Interreg
Cofinancé par l'Union Européenne
Medegefinancierd door de Europese Unie
France - Wallonie - Vlaanderen
VALCELMAT

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Functionalization of Cellulose to Produce New High-Performance Materials

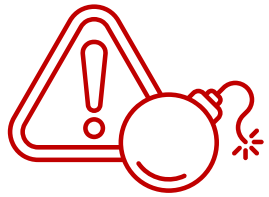
OBIWAN workshop
30/04/2026
Sofie Verschraegen

NOW

2019

2030
GOAL: Emissions down by 50%

European Green Deal

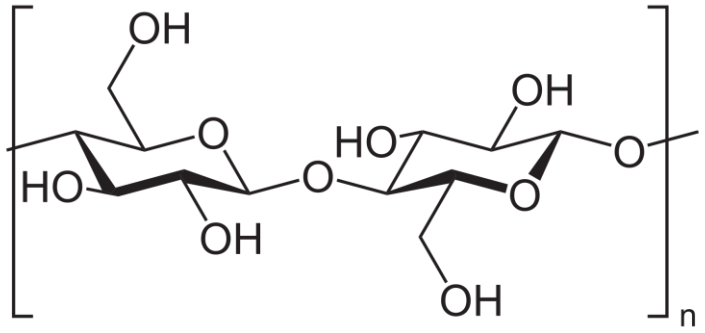


Petroleum-based materials
packaging, textiles, insulation…

Find alternatives based on an abundant biomass, using green chemistry processes

2050
GOAL: Climate neutrality

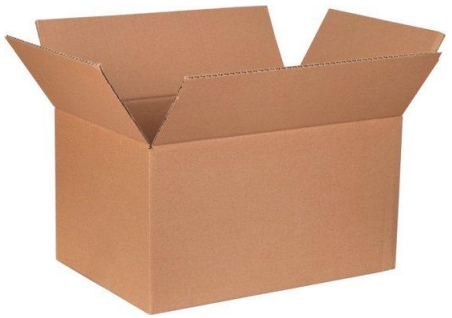
Abundant biomass?



CELLULOSE

Most abundant natural biopolymer on Earth

Recyclable, biodegradable



Cellulose: abundant material with unrealized potential!

Food packaging

vs.

Protective properties?

Introduce functionalities: barrier against micro-organisms, gas, moisture

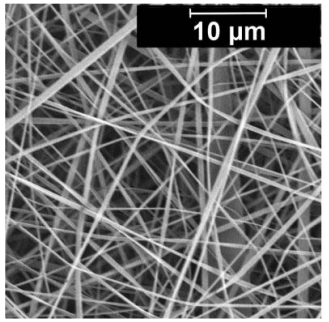
Textiles

Conventional

Sustainable source?

Start from local sources, ideally waste streams

High-performance



Properties and morphology?

