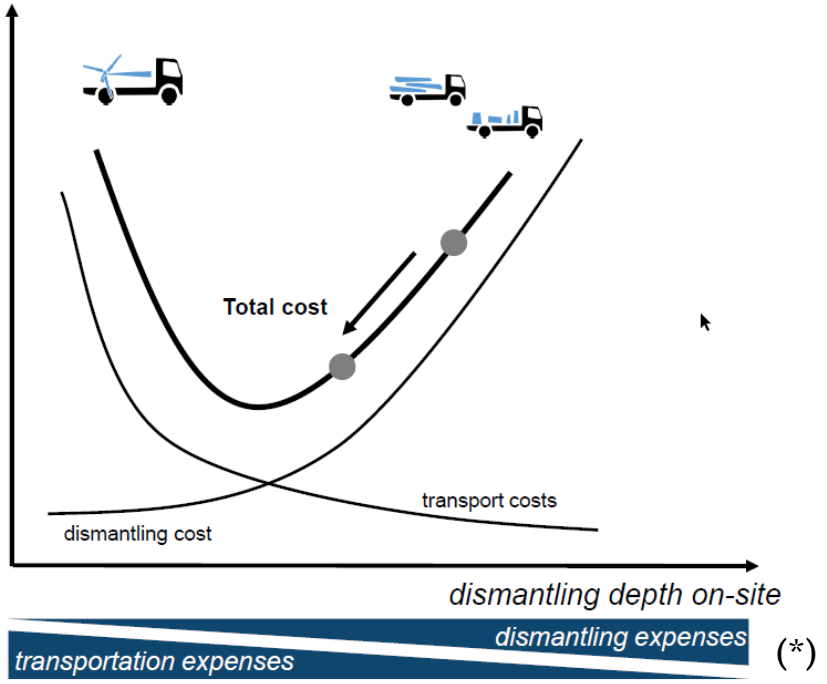
Large blade waste volumes, little recycling options, in the near future!

Solutions for Decommissioning & Logistics

Reciclalia

Neowa

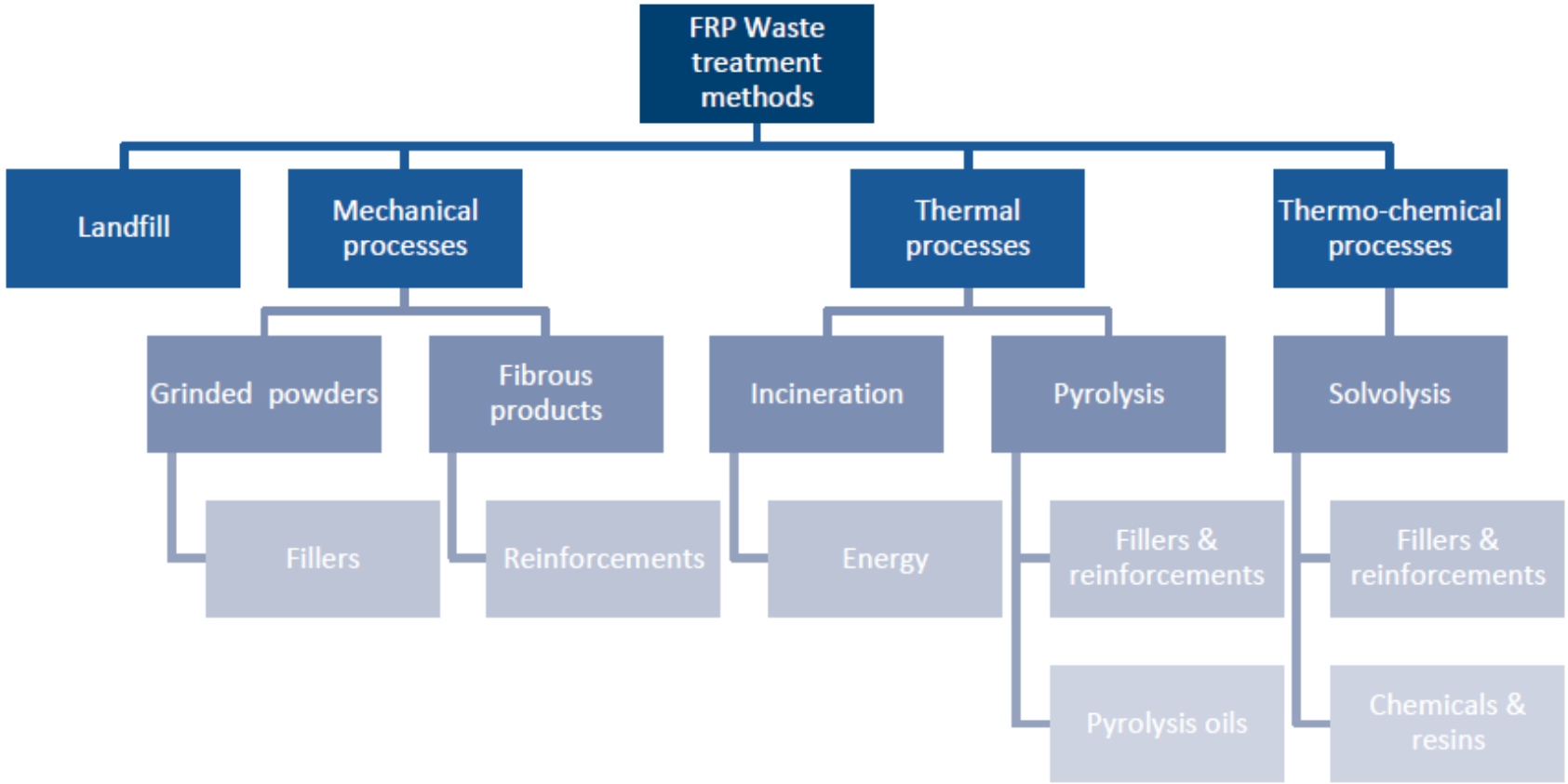
(*)



(*)

(*) Martin Westbomke, “Efficient Dismantling Networks for Wind Turbines”, Wind Europe Conference, 28.09.2018, Hamburg

Blade waste treatment: technologies



WindEurope: Discussion paper on managing composite blade waste, March 2017

Technology readiness level

9
- Actual system 'flight proven' through successful mission operations

8
- Actual system completed and 'flight qualified' through test and demonstration

7
- System prototype demonstration

6
- System/subsystem model or prototype demonstration in a relevant environment

5
- Component and/or breadboard validation in laboratory environment

GRP end of life strategies

1 Incineration & landfill (incl. co-processing)

2 Mechanical recycling Grinding (GF)

3 Structural reuse of wind blades (GF)

4 Pyrolysis (GF)

Recyclage thermoset composieten

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Vlaanderen is ondernemen

- Interreg project Recy-composite

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Recyclage thermoset composites

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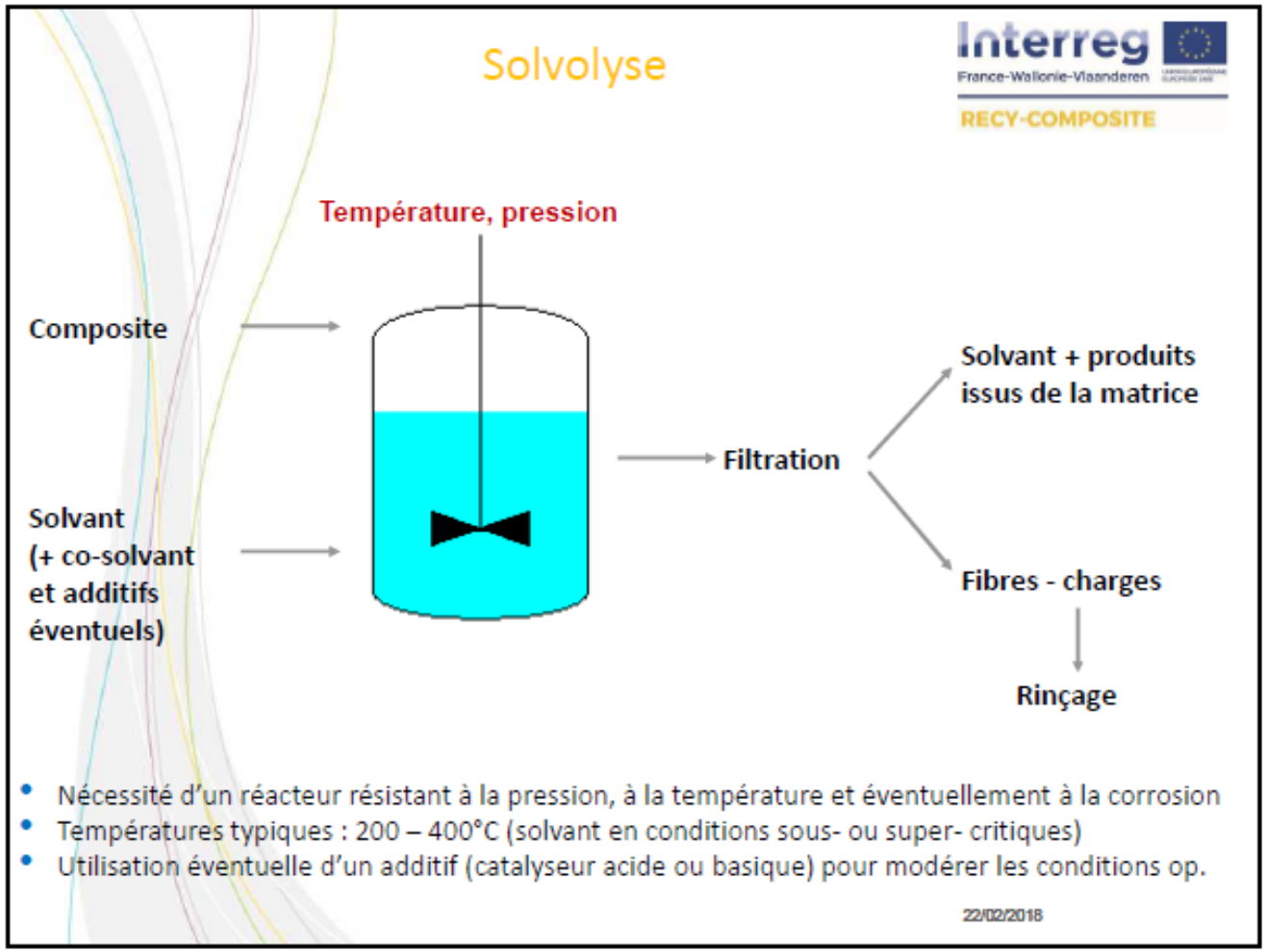
AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen



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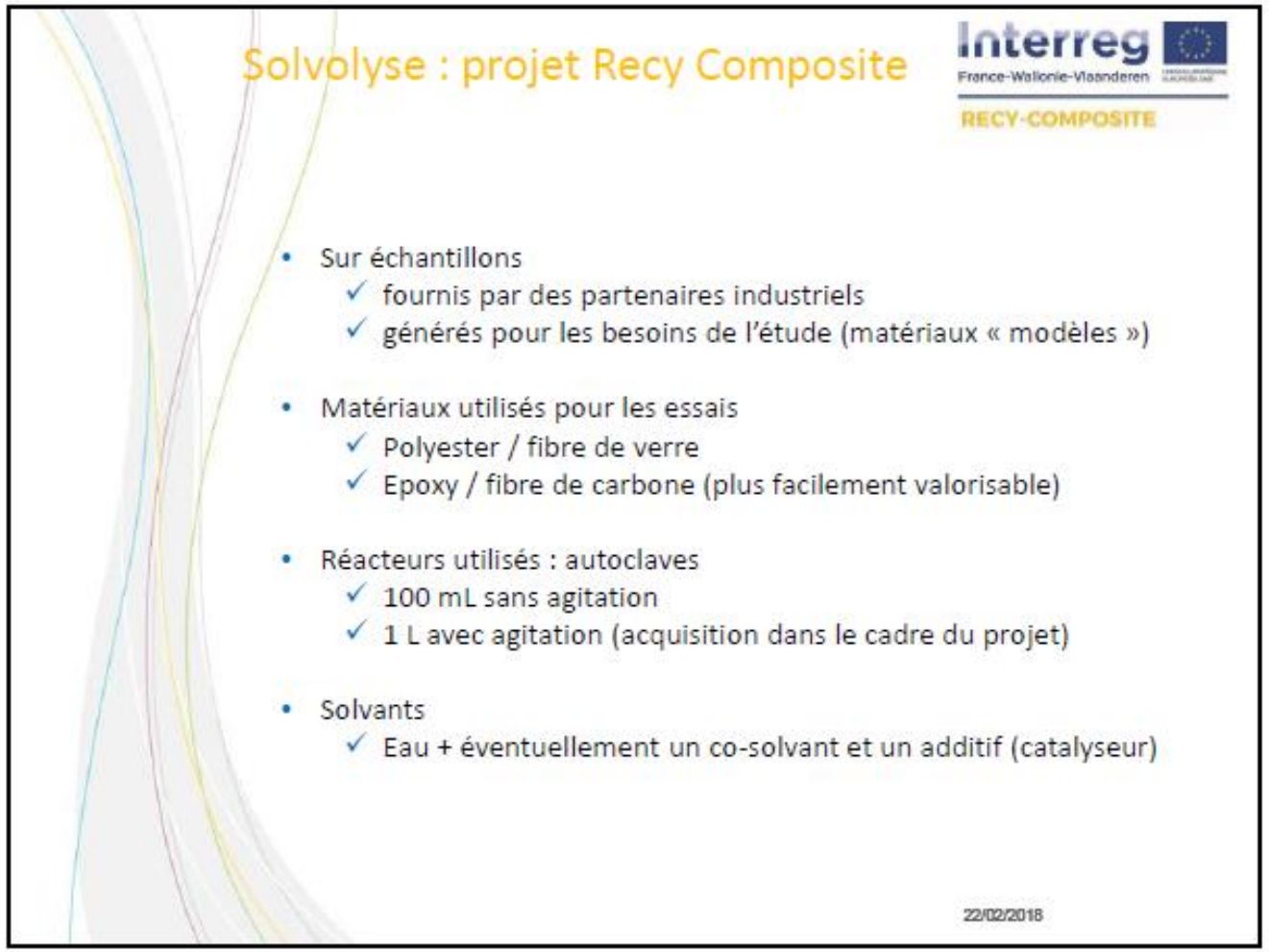
Recyclage thermoset composieten

