

# **Fibre-polymer interfaces - significance in tailoring next generation biocomposites in-line with sustainable development**

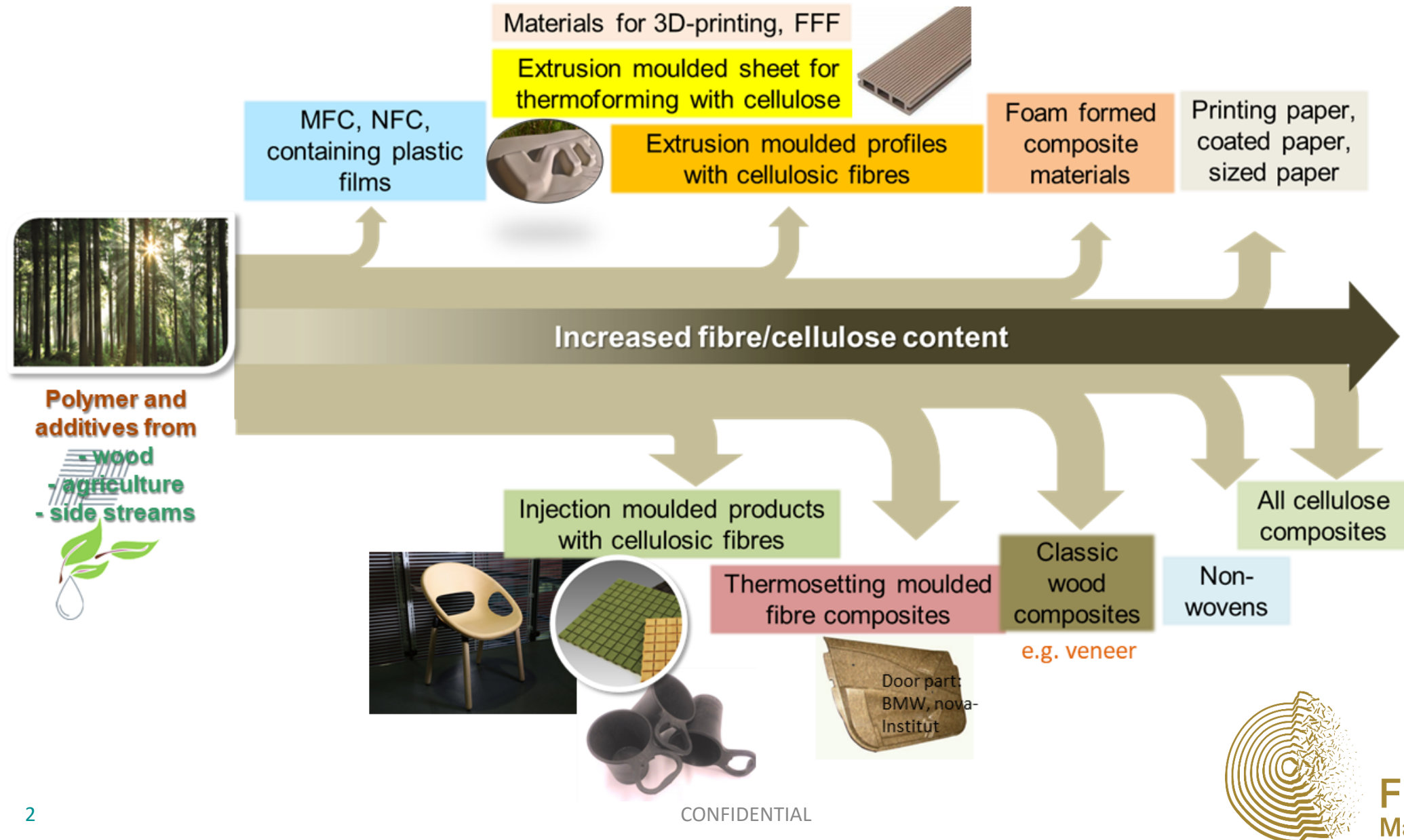
5.11.2018 Helsinki, Paasitorni

Kirsi Immonen (VTT)