Introduce flame retardancy, produce ultrathin fibers

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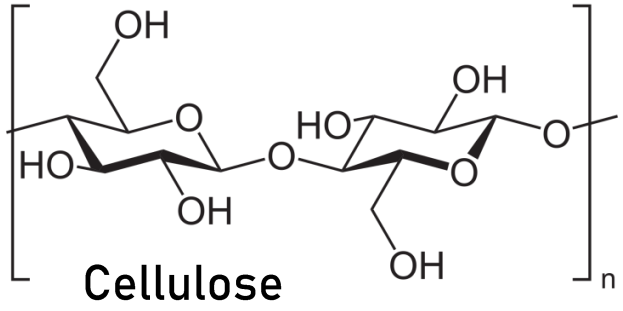
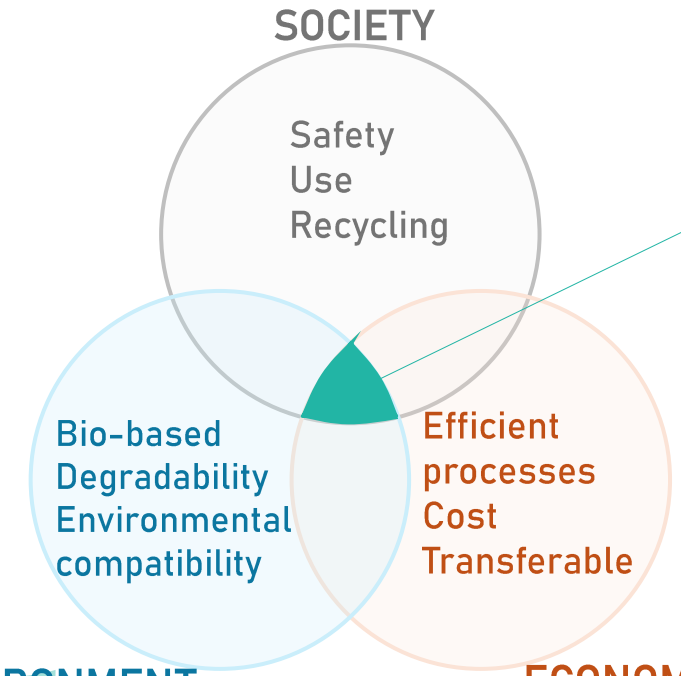
Find cellulose-based alternatives for petroleum-based materials, using green chemistry processes.

Supporting businesses, growth, and the recovery of economic activity through innovation and applied research.



Cellulose

→ Modify via green processes to introduce new functionalities → Packaging materials, textile materials



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4-year objective

to develop viable products and processes at prototype/pilot scale, transferable to industrial partners across all targeted sectors.

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UArtois
functionalization – characterization

MaNo
functionalization – processes

UPJV
Biological properties – degradability

CELLULOSE

5 partners

HOGENT
spinning – functionalization

UGent
(yarn) electrospinning

8 associated partners

Industry

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Functionalization of cellulose

Advanced cellulose textile

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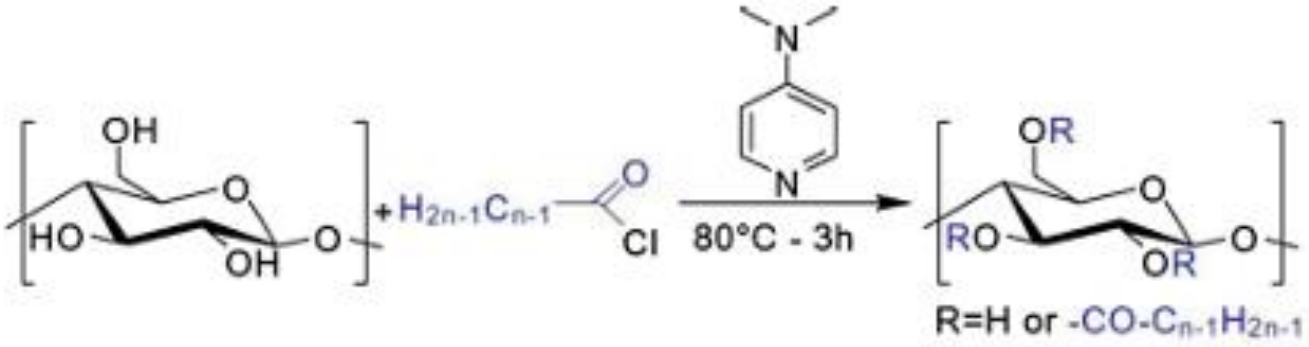
Functionalization of cellulose

Advanced cellulose textile

Functionalization of cellulose: introduce hydrophobicity



Fatty acid chloride (C8-C18)

Esterification to form Fatty Acid Cellulose Esters (FACEs)

