



# Introduction to COST-Action FP0802

**Karin Hofstetter, TU Vienna  
Chair of COST Action FP0802**

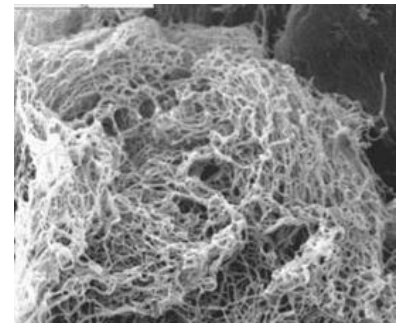
## FP0802 – Primary objectives

Increased understanding of wood micro-structure and micromechanics

- exploring and evaluating emerging techniques in the fields of physics, chemistry, materials and computer science
- increasing comparability of approaches and results - standardization vs. individual solutions
- establishing pool of structural and mechanical data
- providing a strong basis for the development of innovative wood-based products

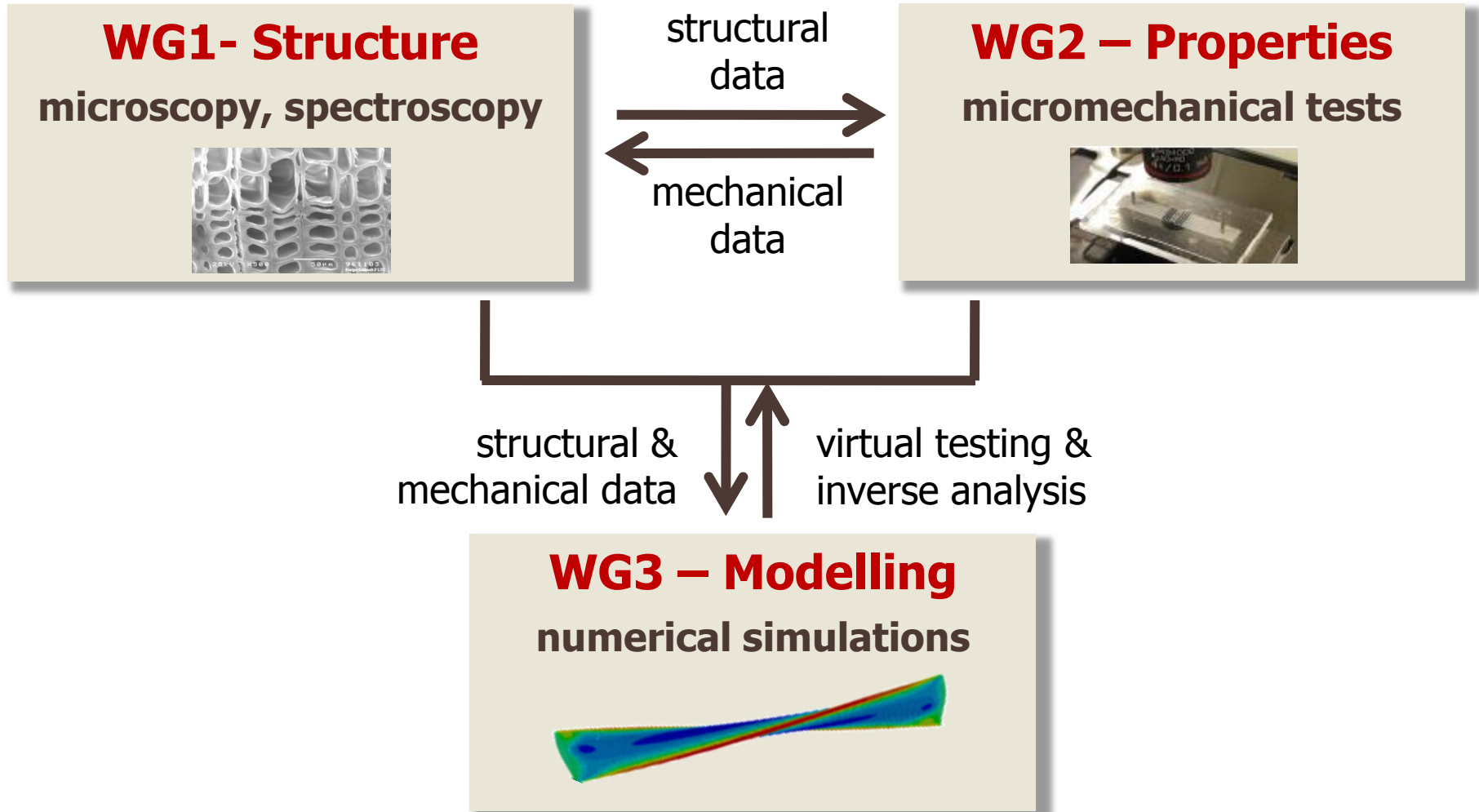


time-resolved scanning acoustic microscope, SASAM (P.V. Zinin)



bio-composites made of cellulose nano-fibers and recombinant resilin; (O. Shoseyov)

# Organization



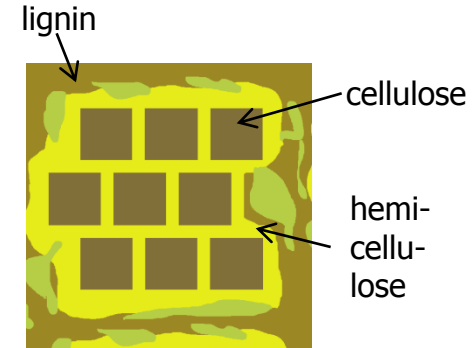
# WG1 – Wood microstructure (*Lisbeth Thygesen*)

## Principal topics:

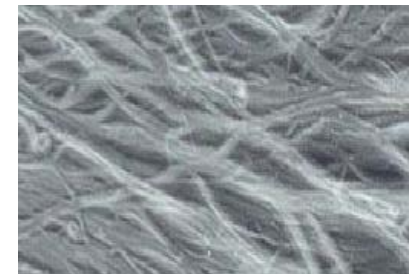
- molecular structure of cell wall
- molecular origin of time and moisture dependence of mechanical behaviour