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen



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Recyclage thermoset composieten

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AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

Solvolyse sur époxy / FC

Interreg France-Wallonie-Vlaanderen
RECY-COMPOSITE

- Réacteur autoclave de 100 mL
- 48 g dont 16,7% MS (composite)
- 320°C (env. 110 bar si solvant = eau pure)
- 120 min
- **Pas d'agitation**
- Flush préalable à l'azote
- Solvant = eau + co-solvant éventuel + additif éventuel

Broyage CTP : < 5mm

Epoxy / FC
22,7 / 77,3 %m
(Certech)

Eau (+ co-solvant + additif)

Filtrage Buchner

Résidu solide

Phase liquide

Extraction DCM

φ aqueuse / φ organique

Produits gazeux (pression résiduelle)

22/02/2018

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Recyclage thermoplast composieten

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

- (Thermo)mechanisch
- Chemisch
- Enzymatisch
- Thermisch

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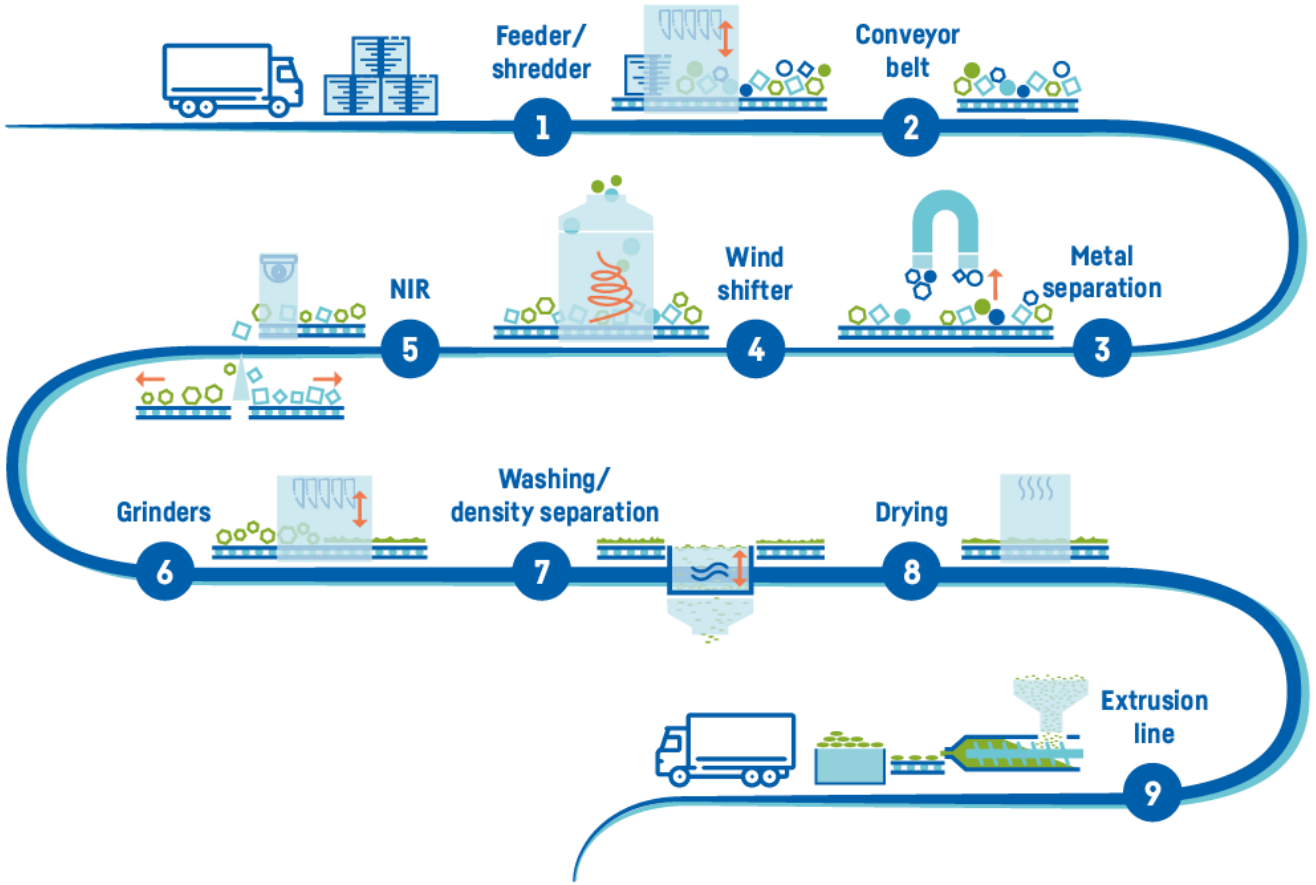
Recyclage thermoplast composieten

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

- **(Thermo)mechanisch**
- Chemisch
- Enzymatisch
- Thermisch



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Recyclage thermoplast composieten

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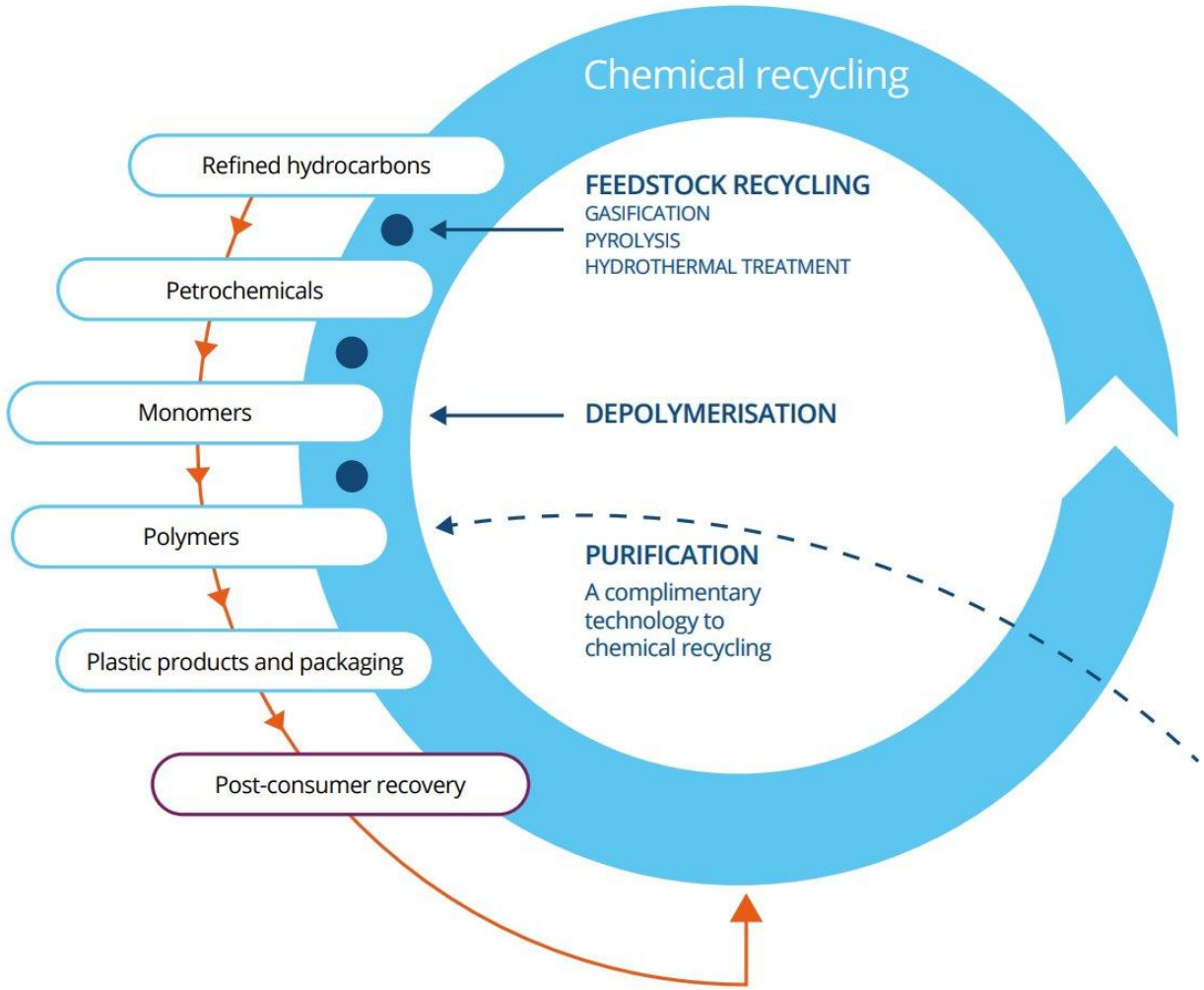
AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

- (Thermo)mechanisch
- **Chemisch**
- Enzymatisch
- Thermisch

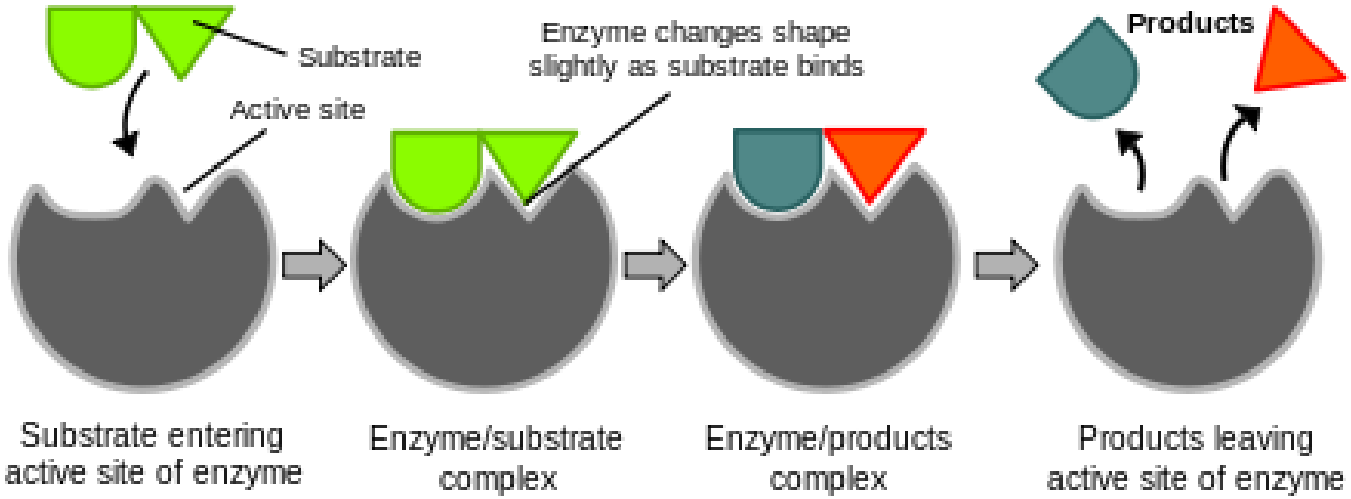


Recyclage thermoplast composieten

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

- (Thermo)mechanisch
- Chemisch
- **Enzymatisch**
- Thermisch



Recyclage thermoplast composieten

COOCK project HBC.2020.2567

- (Thermo)mechanisch
- Chemisch
- Enzymatisch
- **Thermisch**

LCA vezels

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN Vlaanderen is ondernemen

- LCA vlas-glas

Impact category	unit	Le Duigou et al.	
		1 kg hackled flax	1 kg glass fiber
global warming	kg CO2 eq.	-1,40E+00	2,65E+00
ozone depletion	kg CFC-11 eq.	2,40E-08	2,00E-07
acidification	kg SO2 eq.	2,20E-03	1,60E-02
photochemical oxidation	kg C2H4 eq.	7,30E-05	6,00E-04
eutrophication	kg PO4 eq.	1,40E-03	1,20E-03
fresh water ecotoxicity	kg 1.4 DB eq.	5,90E-02	1,70E-01
terrestrial ecotoxicity	kg 1.4 DB eq.	8,70E-03	4,20E-02
human toxicity	kg 1.4 DB eq.	2,15E-01	9,10E+00
land use	m²/year	8,40E-01	7,00E-03
non-renewable energy	MJ	1,17E+01	4,50E+01
abiotic depletion	kg Sb eq.	1,70E-03	1,90E-02

LCA bio-epoxy

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN Vlaanderen is ondernemen

Impact category	unit	Sicomin	
		1 kg bio-epoxy	1 kg epoxy
global warming	kg CO2 eq.	5,33E+00	9,40E+00
ozone depletion	kg CFC-11 eq.	4,62E-08	1,78E-07
acidification	kg SO2 eq.	3,15E-02	4,72E-02
photochemical oxidation	kg C2H4 eq.	1,11E-02	4,60E-02
eutrophication	kg PO4 eq.	7,97E-03	4,15E-03
fresh water ecotoxicity	kg 1.4 DB eq.	1,91E-02	8,29E-02
terrestrial ecotoxicity	kg 1.4 DB eq.	8,18E-03	3,28E-02
human toxicity	kg 1.4 DB eq.	2,39E-01	7,79E-01
land use	m^2/year	NA	NA
non-renewable energy	MJ	1,96E+02	8,21E+02
abiotic depletion	kg Sb eq.	9,48E-07	3,45E-06

