

A Novel Material Concept for High Strength Cellulose Composites

ForestValue Research Programme, Final Conference,
September 28 –29, 2022
Royal Botanical Garden, Madrid

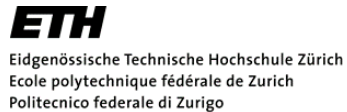
Project acronym: Strong Composite
Website: www.cellulosecomposites.com

Ingo Burgert (ETH Zürich/Empa)



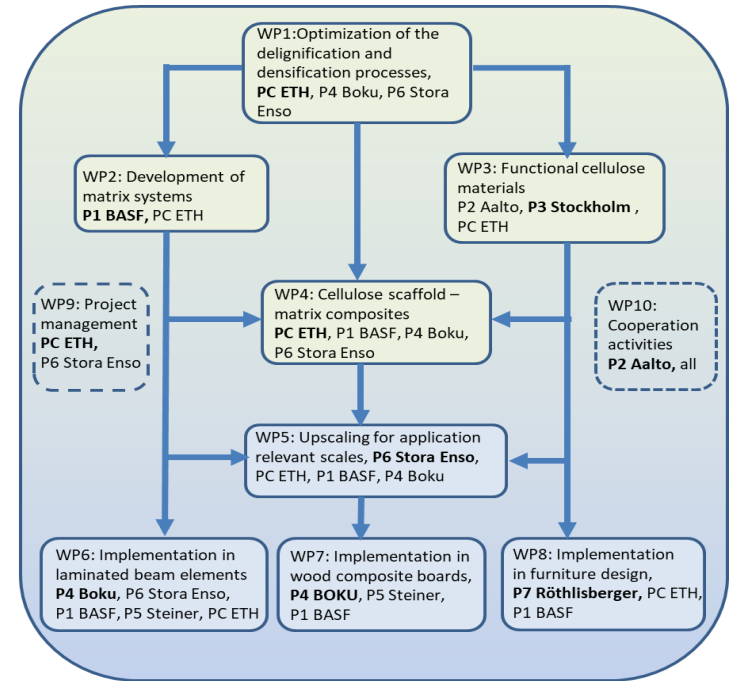
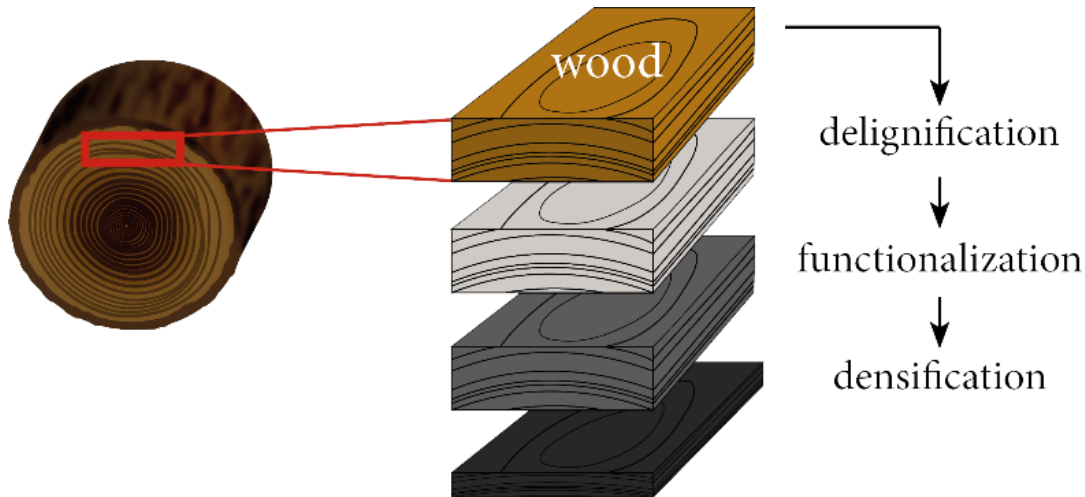
Project partners

PIs: Ingo Burgert (ETH Zürich/Empa), Andreas Hafner (BASF), Markus Linder (Aalto University), Lennart Bergström (Stockholm University), Wolfgang Gindl-Altmatter (BOKU), Gottfried Steiner (IB Steiner), Mikael Hannus (Stora Enso), Mark Röthlisberger (Röthlisberger AG)