## Current issues:

- arrangement of cell wall polymers, cellulose network structure
- microstructural effects of modifications and treatments
- X-ray (micro-) tomographic methods
- material heterogeneity



Distribution of wood polymers  
(Fahlen & Salmén 05)



Bleached spruce fibre  
(Daniel et al. 07)

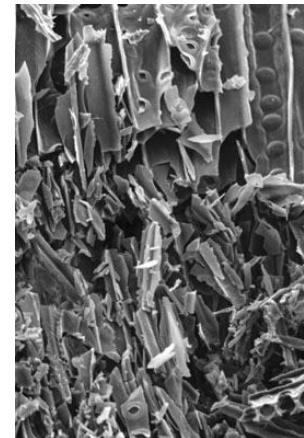
# WG1 – Wood microstructure (*Lisbeth Thygesen*)

## Interlinks:

- investigation of degraded/ancient wood, advanced methods and data evaluation strategies
- understanding of effects of biological and abiotic degradation on microstructure
- identification of suitable inspection/monitoring methods for degradation state both in-situ and ex-situ
- enhanced insight by examining materials deteriorated by various mechanisms



Soft rotted wood  
(Blanchette '06)



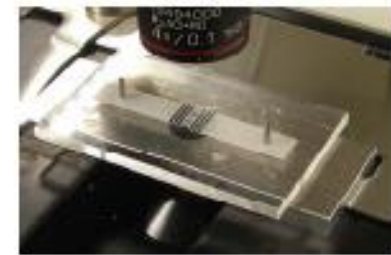
SEM graph of brown-rotted wood  
(Blanchette '06)



# WG2 – (Hygro-)mechanical properties (*M. Eder*)

## Principal topics:

- (micro)structure function relationships
- hygro-thermo-mechanical properties of cell wall and its components under different environmental conditions
- in-situ tests

