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Ph.D. thesis (2018-2021)
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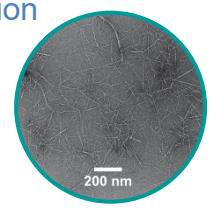
Nanocellulose hybrid suspensions with lignin particles and metallic nanoparticles for advanced materials

Suspensions hybrides de nanocellulose, particules de lignine et nanoparticules métalliques pour la fabrication de matériaux avancés

Context

Cellulose nanofibers (CNF)

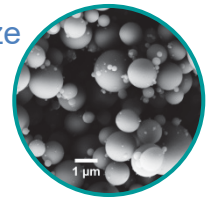
- Good mechanical properties
- High surface area
- Particulate suspension stabilizer



Hybridization with:

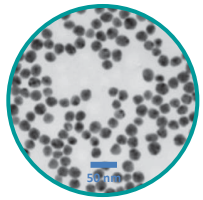
Lignin particles

- Anti-oxidant properties
- Tunable particles size
- Bio-based material



Metallic nanoparticles

- Conductive properties
- Nano sized scale



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In collaboration with Aalto University

Objectives

Hybrid materials based on cellulose nanofibers (CNF)

- Combination of different functions
- Improve CNF films properties
- Replace cellulose nanofibers by chitin nanofibers from different sources

High added value for CNF films

- Super-hydrophobic surface
- Conductive films
- Anti-oxidant films
- Drug release

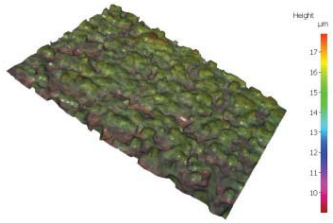


Image of the surface of a CNF TEMPO film containing 9% of lignin particles

Methods

Ex-situ mixing

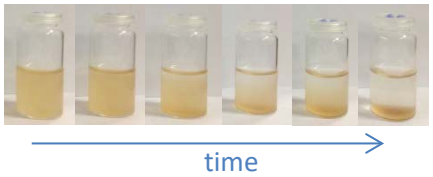
Mechanical addition of the different materials

In-situ preparation

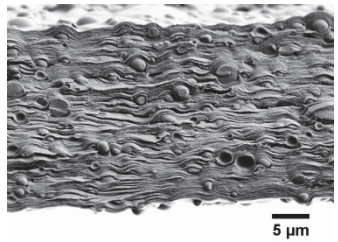
Synthesis of the particles on the CNF suspensions or films

Characterizations:

- Interactions between particles
- Suspensions stability over time



- Particles dispersion in the films
- Film structure



SEM image of a cross-section of a CNF TEMPO film containing 9% of lignin particles