BREPLA

CENTEXBEL sirris driving industry by technology

LCA flax-epoxy composite

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN Vlaanderen is ondernemen

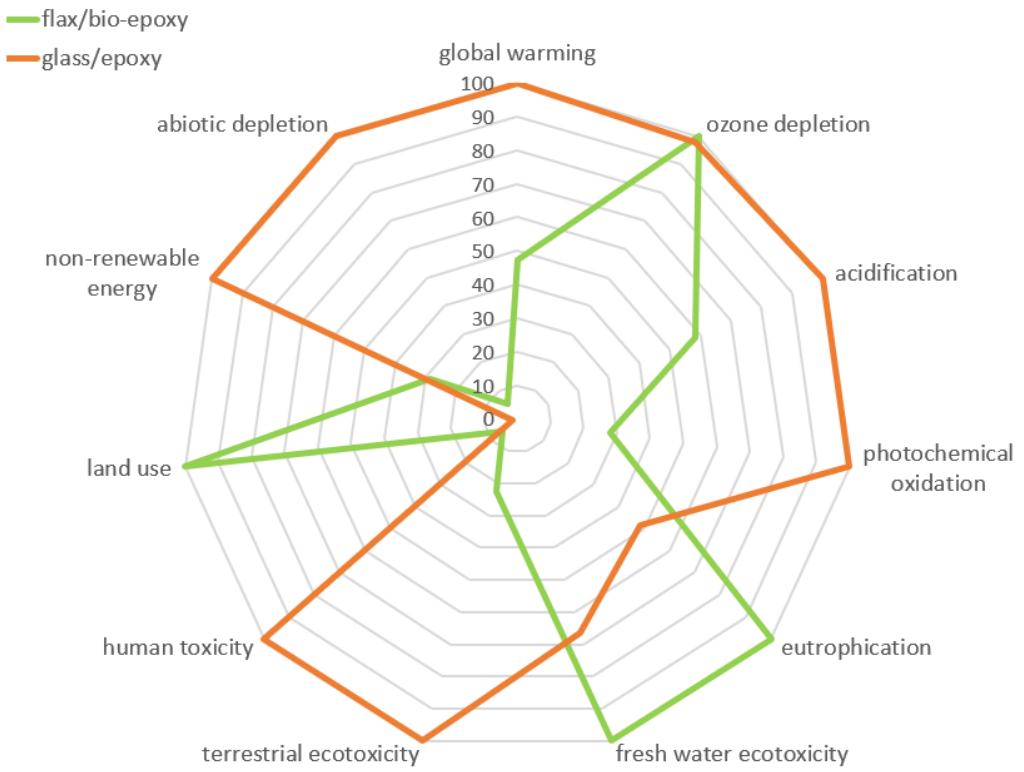
- Belangrijk om de composieteigenschappen te kennen:

	Tensile test DIN EN ISO 527 4/5		Bending test DIN EN ISO 14125	
	Glass/epoxy	Flax/bio-epoxy	Glass/epoxy	Flax/bio-epoxy
Fiber vol%	42	38	42	38
Matrix vol%	58	62	58	62
Density (g/cm³)	2	1,26	2	1,26
E-Modulus (MPa) - 0°	21847	7679	17160	7040
E-Modulus (MPa) - 90°	20116	9150	17700	9380
Tenacity (MPa) - 0°	399	101	492	121
Tenacity (MPa) - 90°	364	143	490	144

LCA uitgevoerd in kader van Interregproject Biocompal

Scenario 1 (equal thickness)

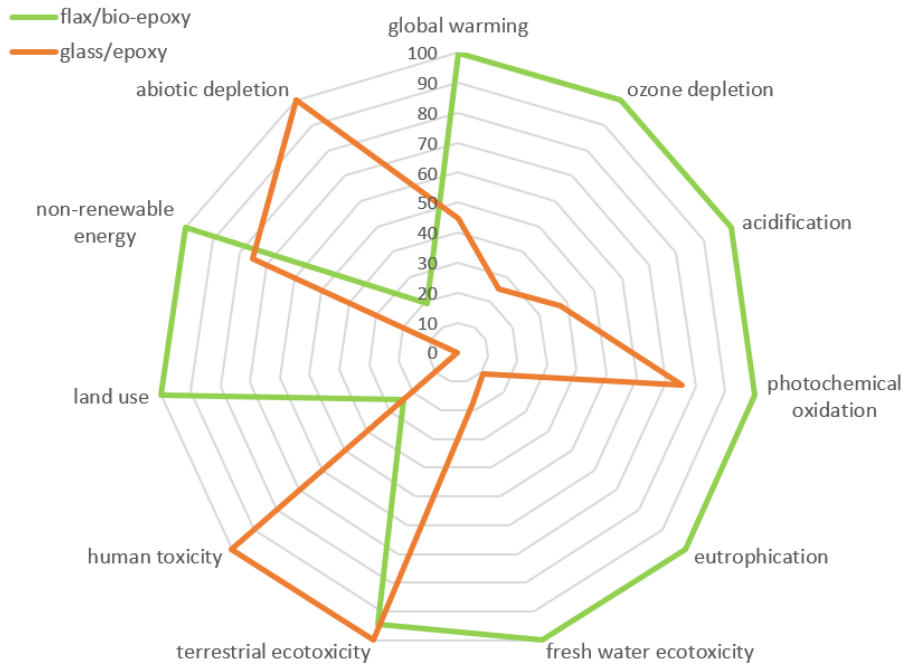
- flax/bio-epoxy composite has lower environmental impacts



Scenario 2 (equal force – corrected thickness)

- The flax/bio-epoxy composites now have much higher environmental impacts
- Tensile strength = breaking force/area
- Area: thickness x width

	Thickness (mm)
Glass/epoxy	2,44
Flax/bio-epoxy	9,62



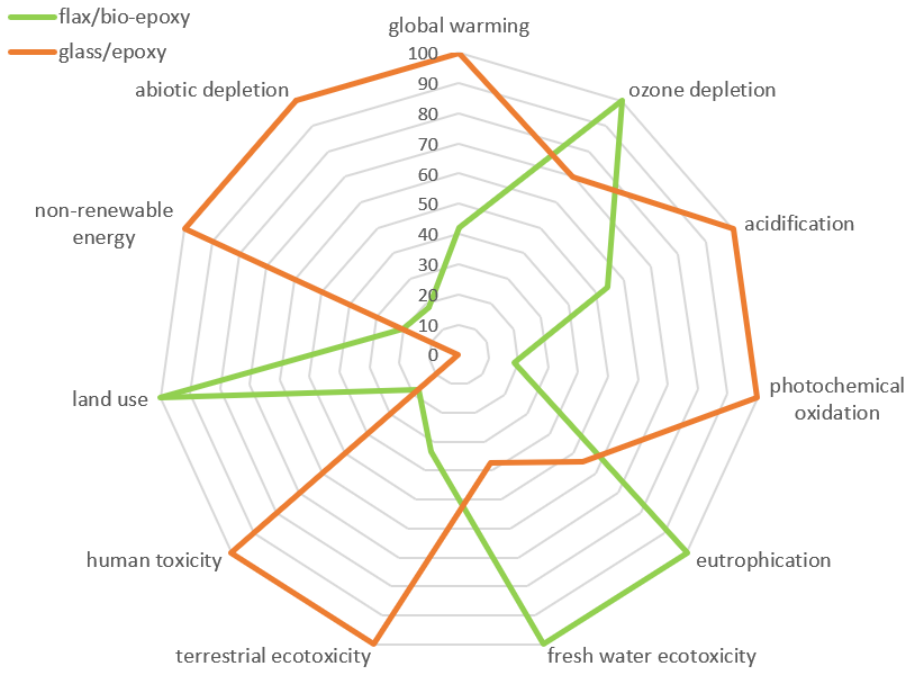
Scenario 3 (equal modulus – corrected volume fraction)

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN Vlaanderen is ondernemen

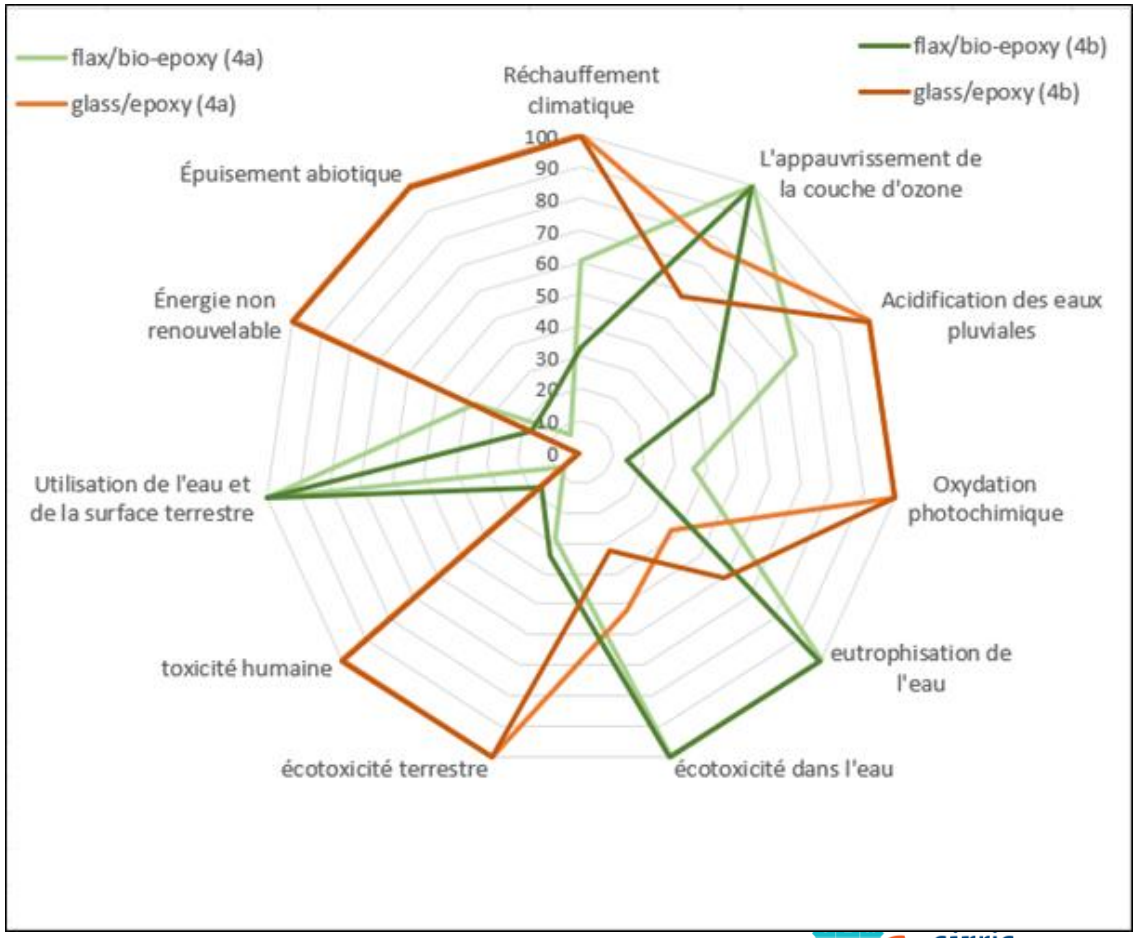
- Flax/bio-epoxy composites now have a better outcome than in scenario 2.

	Fiber vol% (tensile)	Fiber vol% (bending)
Glass/epoxy	11	13
Flax/bio-epoxy	38	38



Scenario 4 equal mass

- 4a: flax composite 33% thicker
- 4b: masse and thickness are the same
  - Adjustment of fibre volume fraction



Vervolgstappen

COOCK project HBC.2020.2567

AGENTSCHAP INNOVEREN & ONDERNEMEN
Vlaanderen is ondernemen

- LCA vergelijking tussen:
  - self reinforced PP tegen PLA,
  - Tropisch hardhout tegen vlas PLA met PLA kern
  - Deurpaneel aluminium vs vlas bio-epoxy

- Ander voorstel?

Vragen?