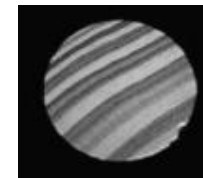


Micro-tensile testing stage and fiber fracture zone  
(*Eder et al. 07*)

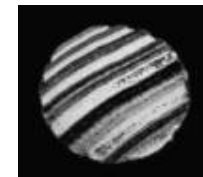


## Current issues:

- quantitative application of NI and AFM
- testing of (enzymatically/genetically) modified and (thermally/mechanically) treated material
- comparability of results and methods



initial state before pressure application



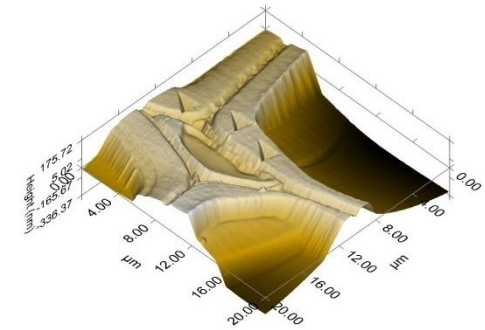
270 minutes of drainage

NMR images of moisture distribution (*Almeida et al. 08*)

## WG2 – (Hygro-)mechanical properties (*M. Eder*)

### Interlinks:

- determination of mechanical properties of ancient wood (considering anisotropy, rheology, moisture influences)
- identify basic data for risk assessment of historical wooden objects and for recommendations for environmental conditioning of cultural objects
- derivation of structure-function-relationships over larger range of structural characteristics, again additional insight/data



Nano-indentations in wood cell wall (*Jäger 06*)



Tensile testing of Vasa material (*Bjurhager, Kristensson '10*)

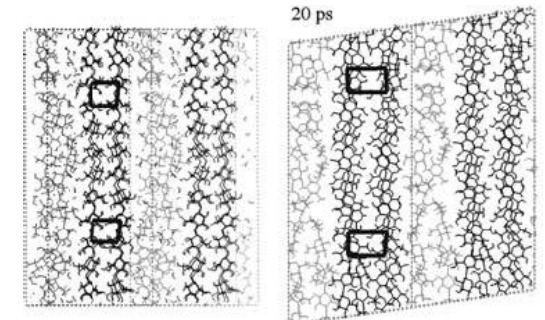
## WG3 – Modeling (*Kristofer Gamstedt*)

### Principal topics:

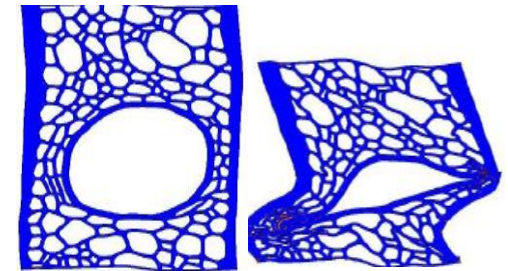
- multiscale models considering hygro-thermo-mechanical couplings
- bottom-up approaches for predictive simulations

### Current issues:

- suitable/missing input parameters
- inverse analysis, particularly in relation to image correlation techniques
- combination of modeling and testing in order to approach molecular scale and to identify critical nanoscale features



Molecular dynamics simulation of simultaneous drying and shearing  
(Navi et al. 02)



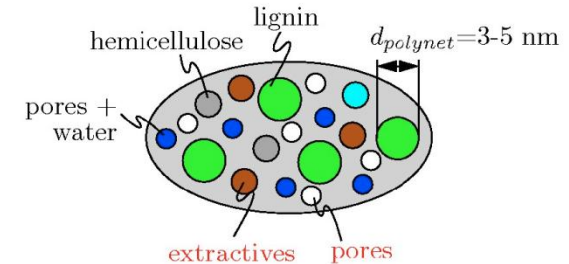
Deformation at compressive loading in R-direction  
(Ransgri et al. 04)