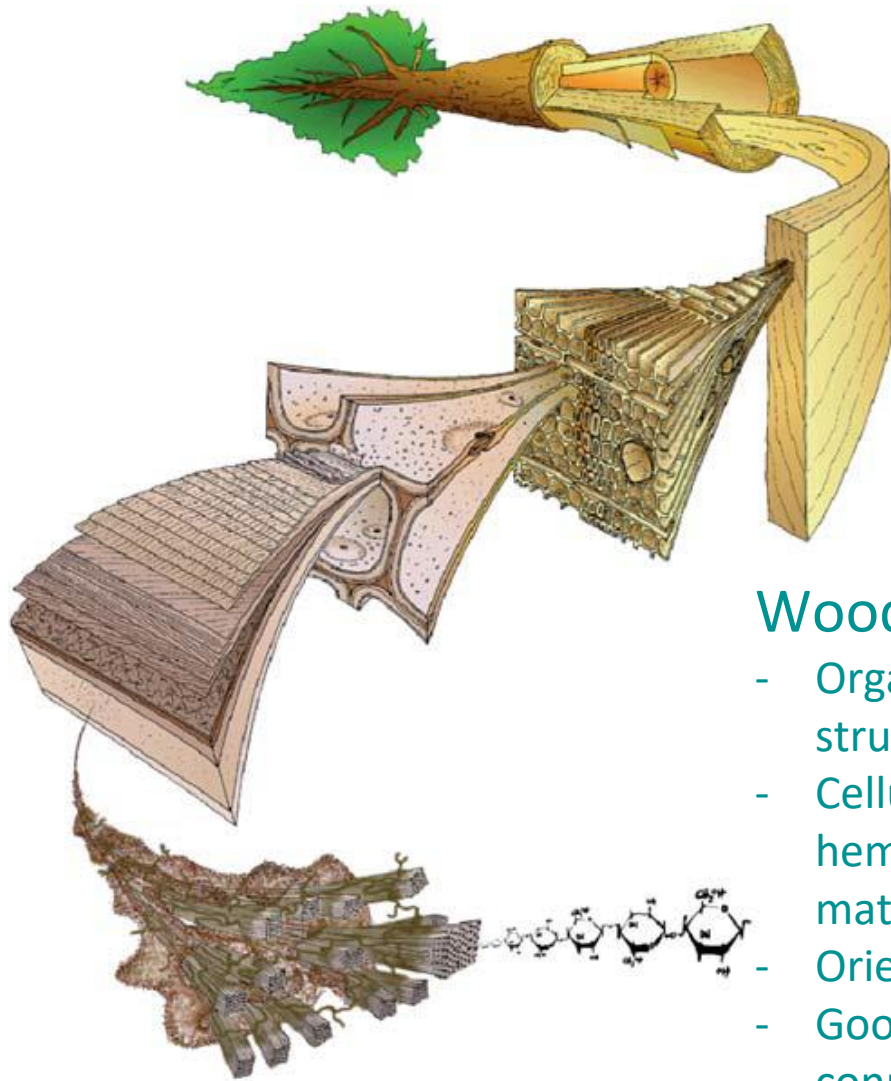


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# Fibre composites according to cellulose content



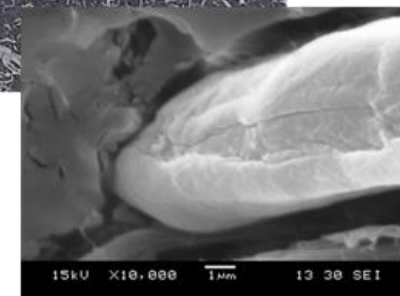
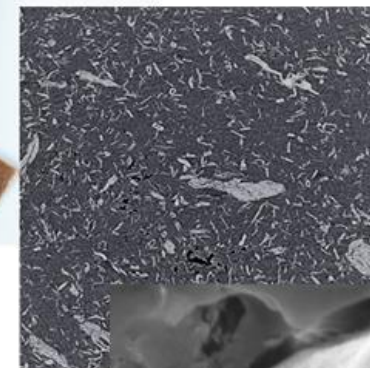
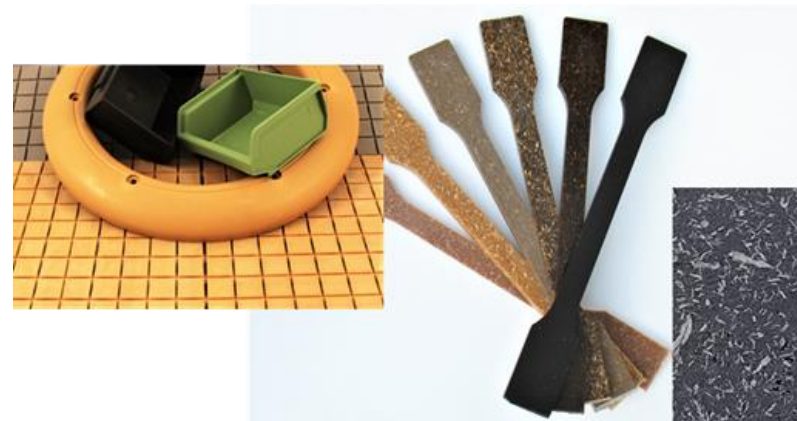
# From wood to wood containing thermoplastic composite