Project duration: 01.02.2019 – 31.5.2022

Introduction

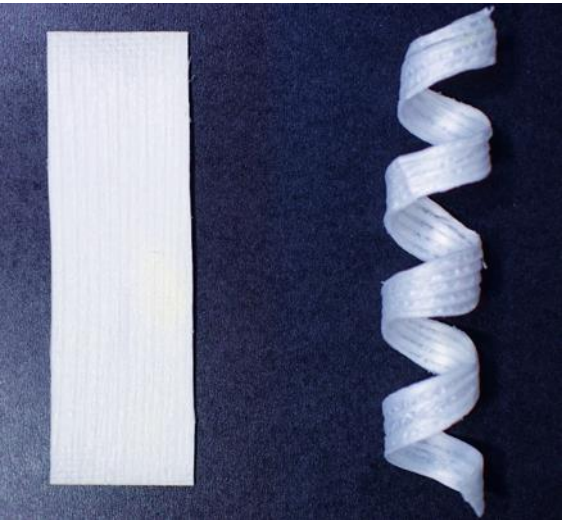
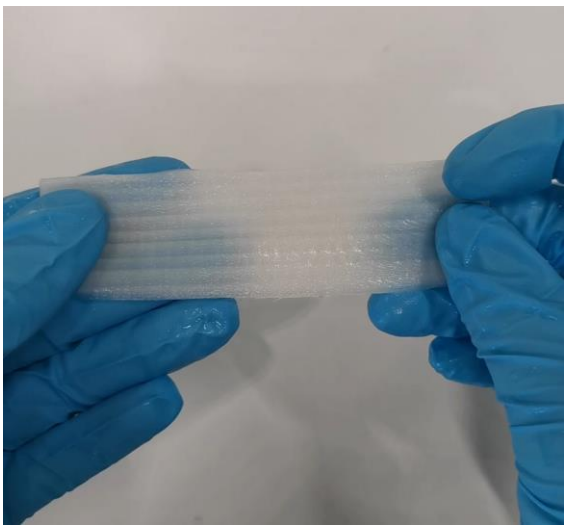


Objectives

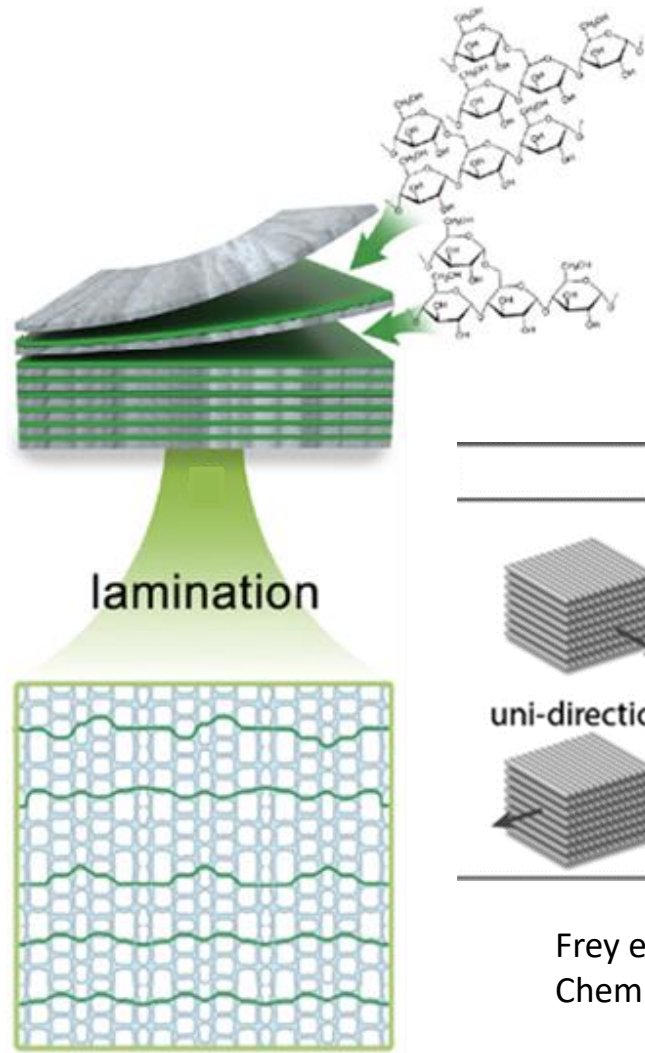
- Develop cellulose composites with high strength and high stiffness
- Functionalize the cellulose scaffolds to achieve additional properties
- Design adjustable resin matrices
- Upscale to industrial processes for prototype geometries for different fields of application



