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Self-assembly of nanocellulose on natural fibre surface for advanced functional biocomposites

Auto-assemblage de nanocellulose à la surface de fibres végétales pour l'élaboration de biocomposites fonctionnels avancés

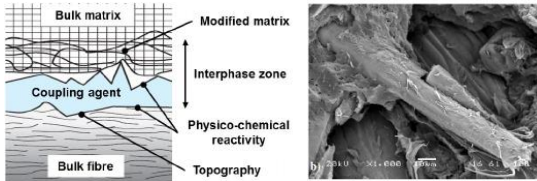
Context

Biobased nanocomposites

Flax nanocomposites

- Important development since 90's
- Ligno-cellulosic fibres: bio-renewable, low density, no competition with food industry
- Problem: limited mechanical performances

Enhancement of fibre/matrix interface in biocomposites



N. Le Moigne et al. (2018)

G. Coroller et al. (2011)

Better dispersion of fibers in matrix
 Better mechanical properties

→ Bulk or surface modifications:

- **Physical treatment** (UV, corona, etc.)
- Chemical modifications of the **surface OH groups**

Funded by

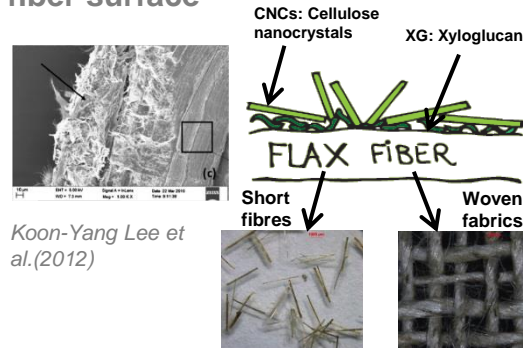


In collaboration with
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Objectives

Self-assembly of nanocellulose on fiber surface



Koon-Yang Lee et al. (2012)

Presence of **nanocellulose**:

- **High specific surface area**
- **Compatibilization** (fonctionnalization)
- **Enhancement** of the interphase and mechanical properties

« **Biomimetism** » of wood fibre with hierarchical architecture



Preparation of nanocomposites

- Different processes
- Thermoset (epoxy resin, flax woven fabrics)
- Thermoplastic (PP, flax short fibres)

Methods

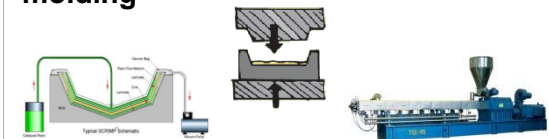
Functionalization of natural fiber

- Layer by layer self-assembly technique
- Adsorption of nanocellulose and/or XG on natural fibre: characterization of arrangement by SEM, AFM

Preparation of nanocomposites

Multiple processes

Thermoset: **infusion (1), thermocompression (2)**
 Thermoplastic: **twin-screw extrusion (3), injection molding**



(1)

(2)

(3)

Nanocomposites characterisation

- Mechanical tests (Tensile tests, Charpy choc, etc.)
- Rheological tests
- SEM, AFM,...