- Laat ons weten wat jullie nog verwachten/graag behandeld willen zien in dit project

- Welke info ontbreekt om zelf projecten op te starten
  - Technisch, samenwerking, subsidiemogelijkheden, …

- Contact: frg@centexbel.be, edm@vkc.be, Linde.Devriese@sirris.be

sirris

The innovation companion of the technology industry

Update Brepla demonstratoren (WP1, 5 & 6)

WANNES LEMBRECHTS

LINDE DE VRIESE

Users committee 4 BREPLA - project
1 December 2022 @ Centexbel Zwijnaarde

innovation
forward

Update deliverables

Tegen eind december:

- D1.1.1 : Productvereisten voor 3 sectoren
- D1.2.1 : Benchmarkstudie bio vs niet-bio

Tegen eind januari:

- D5.1.1 : Methodiek productie plaatstructuren
- D5.1.2 : Karakterisatie halffabricaten uit WP 2-4

→ Komen op website

Update Brepla demonstratoren (WP1, 5 & 6)

1 DAKKOFFER DEMONSTRATOR

2 DIENBLAD DEMONSTRATOR

3 STOEL (MEUBEL) DEMONSTRATOR

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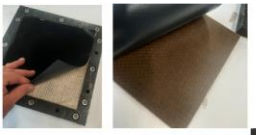
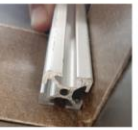
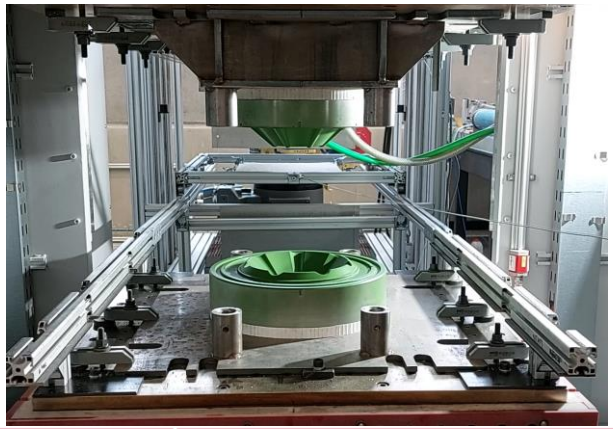
Overzicht demonstratoren







	Meubel	Dakkoffer	Dienblad
Thermoset/ Thermoplast comp.	TP + lange vezel	TP + korte/lange vezel	TS + lange vezel
Proces	Plooien	Thermovormen	UV curen
Dimensies	Groot	Groot	Klein
Sector	Meubel	Transport	Consumentengoederen
Geïnspireerd door	LIV-O	circular matters	roltex®

Update Brepla demonstratoren (WP1, 5 & 6)

1 DAKKOFFER DEMONSTRATOR

2 DIENBLAD DEMONSTRATOR

3 STOEL (MEUBEL) DEMONSTRATOR

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Update dakkoffer demonstrator

Inhoud:

- Testen non-woven He-PP mal G. Desmet met nieuw klemsysteem
- Plan volgende stappen

Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

Twee onderzoekstopics:

- Variatie procesparameters in het vlakke plaat persen
  → Wat is de variatie in consolidatiekwaliteit?
- Nieuw klemsysteem tijdens de thermocompressie in de mal
  → Persen zonder plooi- en scheurvorming mogelijk met dit systeem?

Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

Plaatafmetingen: 52,5 cm x 78 cm ; 0,4095 m²

Variatie procesparameters in het vlakke plaat persen

Materiaal:

Fibriplast EcoTechnilin

50% Hennep/50% PP black 1900 g/m²

Fibre weight fraction	0,5	
Areal weight fabric	1900	g/m²
Density fibre	1500	kg/m³
Density matrix	900	kg/m³
V_f	**37,50%**	
Theoretical thickness	**1,69**	**mm**

Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

Variatie procesparameters in het vlakke plaat persen

Non-woven mat → vlakke plaat:

Perstemperatuur: 180°C - 200 °C

Persdruk: 5 bar – 10 bar – 15 bar

opwarming met +10°C/min – afkoeling met -5°C/min

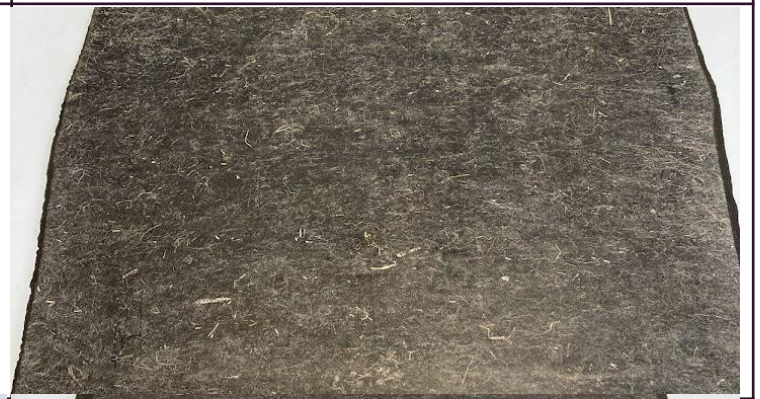
(bar = kgf/cm²)

Totale cyclustijd: +- 50 min

Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

Variatie procesparameters in het vlakke plaat persen

	5 bar	10 bar	15 bar
180 °C			
200 °C			

Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

Diktemetingen

5 bar – 180°C	15 bar – 200°C
	

10 – 20 % dunner : 0.2 - 0.3 mm verschil

Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

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Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

Thermocompressie met nieuw klemsysteem

Opwarmtemperatuur materiaal: 200°C

Duur homogenisatie 200°C : 1 min

Maltemperatuur: 80°C

Sluitingsnelheid: 50 mm/ sec

Persdruk: 30 bar

Persoppervlak: 42,5 cm x 63 cm

Perskracht: 805 kN

Theoretische plaatdikte: 1,69 mm

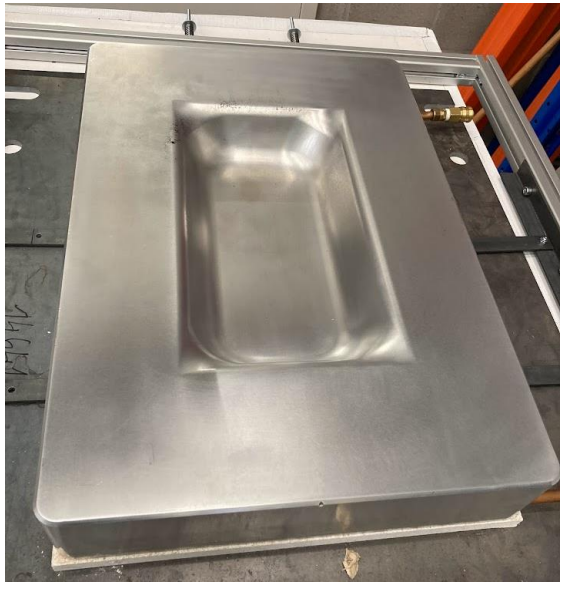
Vf_theoretisch = 37,5 %

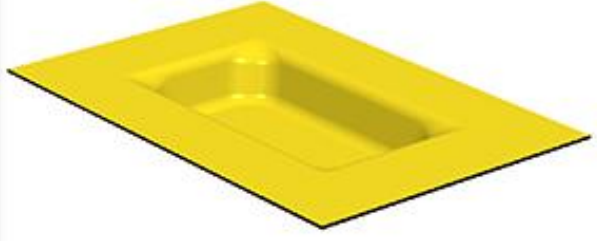
Opgemten plaatdikte: 1,7 – 2,2 mm

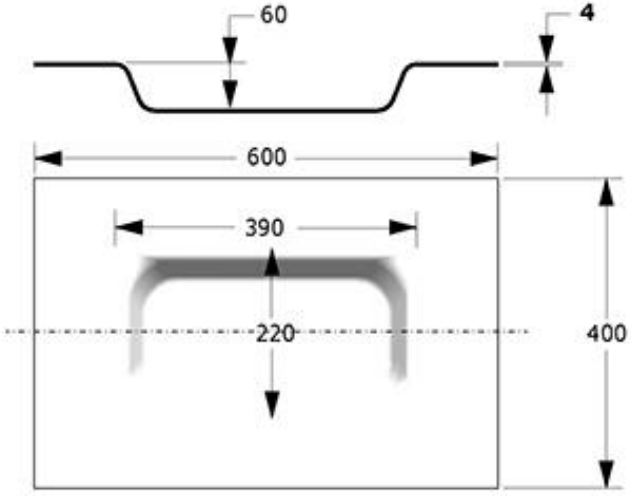
Dikte matrijsopening 4 mm

Mal: Bovenkant

Mal: Onderkant







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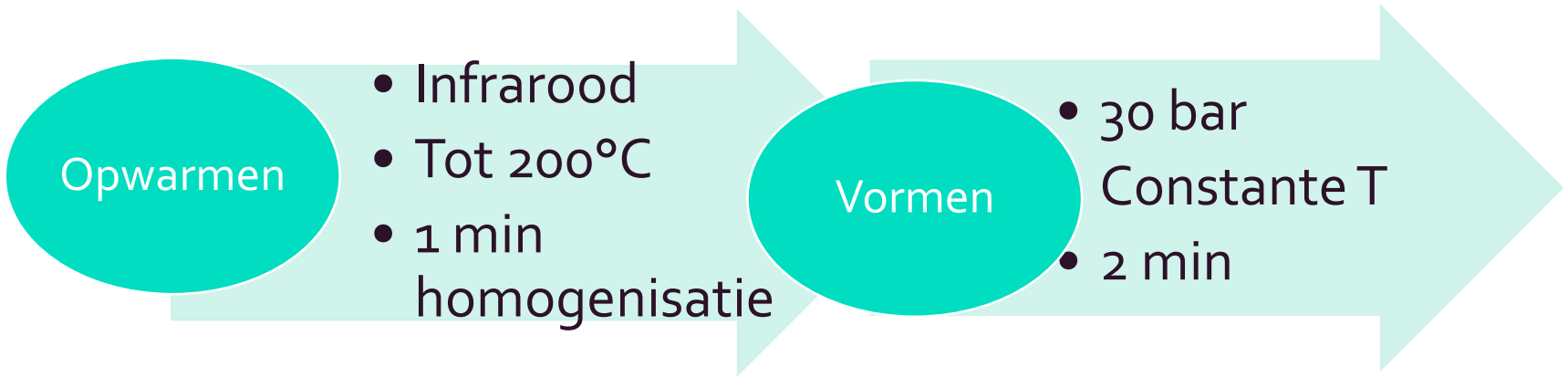
Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