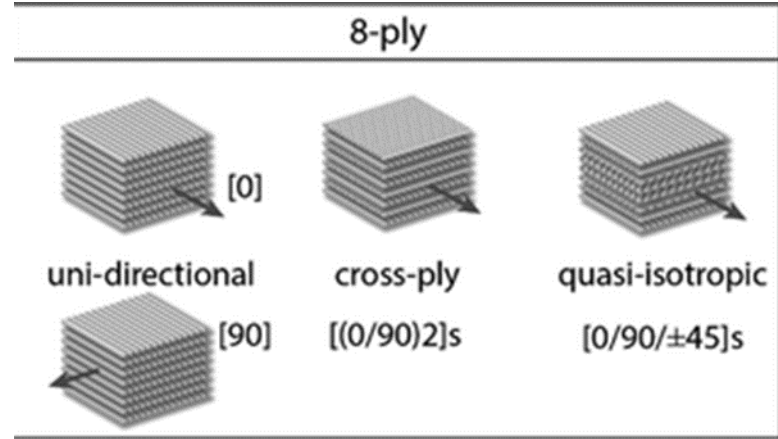
Cellulose composites



Results



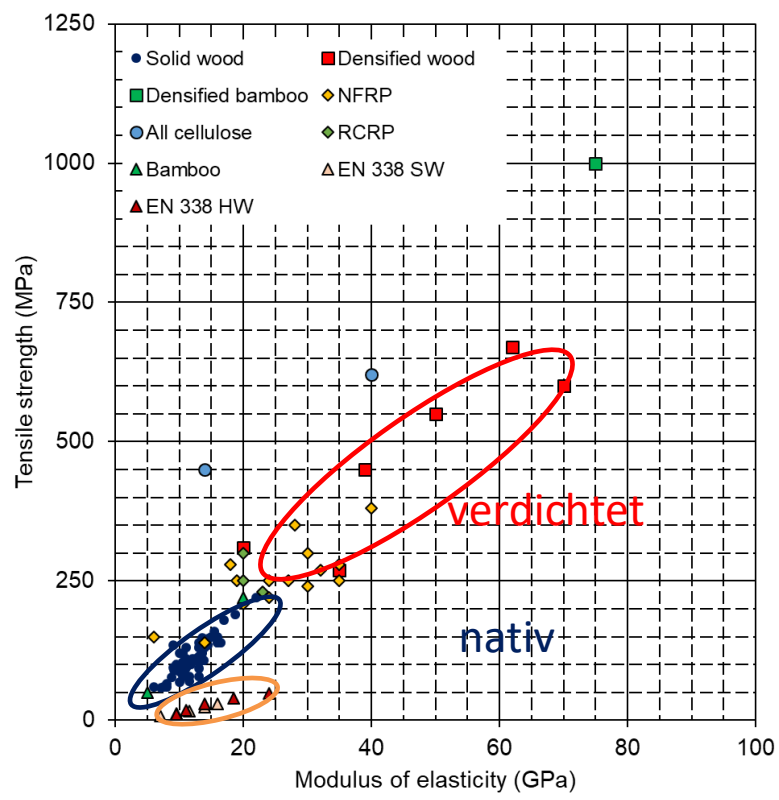
Assembly of veneers to laminates



Frey et al. (2021) ACS Sustainable Chem. Eng.

Cellulose Composites

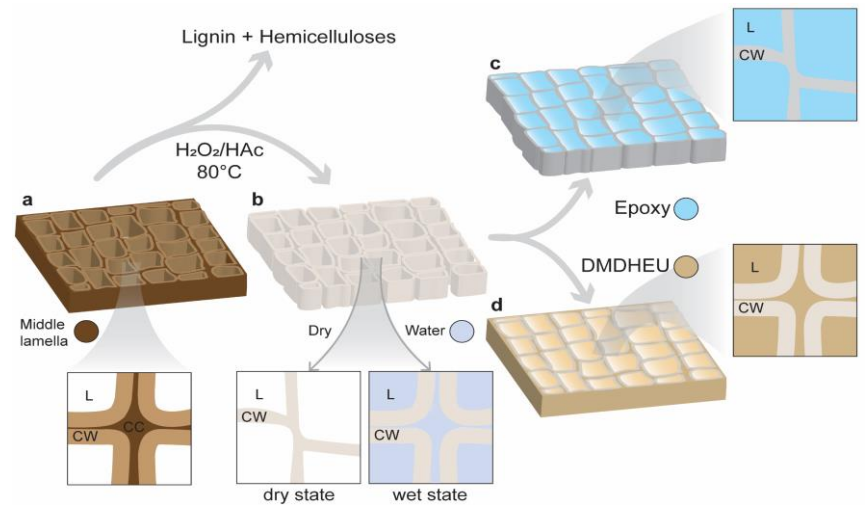
(Partial)delignification plus densification for improved mechanical properties



