Scattering-based analysis method for pulps

Supervisors: Prof. Thaddeus Maloney and Dr. Paavo Penttilä
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We are now looking for a **Doctoral Researcher in Small-angle scattering analysis of cellulose fibers and their moisture interactions.**

Are you passionate of understanding the structure of materials and developing methods for structural characterization?

We are now looking for a doctoral researcher to develop the interpretation of small-angle scattering (SAXS, SANS) data from pulp fibers. Dedicated method development is needed to enable the use of the exceptional capabilities of scattering methods for structural characterization of cellulose fibers under various environments or after specific treatments. In this position you will have a chance to make an impact by laying the ground for a new analytical tool that will extend the usability of advanced scattering-based characterization into pulps and a variety of research cases, supporting the sustainable targets of CIMANET. At the same time, you will create new knowledge about the nanoscale architecture of fiber cell walls and its interactions with water. Join us in shaping the future!

The Biobased Materials Structure group provides fundamental structural information and methods for structural characterization of biobased materials, which supports the development of sustainable applications. Our most important technique is X-ray scattering, but we also utilize spectroscopy and other methods, and develop computer-based data analysis for them. We often handle large amounts of experimental data and extract relevant information from it, also applying some tools of machine learning. We have especially developed the interpretation and analysis of X-ray and neutron scattering data from wood and other cellulosic materials. This method development allows extracting important structural information from cellulosic samples and studying for instance wood-water interactions at the nanoscale, which serves as an inspiration for this project.

Scientific environment

In this position, you will be part of the Biobased Materials Structure group, led by Academy of Finland Research Fellow, Dr. Paavo Penttilä, who will be your thesis advisor and supervisor on a daily basis. The supervising professor is Prof. Thaddeus Maloney.

The work will be done mostly at the Department of Bioproducts and Biosystems at the Otaniemi campus of Aalto University, with occasional visits to large-scale synchrotron and neutron facilities abroad. You will be able to utilize the high-quality laboratory spaces at the department and the state-of-the-art X-ray scattering equipment available at the Nanomicroscopy Center of Aalto University.

In the first weeks, you will be assigned your own onboarding buddy who will help you get started with your work and studies at Aalto.

Your role and goals

Your main role is to perform small-angle scattering experiments on pulp samples and develop the related data analysis, supported by results from other techniques like thermoporosimetry. You will prepare samples and conduct small-angle X-ray and neutron scattering (SAXS, SANS) experiments at Aalto University and at large-scale facilities. You will utilize different kinds of experimental data to

better understand and interpret the structural features of the samples and the scattering data itself, and eventually create a data analysis method (algorithm or model) that extracts relevant structural parameters from small-angle scattering data measured from pulp samples. You will receive help from senior researchers especially in performing the scattering experiments and in the data analysis and method development. Besides the scattering analysis method, the project is expected to yield new information on the nanoscale structure of pulp fiber walls and how they interact with moisture. You will write high-quality papers on your results and publish them in international peer-reviewed journals.

Your experience and ambitions

We are looking for candidates especially with

- A desire for understanding the structural aspects of lignocellulosic materials and developing structural characterization methods
- A keen interest to prepare samples, perform experiments, analyze the results, and develop the analysis further
- Goal-oriented mind and proactive attitude
- Excellent student track records

We also appreciate the following qualifications or skills (please mention in the cover letter):

- Hands-on experience on X-ray/neutron scattering methods (SAXS, SANS, WAXS)
- Experience on pulp/wood/cellulose
- Scientific computing or programming skills (e.g., Python)

An applicant must have completed by 31 July 2024 or preferably earlier (to start employment on 1 August 2024) or by 31 December 2024 or preferably earlier (to start employment on 1 January 2025)

- a master's degree awarded by a university, or
- a study programme that in the awarding country gives eligibility for doctoral level studies

in chemistry, physics, materials science, or a closely related field. A good command of English is required, Finnish language is not.