Thermocompressie met nieuw klemsysteem

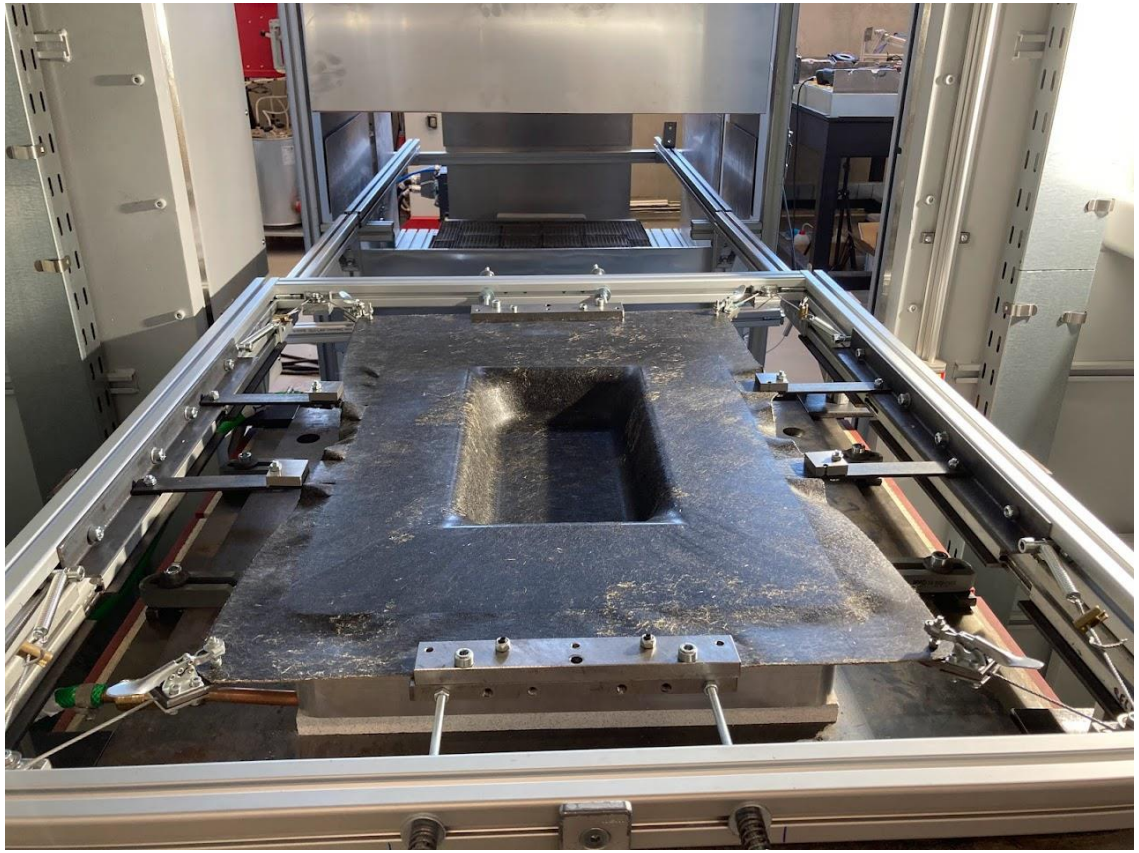


Totale cyclustijd: 4 min

Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

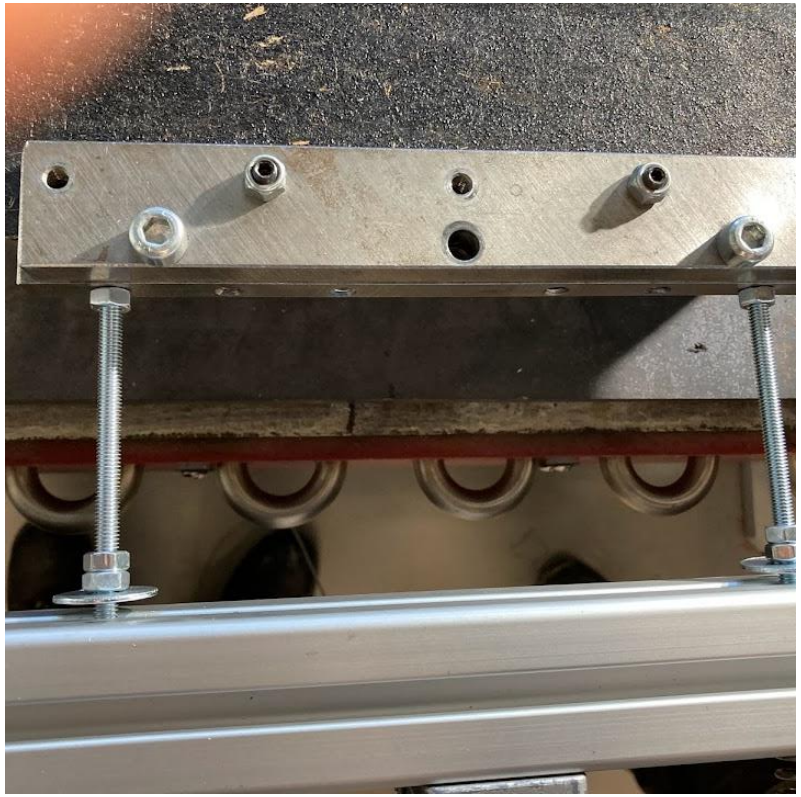
Thermocompressie met nieuw klemsysteem



Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

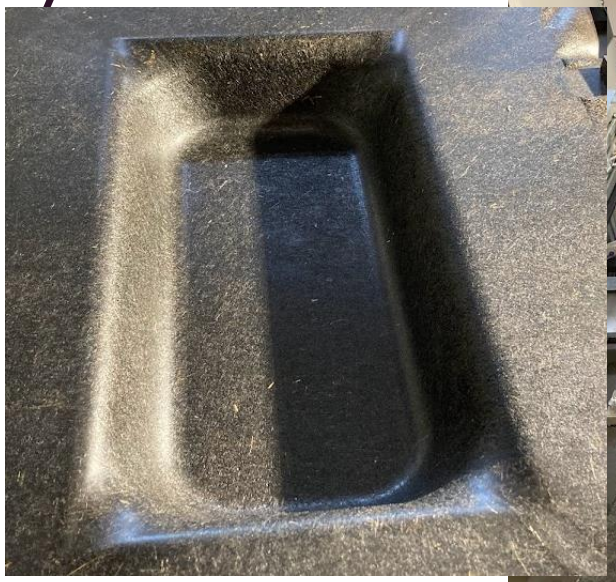
Thermocompressie met nieuw klemsysteem



Tests non-woven mat in mal G.Desmet

UPDATE DAKKOFFER DEMONSTRATOR

Thermocompressie met nieuw klemsysteem



Resultaat:

- ✓ Geen plooivorming
- ✓ Geen scheurvorming

Gemiddelde rek in het materiaal:

11.5 % in breedte ⟷

13 % in lengte ↕

Volgende stappen richting dakkoffer

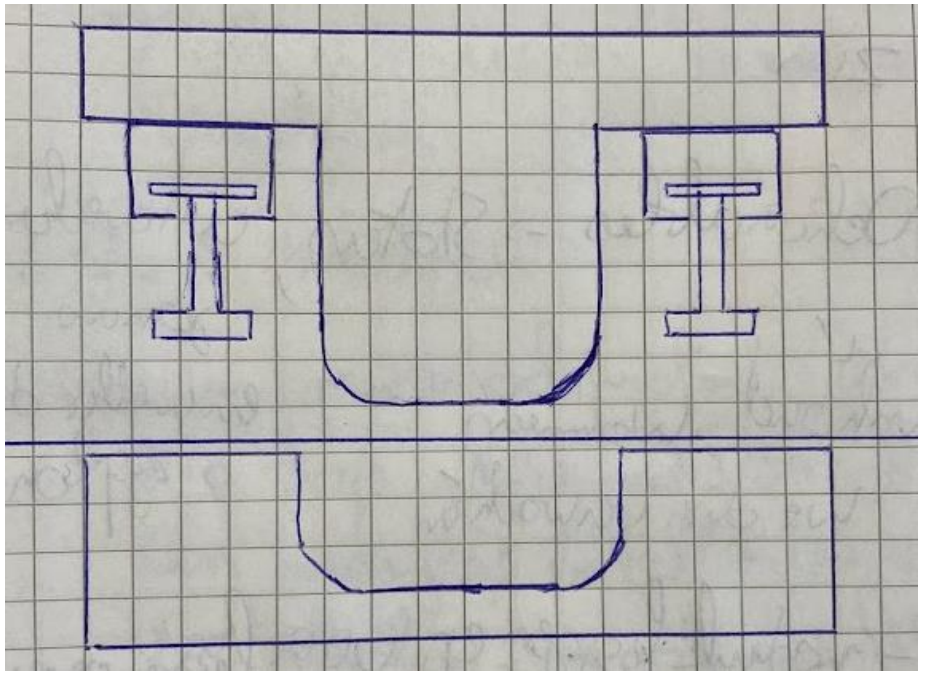
UPDATE DAKKOFFER DEMONSTRATOR

- Zelfde vorm met drukkader
- Opschaling naar grotere vorm
- Non-woven mat met PLA vezel

Volgende stappen richting dakkoffer

UPDATE DAKKOFFER DEMONSTRATOR

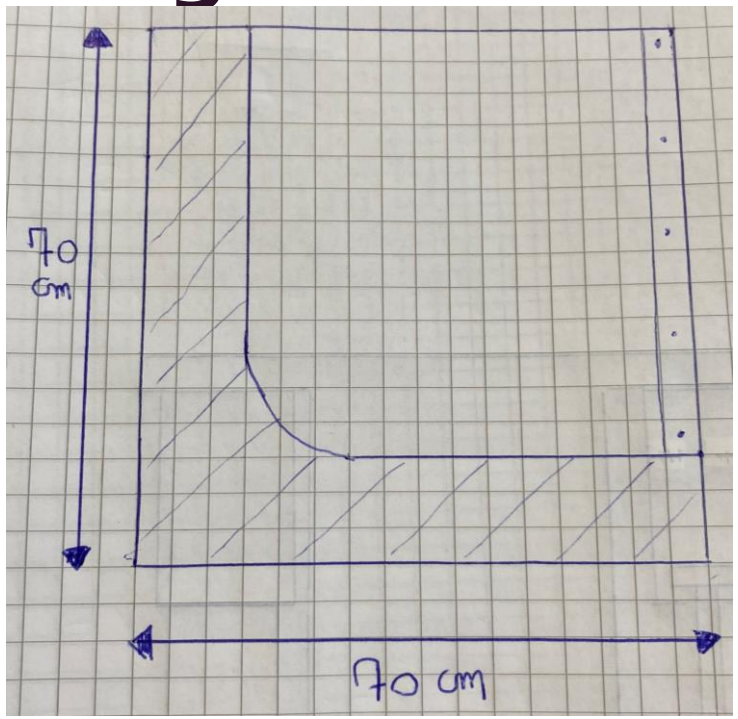
- **Zelfde vorm met drukkader**
- Opschaling naar grotere vorm
- Non-woven mat met PLA vezel

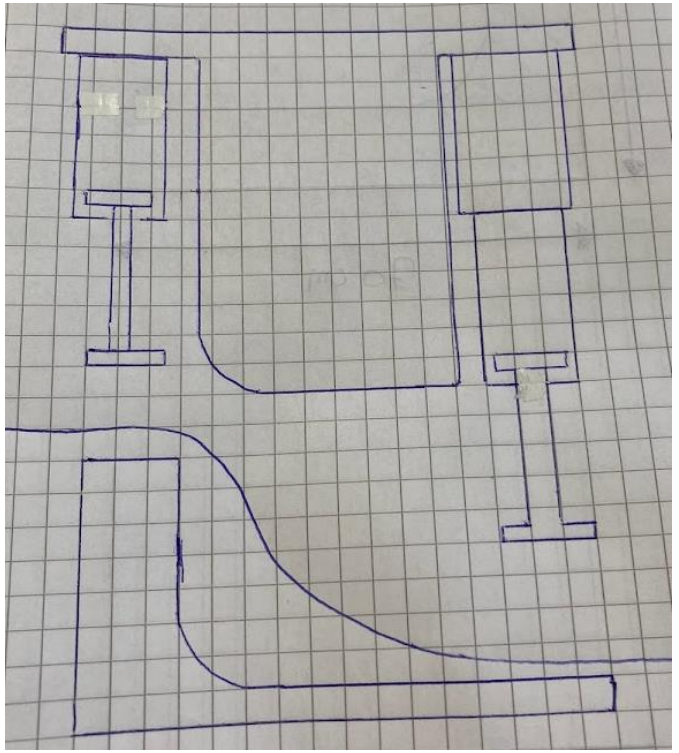


Volgende stappen richting dakkoffer

UPDATE DAKKOFFER DEMONSTRATOR

- Zelfde vorm met drukkader
- **Opschaling naar grotere vorm**
- Non-woven mat met PLA vezel





Extra testen:

- Testing van vervormingslimieten non-woven materiaal
- Eerste kleine test met vacuümvormtechniek

Volgende stappen richting dakkoffer

UPDATE DAKKOFFER DEMONSTRATOR

- Zelfde vorm met drukkader
- Opschaling naar grotere vorm
- Non-woven mat met PLA vezel

Extra testen:

- Testing van vervormingslimieten non-woven materiaal
- Eerste kleine test met vacuümvormtechniek

Update Brepla demonstratoren (WP1, 5 & 6)

1 DAKKOFFER DEMONSTRATOR

2 DIENBLAD DEMONSTRATOR

3 STOEL (MEUBEL) DEMONSTRATOR

innovation forward

Update dienblad demonstrator

- Vlasvezelnet om nieuwe ontwikkelingen van te starten
- Eerste test uitgevoerd: uitgehard met epoxy
- Materialenmatrix voor bioharsen

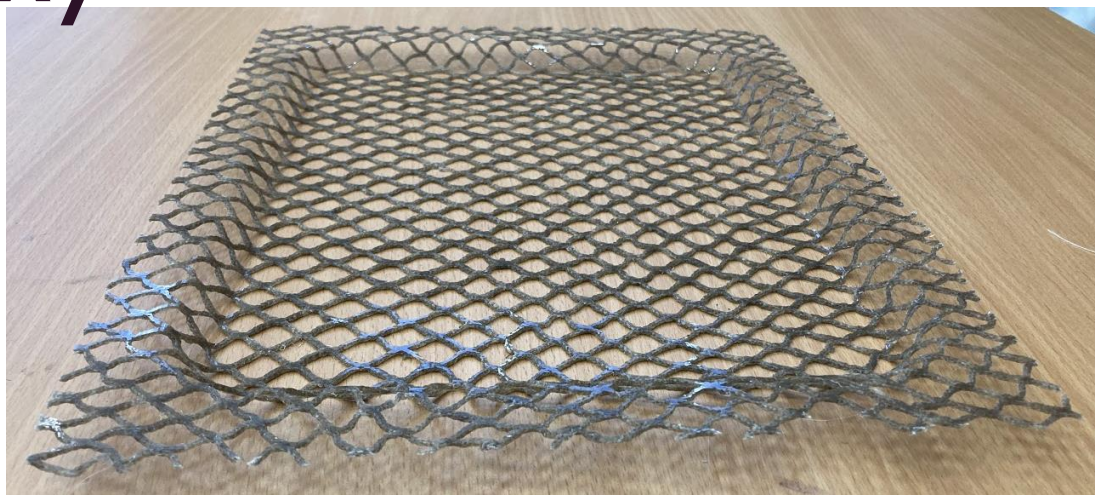
Volgende stappen:
Gebruik biohars
Nieuwe UV curende harssystemen bekijken
Versteviging van dienblad uit vlasnet

Eerste test vlasnet met epoxy

UPDATE DIENBLAD DEMONSTRATOR

Productiemethode:

- Vlasnet ondergedompeld in hars
- Vlasnet gedrapeerd op voorverwarmde mal
- Mal handmatig gesloten
- Hars laten uitharden



Volgende stappen

UPDATE DIENBLAD DEMONSTRATOR

- Gebruik biohars, materialenmatrix:

Hars	Bedrijf	Biocontent
Oribond	Orineo	100%
Formulite	Cardolite	27-45%
Greenpoxy	Sicomin	34-42%

- Curing door straling:

UV-straling: Moeilijkheden, vezel houdt straling tegen

Mogelijkheden IR-straling: te exploreren

Volgende stappen

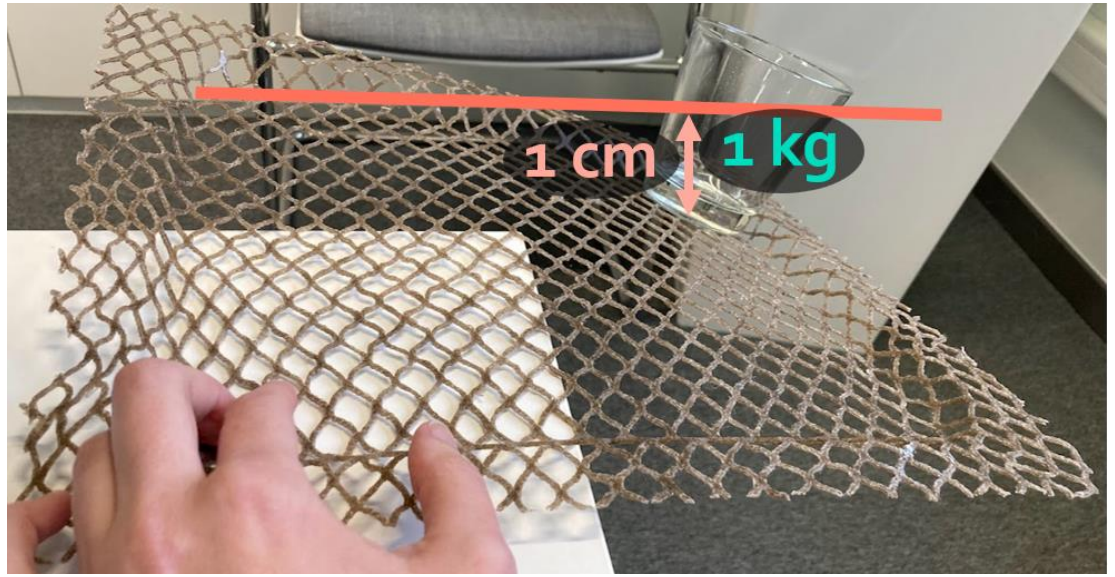
UPDATE DIENBLAD DEMONSTRATOR

- Stijfheidsverbetering:

Door optimalisatie vezelplaatsing en/of mesh opvullen met hars

→ Te bereiken stijfheidscriterium:

  - Kwart ingeklemd
  - 1 kg massa in tegengestelde hoek
  - 1 cm doorbuiging als limiet



Update Brepla demonstratoren (WP1, 5 & 6)

1 DAKKOFFER DEMONSTRATOR

2 DIENBLAD DEMONSTRATOR

3 STOEL (MEUBEL) DEMONSTRATOR

innovation forward

Update stoel (meubel) demonstrator

Inhoud:

- Coatingtesten op vlas-pla en vlas-epoxy in functie van stoeldemonstrator
- Haalbaarheidsvraag productie panelen stoeldemonstrator

Coatingtesten

UPDATE STOEL (MEUBEL) DEMONSTRATOR

Uitgevoerd door collega Pieter Samyn
pieter.samyn@sirris.be

Sicomin

	Surf Clear ECO (resin)	ECO Fast (hardener)	bio triglycidyl ether (diluent)	phenalkamine
sample 1	22,5	9,225		
sample 2	15			7,875
sample 3	15		7,5	10,35

Scabro/Resoltech

	1070 ECO (resin)	1074 Hardener (hardener)	bio triglycidyl ether (diluent)
sample 4	15	5,25	
sample 5	15	4,8	6

Referenties

	DGEBA	Fossil hardener	phenalkamine
sample 6	15	7,5	
sample 7	15		9,375

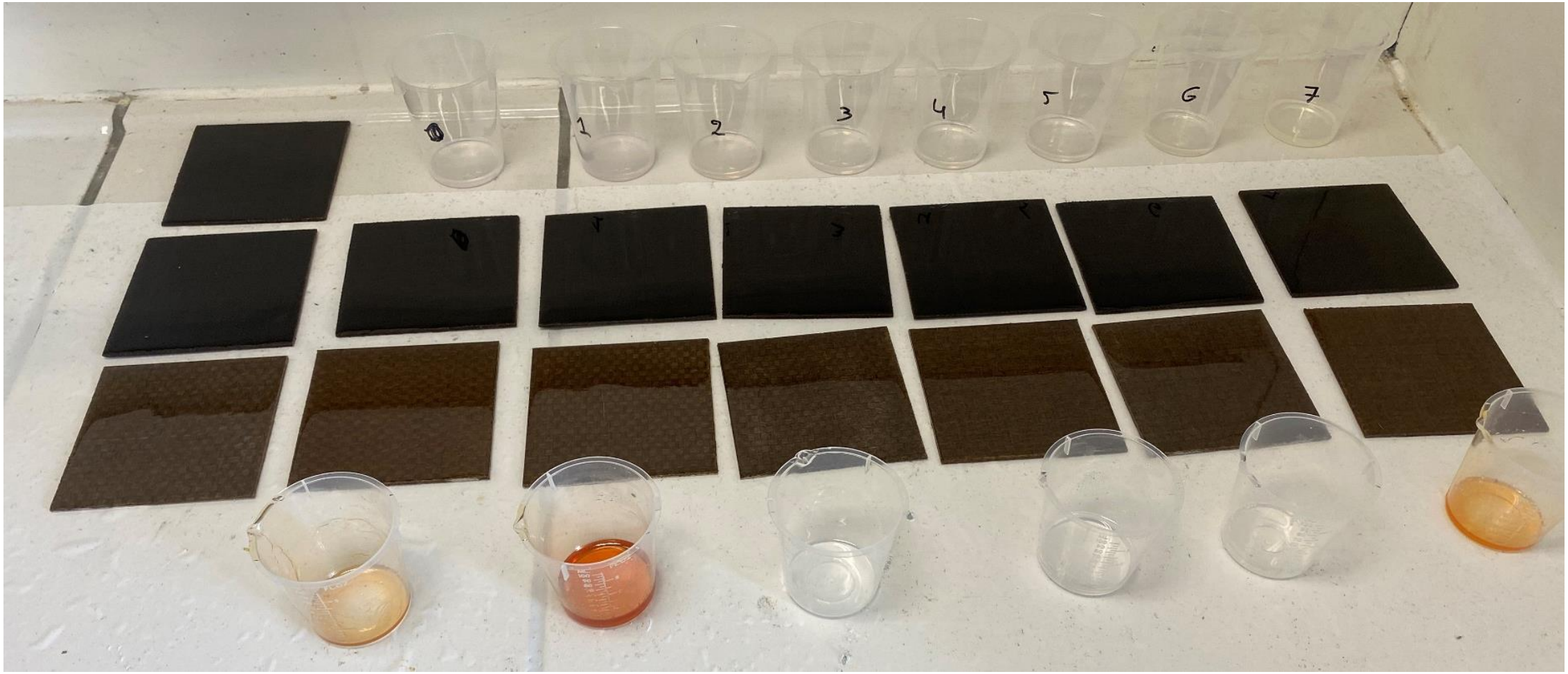
- Blade-coating 500 µm
- Air inclusions are removed after coating by short flaming.

- Flax/epoxy (BLACK): coating on glossy side
- Flax/PLA (BROWN): same roughness at both sides
- All samples are smoothly roughned by abrasive paper, 240grit

Coatingtesten

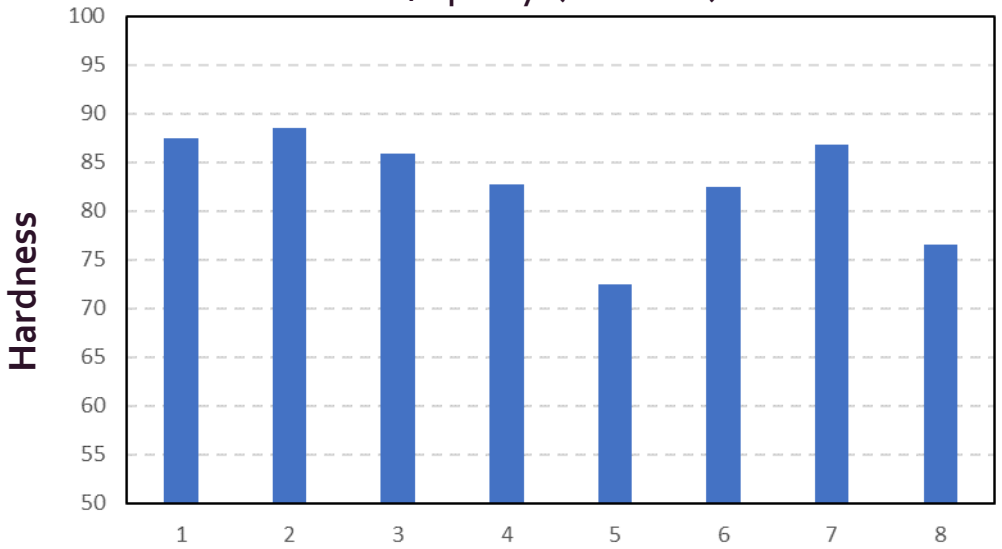
UPDATE STOEL (MEUBEL) DEMONSTRATOR

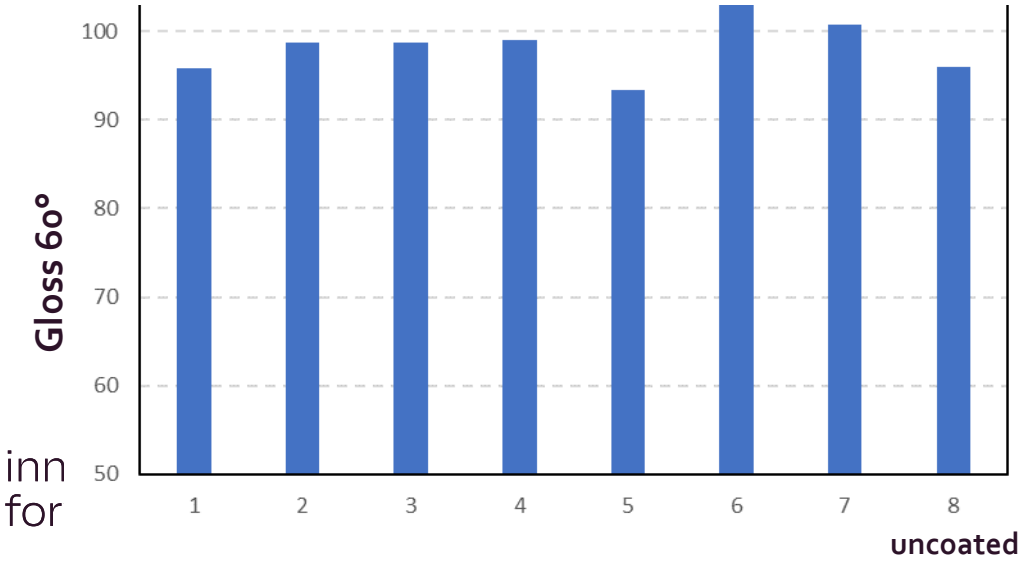
Left to right 1 tot 7, top black (flax/epoxy), bottom brown (flax/PLA)



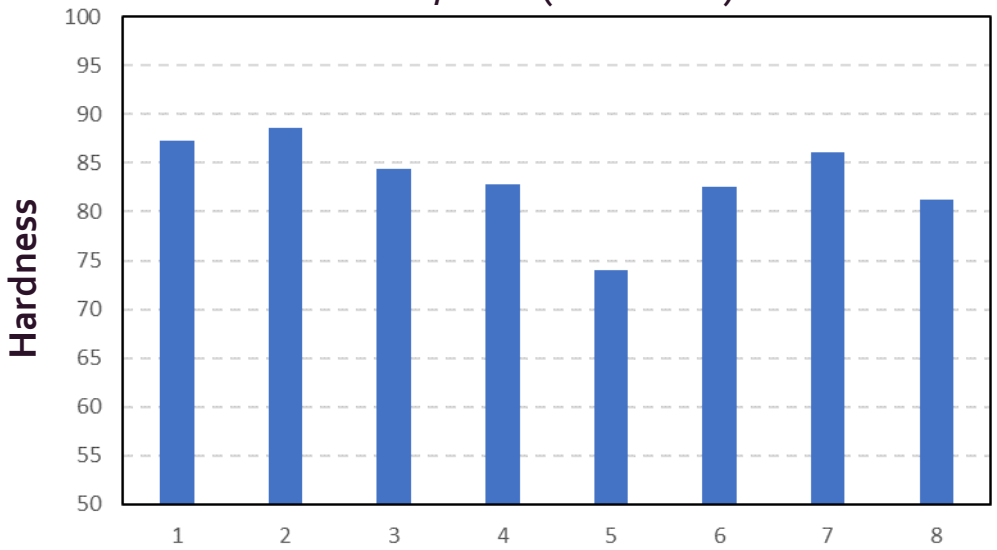
Coatingtesten

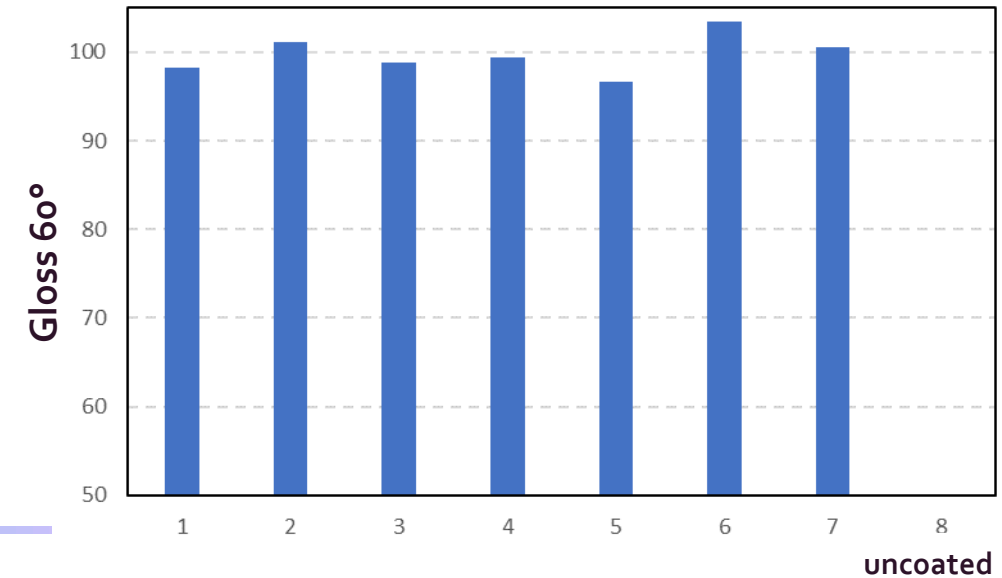
Flax/epoxy (BLACK)





Flax/PLA (BROWN)