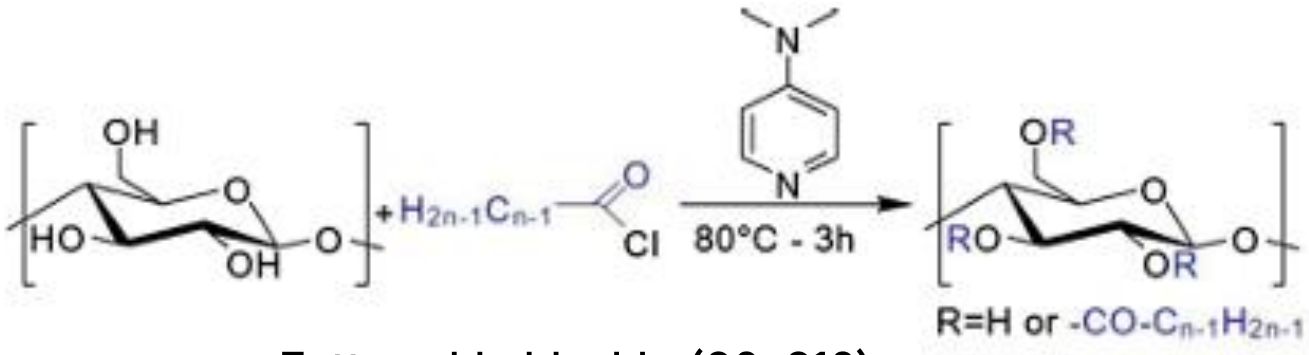
Vary chain length (C8 – C18)
Vary degree of substitution (1 – 3)

Casting →

FACE film

Hydrophobicity?
Mechanical properties?
Resistance against acids/bases?
Thermal properties?
Structural analysis?
Solubility?

Functionalization of cellulose: introduce hydrophobicity

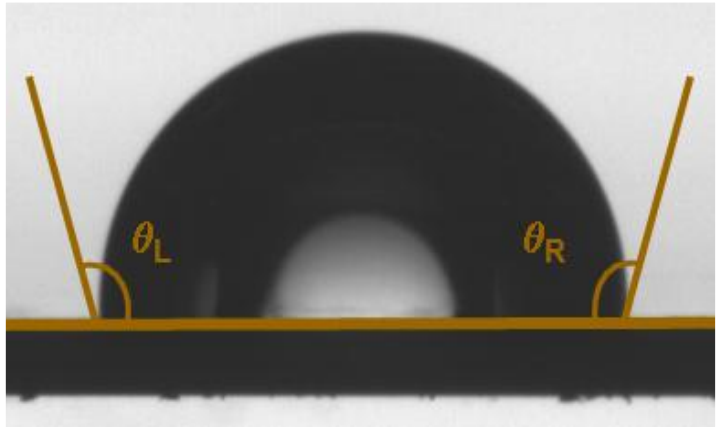


Casting →

FACE film

Fatty acid chloride (C8-C18)

Esterification to form Fatty Acid Cellulose Esters (FACEs)

