

Template for project overview (max. 1-2 pages)

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WOODFIBRE3D

Structure-property relations of wood fibres: 3D characterisation and modelling

Project Start Month: 01 - 2008

Project Duration: 36 months

Project Consortium

Project Coordinator

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Project Partners

Paper and Fibre Research Institute (PFI), Høgskoleringen 6B, 7491 Trondheim, Norway

University of Jyväskylä (JyU) Dept. Physics, P.O. Box 35, FIN-40014, Jyväskylä, Finland

Swedish University of Agricultural Sciences (SLU), Centre for Image Analysis, Box 337, S-75105 Uppsala, Sweden

Royal Institute of Technology (KTH), Dept Solid Mechanics, Osquars Backe 1, S-10044 Stockholm, Sweden

Risø National Laboratory (Risø), Frederiksborgvej 399, DK-4000 Roskilde, Denmark

Project Objectives

The primarily objective of WoodFibre3D is to apply and combine a set of advanced state-of-the-art 3D characterisation facilities to gain increased fundamental competence on the fibre structures at cell-/fibre-/wood-structure level. This competence will be combined with modelling expertise to understand and predict the mechanical properties of the wood fibres and how they can be utilised as reinforcements in composite applications.

Project Approach

In order to reach the objective, the project is organised in 5 work packages, where the main tasks and techniques are briefly described below;

- Develop and apply sample preparation strategies involving selective staining compatible with Field Emission Transmission Electron Microscopy (FE-TEM) tomography requirements.
- Apply FE-TEM tomography to obtain a documented 3D understanding of wood fibre ultrastructure and composition for a set of fibre materials.
- Apply X-ray microtomography to obtain a documented 3D understanding of
 - wood fibre structure.
 - fibres as reinforcement in a polymer.
- Develop effective software tools to handle and quantify the achieved large 3D data sets

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- Develop finite element models (FEM) to describe relations between fibre ultrastructure – fibre structure – fibre reinforced polymer structure based on the 3D structure data on all three different levels.
- Verify the modelling results with mechanical testing.

The role of the different partners is described below;

SINTEF: Coordinator, 3D TEM tomography of wood fibres and wood fibre reinforced composites, x-ray microtomography of wood fibre reinforced composites

PFI: X-ray microtomography of wood fibres, SEM of wood fibres and wood fibre reinforced composites, image analysis

JyU: Table top X-ray microtomography, 3D image analysis, multiphase flows, flow in porous media, transport properties.

SLU: Visualisation and characterisation of 3D structure in terms of images. Development of image analysis tools for porous materials such as WFC.

KTH: Experimental micromechanics of heterogeneous materials, in particular fibre composites. Development of mechanism-based models.

Risø: Macroscopic and microstructural material characterisation, micromechanical modelling, fibre matrix interface and its influence on the macroscopic behaviour of composites.

Expected Project Impact

The primary impacts from the project are

- An increased knowledge of the relations between fibre processing and fibre (ultra)structure and subsequently the relations between fibre ultrastructure and composite properties could open for more targeted and tailor-made fibre processing for use of fibres on composite applications. This will be of high interests for all fibre producers and composite converters.
- Except the results expected from this project, the close collaboration in this consortium is expected to realize new project ideas and fruitful collaborations.
- The region will further position itself as one of the major region of excellence in the field of wood fibres and also strengthen collaborations with international partners
- A network of several PhD students will be present in the project, which will be of great importance for the PhD students themselves and their respective organisations.

The results from the work will be presented at relevant national meetings and international conferences, and as publications in refereed scientific journals. Further dissemination of the results will be made in the form of

- 4 Doctoral Theses
- 1 Post doctor
- Popular science articles
- Web site for the project
- Regular meetings with presentation of results and future activities

Contact

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