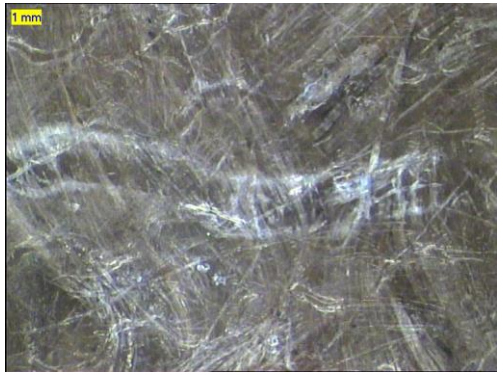
Coatingtesten

UPDATE STOEL (MEUBEL) DEMONSTRATOR

Flax/PLA (BROWN)

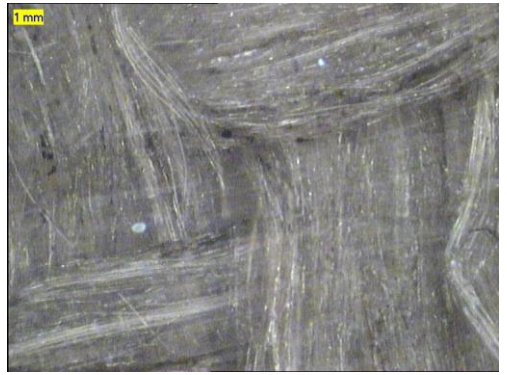
Scratch resistance
20 N

Sicomin 1

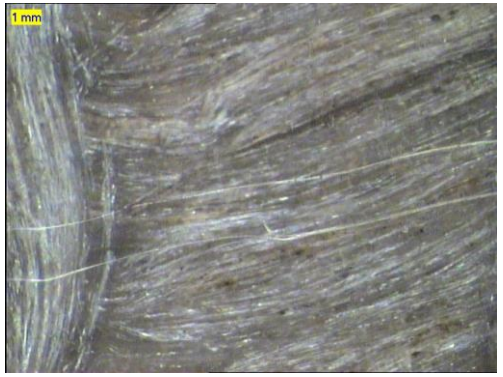


Sicomin 2

Sicomin 3

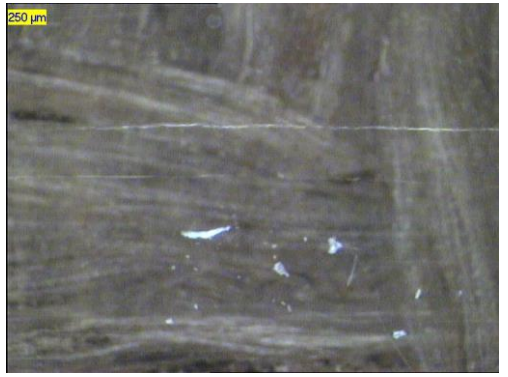


Scabro 4



Scabro 5

Fossiel 6



Fossiel-bio 7

Stereomicroscope, magnification 3.2 x

Coatingtesten

UPDATE STOEL (MEUBEL) DEMONSTRATOR

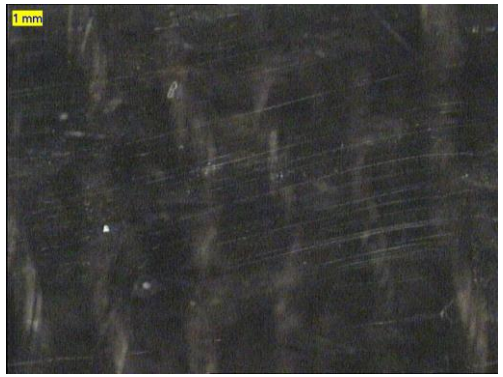
Flax/epoxy (BLACK)

<u>Scratch resistance</u>
<u>20 N</u>

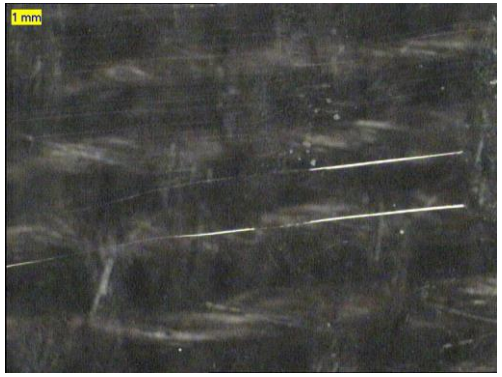
Sicomin 1

Sicomin 2

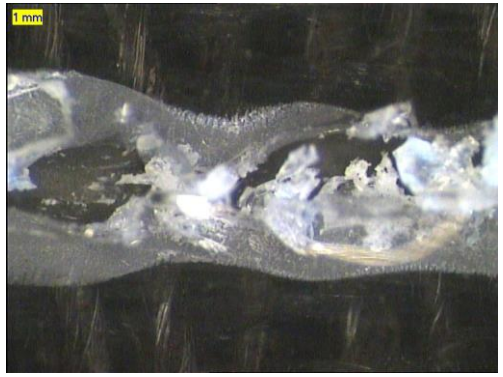
Sicomin 3



Scabro 4



Scabro 5



Fossiel 6

Fossiel-bio 7

innovation forward

Coatingtesten

UPDATE STOEL (MEUBEL) DEMONSTRATOR

Karsten watercolumn test

5 min contact time

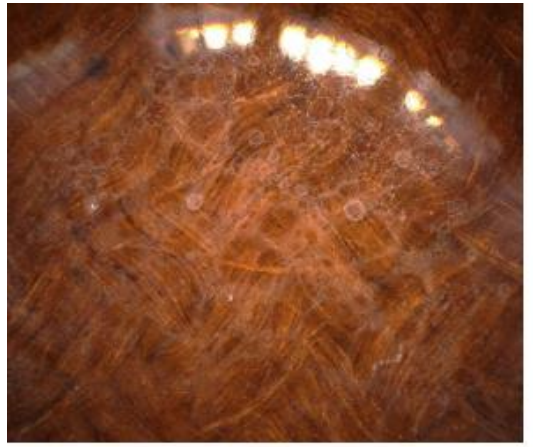
3 ml water column height

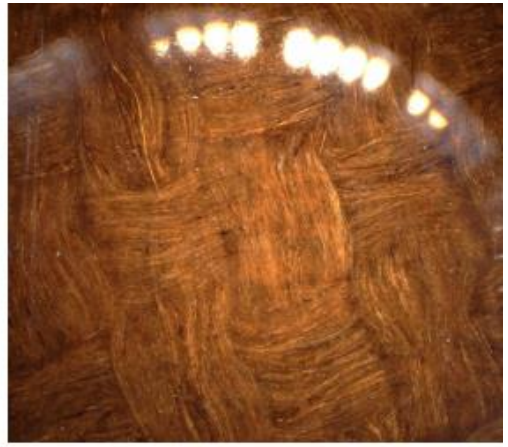
Water absorption is measured as volume absorbed water over contact time (i.e., decrease of the watercolumn).

Water penetration on scratched samples is Measured after making parallel scratches in the coating with handheld crosscut

Water penetration of 0.1 ml/5 min is very minimum

	Original (non-scratched)		Scratched		Remarks
Sample	Brown = flax/PLA	Black = flax/epoxy	Brown = flax/PLA	Black = flax/epoxy	
uncoated	0.1 ml/5min	0.1 ml/5min	0.1 ml/5min	0.1 ml/5min	
Sicomin 1	0 ml/5min	0 ml/5min	0 ml/5min	0 ml/5min	
Sicomin 2	0 ml/5min	0 ml/5min	0 ml/5min	0 ml/5min	
Sicomin 3	0 ml/5min	0 ml/5min	0 ml/5min	0 ml/5min	
Scabro 4	0 ml/5min	0 ml/5min	0 ml/5min	0 ml/5min	
Scabro 5	0 ml/5min	0 ml/5min	0.1 ml/5min	0.1 ml/5min	
Fossiel 6	0 ml/5min	0 ml/5min	0 ml/5min	0 ml/5min	
Fossiel-bio 7	0 ml/5min	0 ml/5min	0.1 ml/5min	0.1 ml/5min	Surface effects





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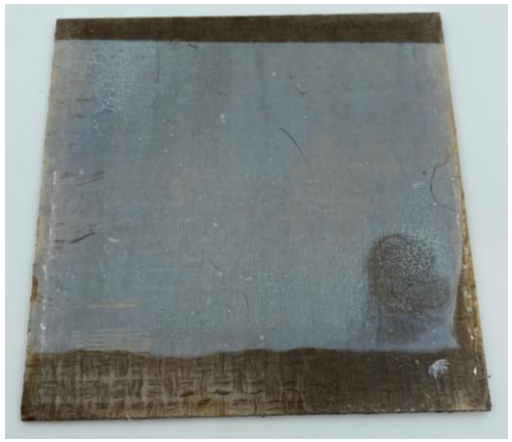
Coatingtesten

UPDATE STOEL (MEUBEL) DEMONSTRATOR

QUV testing 250 h: brown flax/PLA

Uncoated

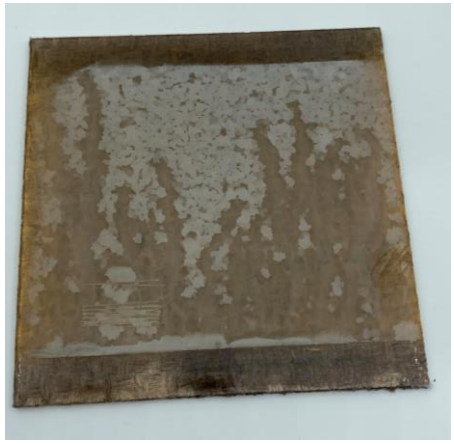
Sicomin 1



Sicomin 2

Sicomin 3

Scabro 4



Scabro 5

Fossiel 6

Fossiel-bio 7

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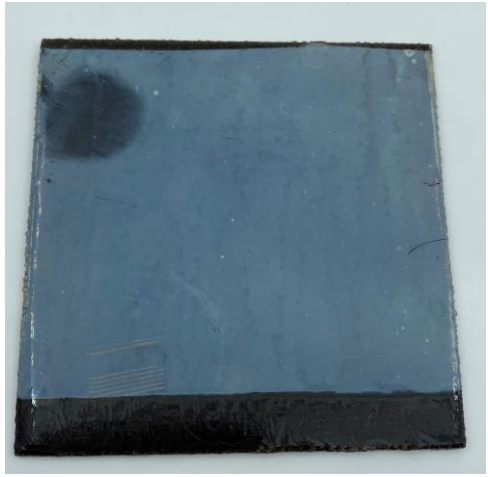
Coatingtesten