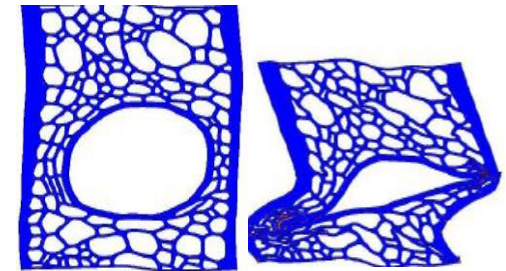
## WG3 – Modeling (*Kristofer Gamstedt*)

### Interlinks – cf. scope of joint meeting:

- establishing (quantitative) relations between microstructure and macroscopic properties
- estimation of (hygro-)mechanical material parameters
- prediction of long-term behavior, projection of current state into future
- numerical investigation of wooden objects, assessment of environmental risks and effects of restoration measures



Representative volume element  
of degraded cell wall matrix  
(*Bader 09*)



Deformation at compressive  
loading in R-direction (*Ransgri  
et al. 04*)

**COST Action FP0802**

The main objective of the COST Action FP0802 "Experimental and Computational Characterization Techniques in Wood Mechanics" is to increase the understanding of the wood microstructure and micromechanics by exploring and evaluating emerging techniques in the fields of physics, chemistry, materials and computer science in order to provide a strong basis for the development of innovative wood-based products in the future and for enhancing the use of the natural resource wood.

**Workshop Objectives**

The objective of the workshop is to present and discuss the current status, the technical challenges and the latest research results of the micro-characterization in wood mechanics within and beyond the framework of COST Action FP0802. In addition, the workshop provides a forum to communicate current ideas and strategies in this field. Particular emphasis will be given on assessing the potential of emerging experimental and computational techniques and of combinations of already well-established techniques for investigating the ultrastructural origin of the moisture and time dependence of the mechanical behavior of wood.

The workshop will bring together researchers from different areas of engineering including biology, physics, chemistry, material science, forestry, engineering, etc. Scientists with a general methodological background in material characterization at smaller length scales with no particular focus on wood mechanics are also strongly encouraged to participate.

**New presentations**

Besides poster presentations for be established as workshop. More presentations are foreseen for this submit an abstract either for the workshop or the WG meeting, or for both (different abstracts).

**Abstract submission  
deadline April 30**

**Tutorial**

A Tutorial is planned in the late afternoon on the day before the workshop. It offers an opportunity to refresh and update the knowledge on "Micro X-Ray Tomography". We are very pleased that Prof. Markku Kataja from Jyväskylä University agreed to give us detailed information on this topic. Please indicate your attendance on the Abstract Submission Form and the Registration Form.

**Workshop Topics**

The workshop will be concerned with the microstructure and micromechanics as well as experimental and computational microcharacterization methods used and developed in the wood sector.

Topics of interest include, but are not limited to:

**Techniques & Tools**

- tomography,
- spectroscopic techniques,
- nanomechanical testing (NI, FIB, AFM, etc.),
- multi-field and multi-physics modeling,
- multiscale modeling, homogenization
- parameter identification and inverse modeling
- hybrid methods (both purely experimental and experimental & numerical)
- ...

**Modified wood & wood/cellulose-based materials**

- thermal & enzymatic treatment,
- genetically modified material,
- wood plastic composites,
- dense and dense resistance

- biomimetic applications,
- ...



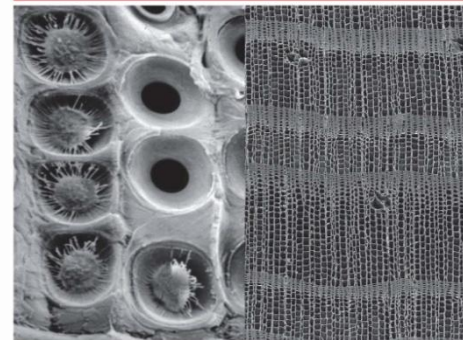
**Action FP0802**

Experimental and Computational  
Micro-Characterization  
Techniques in Wood Mechanics

<http://COST-FP0802.tuwien.ac.at>

**Workshop  
"Wood Structure/Function  
Relationships"**

**October 5-8, 2010  
Hamburg, Germany**



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**Action webpage: <http://cost-fp0802.tuwien.ac.at>**