

Valorization of lower quality hardwood species into high quality veneer-based products.

Summary

In northern Europe, veneer and veneer-based products play an important role in hardwood species sustainable use. Birch is already widely used in veneer products, however lower value and underutilized wood species such as grey alder, black alder and aspen are not widely used in the veneer-based products. The reason for this is not the resource availability, but the lower quality of these wood species. For example, in the case of plywood, its mechanical properties (flexural strength and modulus of elasticity) depend on the type of wood, the quality of the wood, the moisture content of the wood, the density, the structure, the number of veneer layers, veneer thickness and glue. Density is generally considered to be one of the most important properties of a material because it is strongly correlated with the strength properties of wood. It is preferred to use in most construction structures high-density wood species due to their high mechanical strength. However, stocks of high-density wood species are limited and expensive. Therefore there is a need to start using the lower quality alternative hardwood species in the veneer-based products. Secondly, the most wood species used for plywood production have poor resistance to swelling, biodegradation, fire resistance and UV weathering under outdoor and high humidity conditions. Therefore, when using plywood in conditions with high humidity, where regular wetting is possible, it is necessary not only to cover it from the outside with a hydrophobic laminate, but also to treat the single veneers constituting the entire plywood board. Prolonging the service life of wood and wood-based products results in a positive effect on greenhouse gas emissions by storing biomass carbon for longer periods.

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| Research field: | Chemical, materials and energy technology |
| Supervisors: | Prof. Dr. Jaan Kers Dr. Heikko Kallakas |
| Availability: | This position is available. |
| Offered by: | School of Engineering Department of Materials and Environmental Technology |
| Application deadline: | Applications are accepted between June 01, 2022 00:00 and June 30, 2022 23:59 (Europe/Zurich) |

Description

The goal of this PhD project is to enhance the properties of lower quality wood species (grey alder, black alder and aspen) to make them suitable alternatives in the veneer-based products. In this research, the suitable log soaking parameters, peeling parameters, drying parameters, gluing parameters and pressing parameters should be determined for the hardwood species. Veneer strength properties should be tested and increased with the densification. Suitable method for veneer densification for each wood species should be determined that gives the optimal strength and thickness properties.

Evaluating the different hardwood species veneer coating and impregnation properties with fire retardants and weather resistant coatings. Durability and the stability of the coatings on the different hardwood species veneers will be evaluated.

Supervisors:

Main supervisor: Dr. Heikko Kallakas
Co-supervisor: Prof. Dr. Jaan Kers

Responsibilities and (foreseen) tasks

- Composing comprehensive literature survey of the state of the art in the field of veneer processing, plywood properties, wood modification, densification and durability.
- To develop suitable densification methods for different hardwood veneers.

- To demonstrate the impact of veneer properties and processing parameters on veneer densification and surface quality.
- Characterization of the densification process with mechanical properties and surface properties.
- Evaluating the coatings and fire retardants and their durability on the different hardwood species veneers.
- Publishing of the results as journal articles and conference presentations.
- Contribute to the organization of research and practitioner workshops where project findings are presented

Applicants should fulfil the following requirements:

- Master's degree in the field of wood technology, wood science, wood chemistry or materials technology
- Familiar with methods, procedures and safety of wood technology or wood chemistry, which allows to work independently
- Excellent communication skills (written and spoken) in English
- A clear interest in the topic of the position
- Strong and demonstrable writing and analytical skills
- Capacity to work both as an independent researcher and as part of an international team
- Capacity and willingness to provide assistance in organizational tasks relevant to the project

The following experience is beneficial:

- Previous experience in wood technology or wood chemistry would be highly appreciated.
- Previous experience in the most relevant characterization methods (surface roughness, contact angle measurement, tensile and flexural tests) is also expected.
- Previous knowledge about veneer-based products and their technologies.
- Working knowledge of statistics.

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in one of the largest, most internationalized and leading engineering and technology research centers in Estonia.
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of wood technology and wood chemistry.

About the department

Department of Materials and Environmental Technology is an interdisciplinary research center of Tallinn University of Technology that focuses to lead the high-level, internationally recognized teaching, research and development in Estonia in the field of materials and environmental technology.

Additional information

For further information, please contact Prof. Jaan Kers: jaan.kers@taltech.ee and Dr. Heikko Kallakas: heikko.kallakas@taltech.ee or visit the <https://taltech.ee/en/department-materials-and-environmental-technology>



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