Wood structure by Mark Harrington  
(Copyright University of Canterbury, 1996,  
[www.nzwood.co.nz](http://www.nzwood.co.nz))

## Wood

- Organised, hierarchical structure
- Cellulose and hemicellulose in lignin matrix
- Orientation in fibres
- Good fibre-matrix connection



## Cellulose composite

- Random mixed fibre structure
- Ligno-cellulosic fibres in polymer matrix
- No orientation in fibres
- Poor fibre-matrix connection



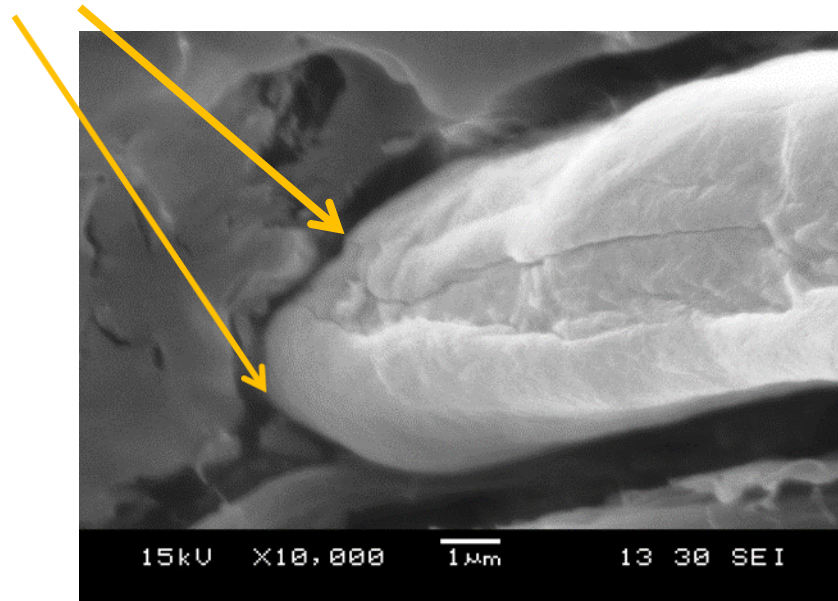
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# Fibre-matrix interface – the main challenge!

Compatibility challenge with cellulose fibre and polymer matrix in biocomposites

- Hydrophilic vs. hydrophobic surface properties
- Different swelling, shrinking properties during processing
- The presence of cellulose effects on polymer crystallisation behaviour during cooling
- Moisture containing vs. moisture sensitive (e.g. polyesters degrade easily)

-> Gap between cellulose fibre and polymer matrix needs some connection



## **External plasticiser/compatibiliser**

- Can fill the gap

## **Internal plasticiser/compatibiliser/fibre plasticisation**

- Connected to fibre or polymer to fill the gap

## **Cross-linker (coupling agent)**

- Bridge between fibre and polymer

## **Fibre surface fibrillation**

- Increase the fibre surface area in polymer matrix



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# Biopolymer – fibre composite end of life



## Reuse

- Mechanical recycling as raw material to new products

## Biodegradation

- Composting

## Combustion

- Energy without fossil CO<sub>2</sub>

**Thank you for your  
attention**



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