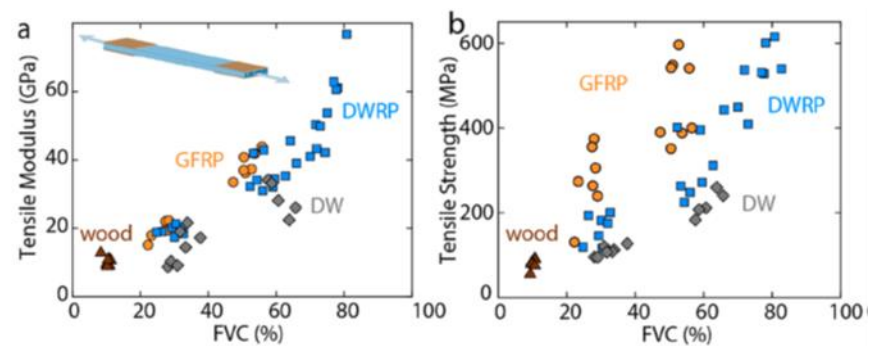
Boku

Results

Infiltration with a resin matrix



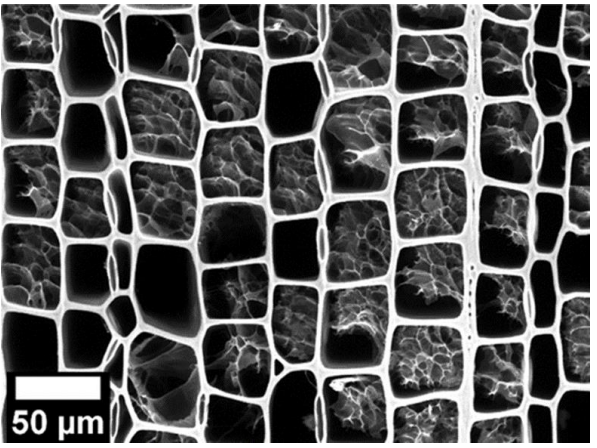
Koch et al. (2022) ACS Appl. Mater. Interfaces



Frey et al. (2019) Appl. Mater. Interfaces.



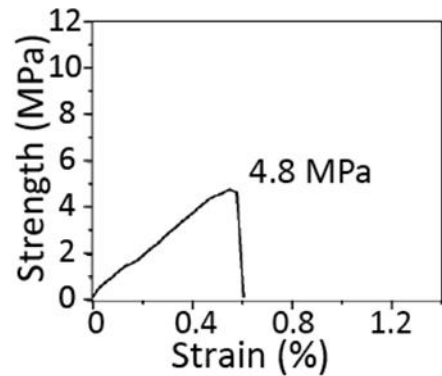
Functionalization



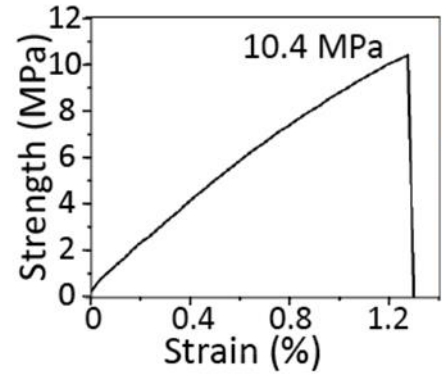
Church et al. (2021) ACS Sust. Chem. Engineer

Results

Biosynthetic silk proteins as adhesives for delignified wood assembly



Cellulose-Gelatin-Composites



Lemetti et al. (2022) ACS Sustainable Chemistry & Engineering



Upscaling (1m² veneers)

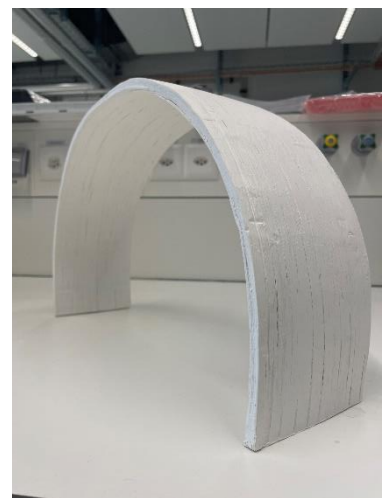


Stora Enso

Results

Demonstrators for Stakeholder Event, May 2022

Bio-based resin composites (BASF)



Impacts

Implementation

- Stakeholder event, May 6th 2022, Empa Nest, Dübendorf, Switzerland
- Several bilateral stakeholder meetings organized by Stora Enso, BASF, ETH, BOKU

Scientific impact

- 10 research articles published/accepted in peer-review journals, some more are in preparation
- 18 presentations to scientific congresses, seminars, workshops

The value of scientific cooperation

Scientific collaboration

- Fruitful and well-balanced combination of fundamental and applied research activities in the project
- Intense and goal-oriented communication and cooperation between partners from industry and academia
- Material and knowledge exchange
- Common efforts on upscaling of technologies
- Common implementation activities

Unexpected peculiarities / barriers

- Corona pandemic and related measures

Final outcomes

- Optimized and scalable processes to produce cellulose composites
- High strength cellulose composites, which may substitute other engineering material in various fields of application
- Functionalized cellulose composites for novel applications
- Extensive stakeholder involvement

Thank you!

Contact details

ForestValue

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