UPDATE STOEL (MEUBEL) DEMONSTRATOR

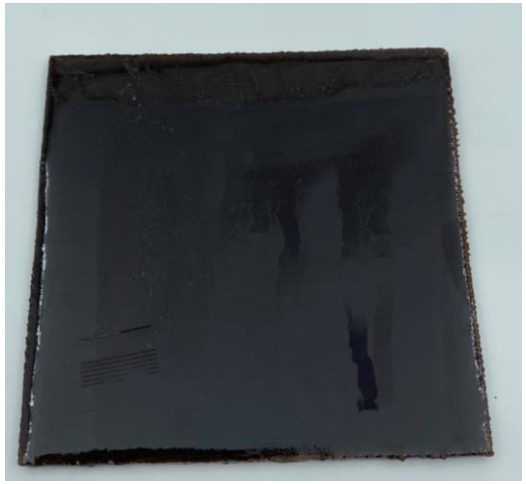
QUV testing 250 h: black flax/epoxy

Uncoated

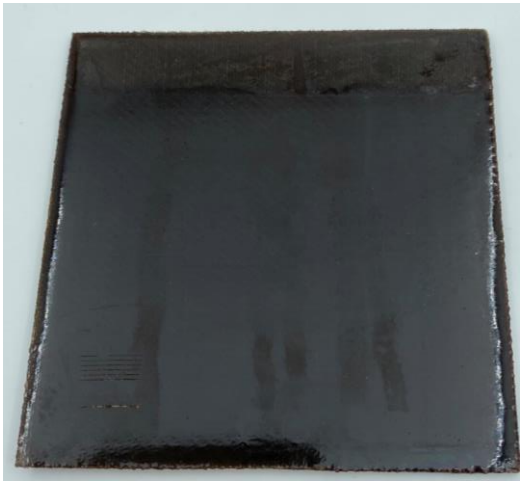
Sicomin 1



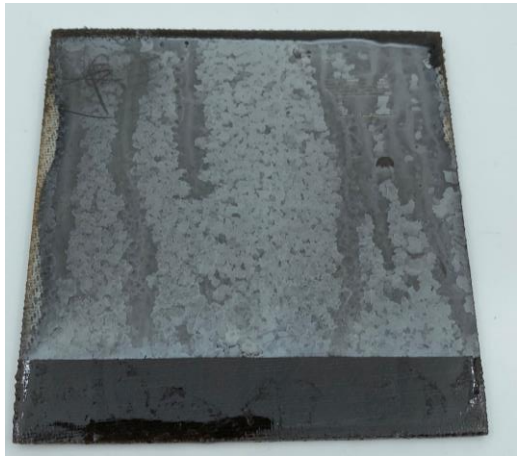
Sicomin 2



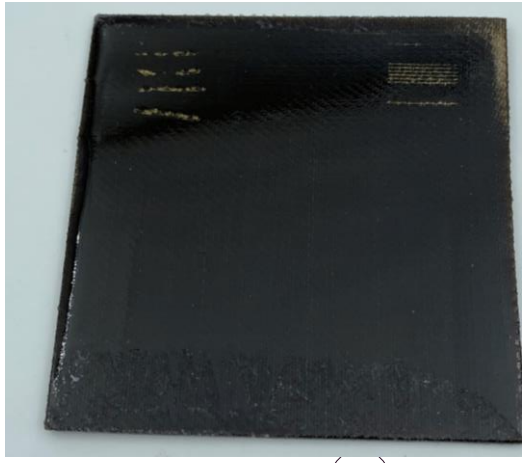
Sicomin 3



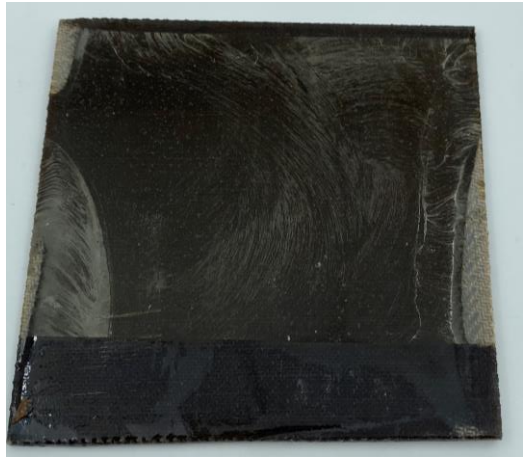
Scabro 4



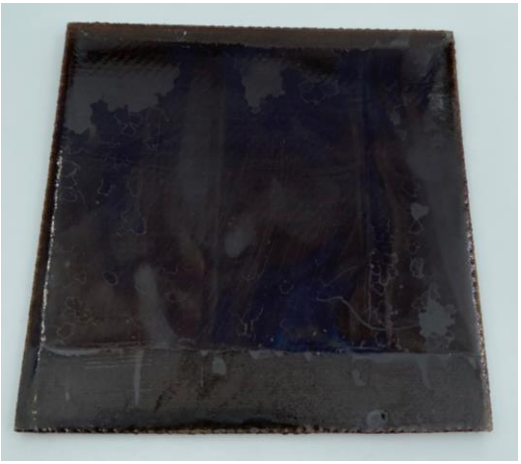
Scabro 5



Fossiel 6



Fossiel-bio 7



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Coatingtesten

UPDATE STOEL (MEUBEL) DEMONSTRATOR

Uitgevoerd door collega Pieter Samyn
pieter.samyn@sirris.be

Conclusie coatings op biocomposiet:

- Verbetering glans
- Verbetering hardheid → krasbestendigheid
- Verbetering vochtbestendigheid
- Verbetering outdoorbestendigheid mogelijk mits goede compatibiliteit met matrix

Update stoel (meubel) demonstrator

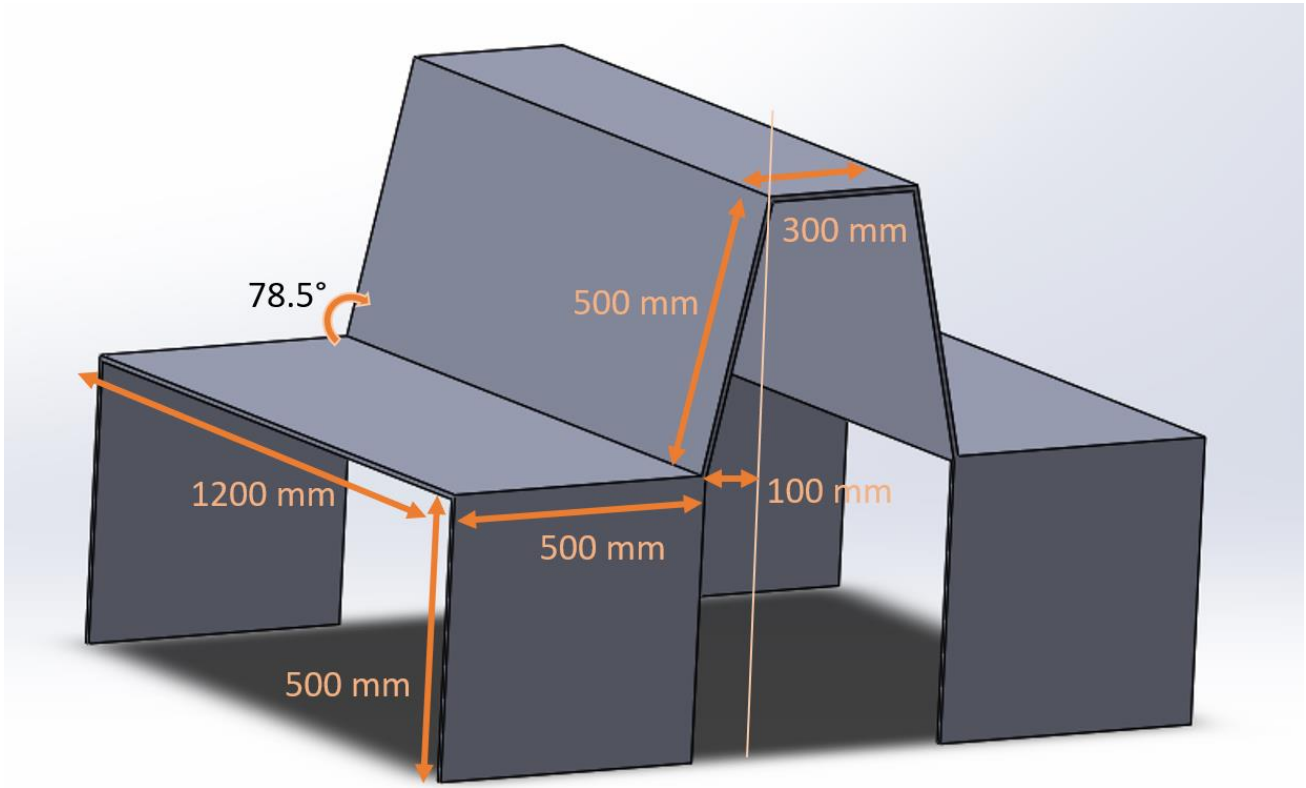
Inhoud:

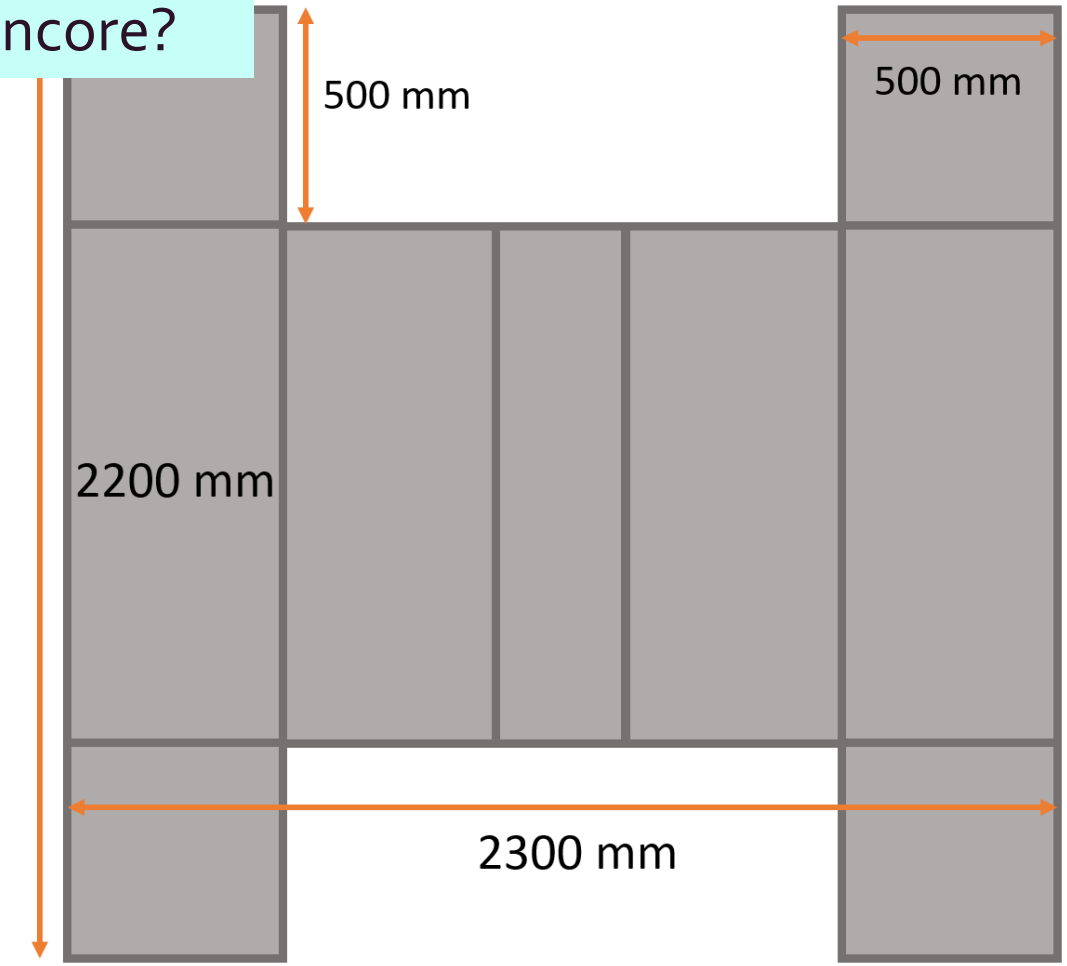
- Coatingtesten op vlas-pla en vlas-epoxy in functie van stoeldemonstrator
- **Haalbaarheidsvraag productie panelen stoeldemonstrator**

Productie panelen meubeldemonstrator

UPDATE STOEL (MEUBEL) DEMONSTRATOR

Grootte haalbaar voor Basaltex, Flipts&Dobbels en Econcore?





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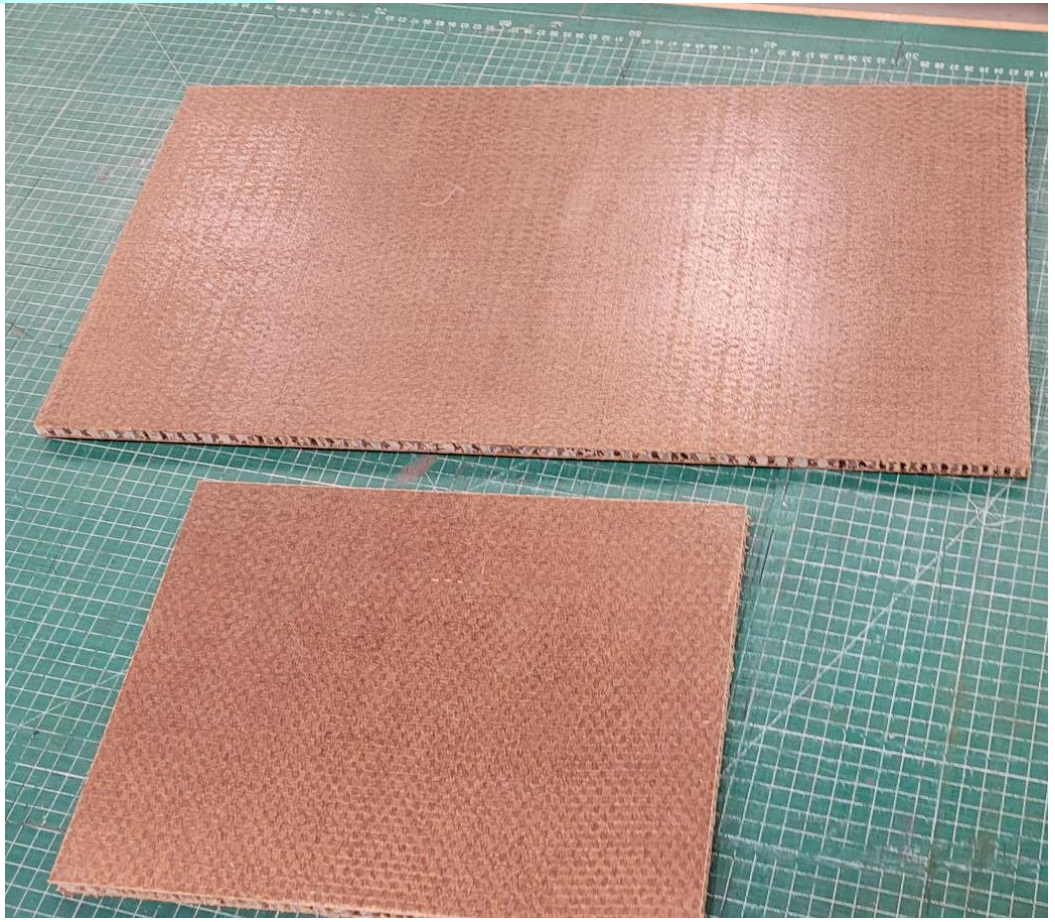
Productie panelen meubeldemonstrator

UPDATE STOEL (MEUBEL) DEMONSTRATOR

Grootte haalbaar voor Basaltex, Flipts&Dobbels en Econcore?

- → Econcore mogelijks gelimiteerd tot breedte van 35 cm, enkel labolijn voor PLA core
  - → Extra testen naar het naast elkaar leggen van kernen

Resultaat:



Update stoel (meubel) demonstrator

Volgende stappen:

- Herdesign of blijven bij huidige stoeldesign → Graag jullie input
- Testproductie paneel basalt-PLA
- Plooitesten op kleine schaal met vlas-PLA en basalt-PLA panel

Veramtex verbetert vuurbestendigheid vlas-weefsel

→ Extra test: vergelijking vuurbestendigheid behandeld vlas, onbehandeld vlas, basalt en glas

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