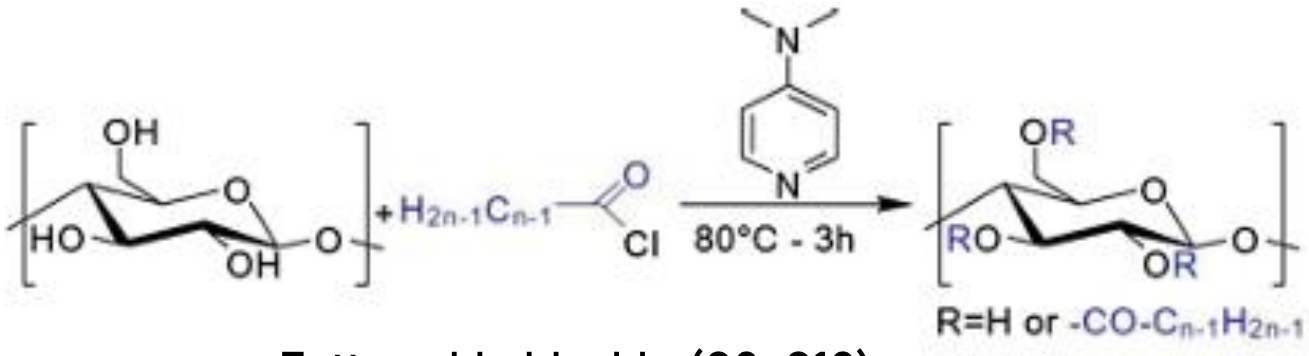


Microcrystalline cellulose: θ ≈ 30°

FACE films: 92° < θ < 107°

	C10		C12		C16	
	DS1.7	DS3	DS1.7	DS3	DS1.7	DS3
θ(°)	93	97	95	100	97	107

Functionalization of cellulose: introduce hydrophobicity

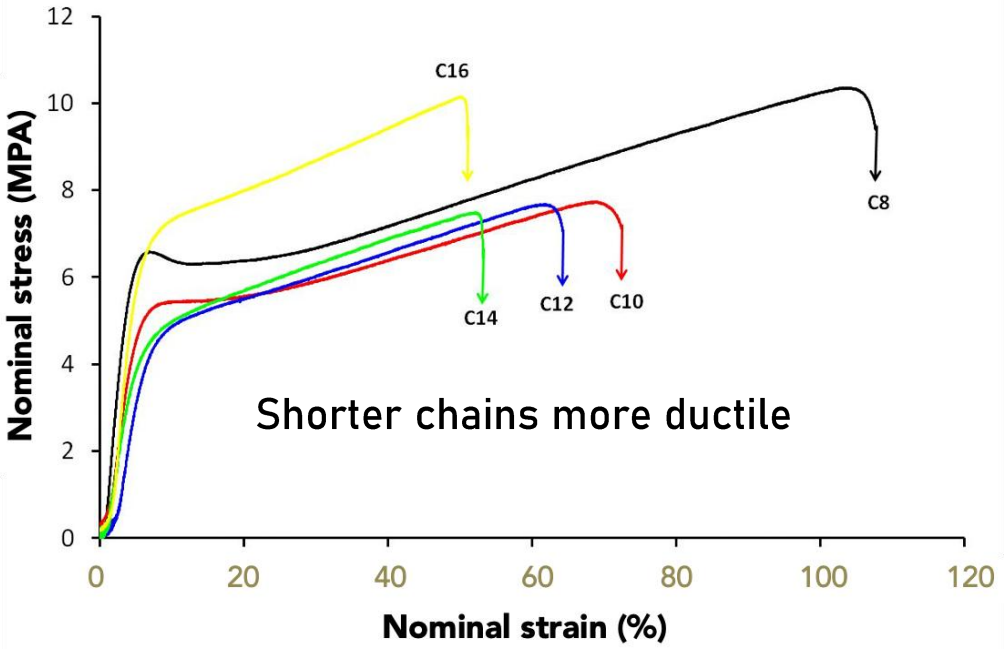


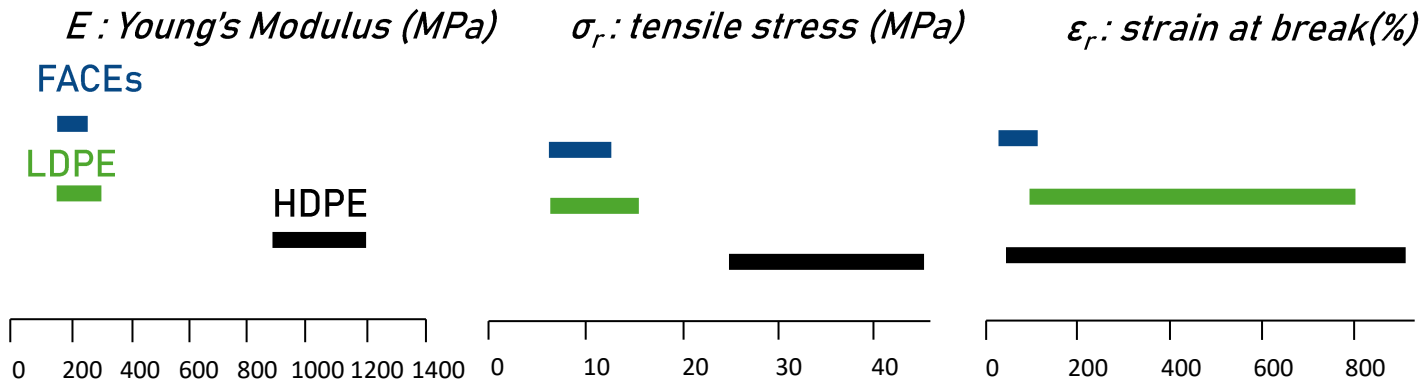
Casting →

FACE film

Fatty acid chloride (C8-C18)

Esterification to form Fatty Acid Cellulose Esters (FACEs)

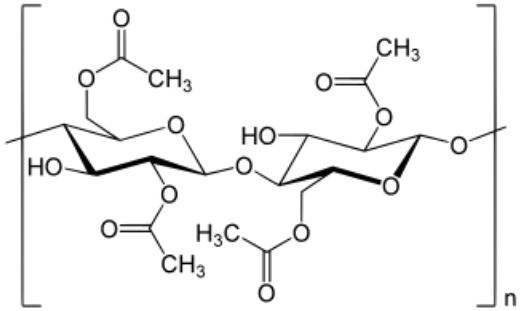




Functionalization of cellulose

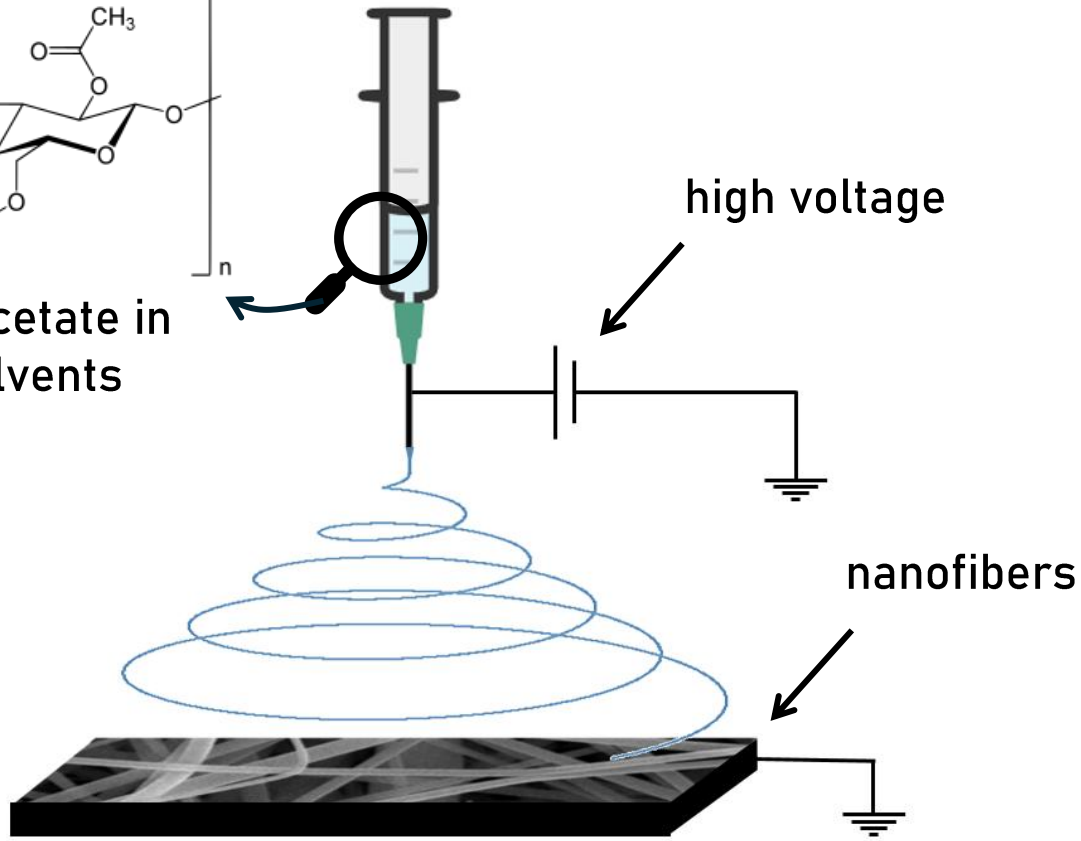
Advanced cellulose textile

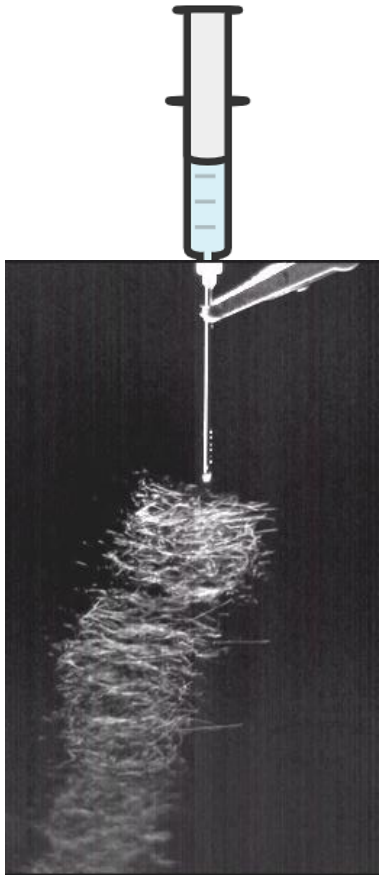
Advanced cellulose textile: nanofibers

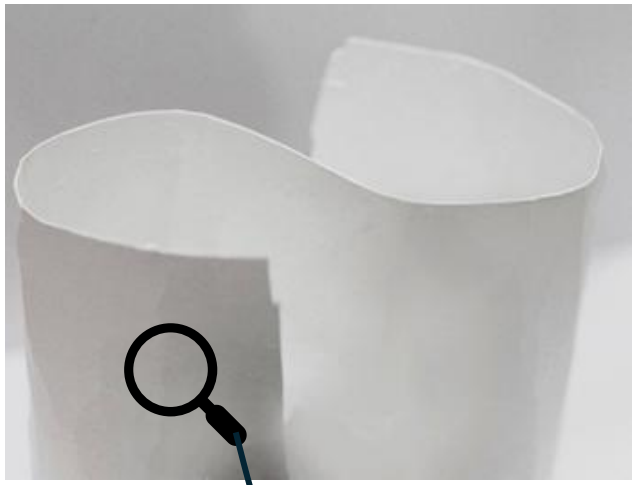


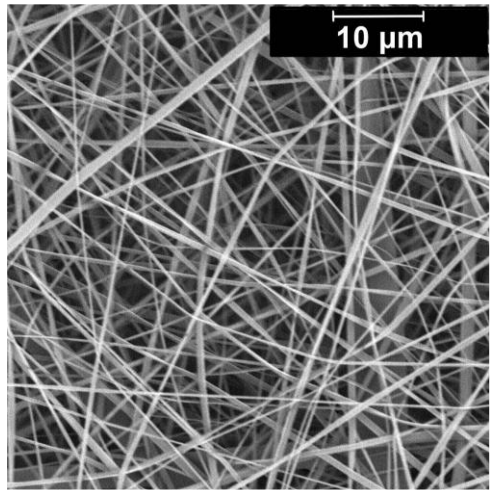
cellulose acetate in green solvents

Electrospinning









VALCELMAT – Perspectives

Find cellulose-based alternatives for petroleum-based materials, using green chemistry processes

Supporting businesses, growth, and the recovery of economic activity through innovation and applied research

Target a range of additional properties for cellulose materials

e.g., by adding biomolecules while casting

e.g., by electrospinning functionalized cellulose

Optimize processes

4-year objective

to develop viable products and processes at prototype/pilot scale, transferable to industrial partners across all targeted sectors.

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