

Wood VISION LAB

The Austrian Center of Excellence for Lightweight Wood Construction





It is lighter and more sustainable than materials used to date and can be reused multiple times beyond the product's life cycle in line with the principles of a circular economy.

The Wood Vision Lab...

1

... researches

the diverse applications of wood in innovative lightweight applications – covering the mobility sector, mechanical engineering, and circular concepts in consumer goods;

2

... integrates

basic and applied research and links them with pilot-scale and accelerator operations to form an ideal interface for cooperation partners in concrete applications;

3

... delivers

game-changing solutions for companies and entire industries in the field of sustainable materials and product solutions;

4

... serves

as a flagship, making a substantial contribution to advancing climate goals while establishing regional value creation for wood-based lightweight applications.

Wood is omnipresent

As a building material, parquet flooring, furniture, or heat source—wood is omnipresent, especially in our densely forested state. However, a comprehensive research journey that began over ten years ago in Styria proves that the material can do much more.

The success story is now reaching its preliminary climax with the establishment of an unprecedented innovation hub focusing on ecological lightweight construction with wood in new applications. The Wood Vision Lab is a unique cooperation initiative that aims to establish wood as a high-tech material of the future, making it a game changer in the search for sustainable materials.



Wood is a true all-rounder

Compared to other materials, it scores points not only for its CO_2 binding properties, but also for its low weight and the fact that it is a renewable raw material. This gives it a clear advantage over components made of carbon, aluminum, fiberglass, steel, or plastic in many applications.

The new applications for lightweight hybrid components based on wood in mobility, plant and mechanical engineering, and beyond are virtually unlimited. This means that components and products can be made more environmentally friendly, and entire industries can be made more sustainable and fit for the future.

Fireproof and robust thanks to expertise

It all comes down to the right processing. When processed correctly, the raw material does not splinter, meets the highest fire safety requirements, and is extremely durable. Several prototypes have already been developed in past projects. The expertise gained now serves as the basis for the next big step. For the first time, the Wood Vision Lab is pursuing a holistic approach along the entire value chain.

In the spirit of a circular economy, wood can be used multiple times. Until now, we have only known how to use wood as fuel at the end of its life cycle. Now, other areas of application are conceivable, such as high-stress structural components in vehicles.

Recyclable solutions are a key focus in concept and product development.



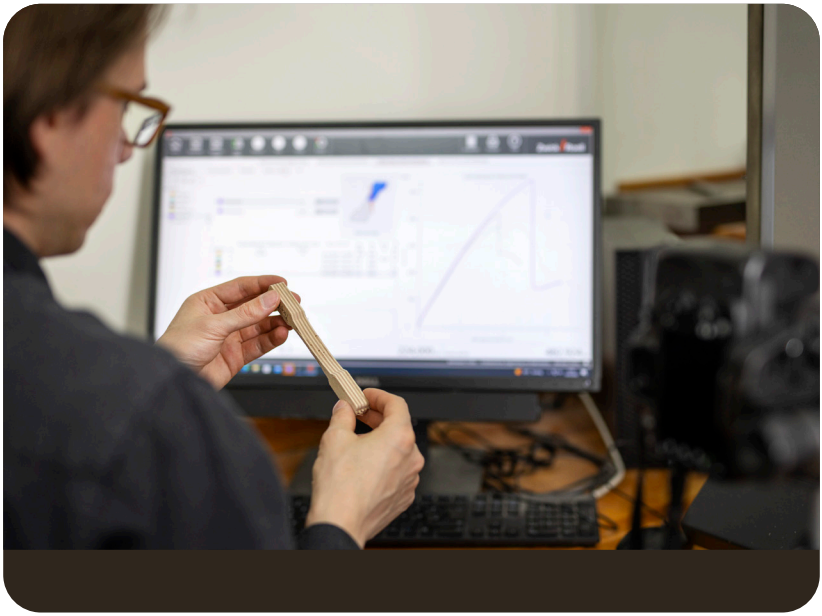


The application perspective is also holistic

Basic and applied research are not conducted separately from the possible applications, but are the beginning of this cycle, which ends in close cooperation with users.

To ensure the sustainable dissemination of knowledge, a dedicated career position funded by the province of Styria has been created at Graz University of Technology, focusing on „Bio-based crash-safe and lightweight materials“ at the Wood Vision Lab.

Ongoing and new R&D cooperation projects in inter/national network also contribute to the further development of know-how and expertise.



The innovation laboratory operates under the umbrella of the Wood Vision Lab

Wood | VISION HUB

Under the umbrella of the Wood Vision Lab, the „Wood Vision Hub" innovation laboratory focuses on „Wood and bio-based materials for new high-tech lightweight construction applications." The innovation laboratory serves as a catalyst for innovation and knowledge transfer, both in the scientific community and in industry/business, education and training, and in close cooperation with existing industry and cluster organizations.

Within existing and new partnerships, new research questions are continuously identified, collaborations are deepened, and new RTI projects are initiated and supported. On the other hand, innovative business models and sustainable service offerings for digitally based tools as well as qualification and accelerator programs are developed to support companies beyond the research level in addressing new future topics and markets.

Federal Ministry
Innovation, Mobility
and Infrastructure
Republic of Austria

FFG
Promoting Innovation.

High-performance material WOOD

Use in the mobility sector

The use of wood in the mobility sector is actually nothing new and ranges from carriage construction to aviation technology as early as World War II (e.g., Havilland Mosquito) to small series in the automotive sector (including Morgan Sports Cars). The technical performance of wood for technical applications has been proven by decades of use in aviation technology and vehicle applications. In recent decades, however, this material has been replaced by plastics and metals in many areas. New manufacturing processes and improved technical control of this natural material justify its return to these areas, supported by current debates on improving the carbon footprint of future vehicle concepts, which therefore also focus on weight reduction and the use of sustainable materials.

Wood, as a natural high-performance material, has outstanding strength, stiffness, and stability values, as well as excellent damping properties—all with low density and low raw material costs. In addition to improving the security of supply of raw materials, the use of this resource as a partial substitute for metal and plastic can bring significant advantages in terms of greening the economy. Furthermore, wood also has the potential to gain a foothold in the field of electromobility, as previous and current research has demonstrated.



PROJECT

WoodC.A.R.

COMPUTER AIDED RESEARCH

(2017 – 2021)

The development of wood hybrid components requires new production technologies, material simulation, manufacturing processes, and mastery of natural materials, which were the main focuses of the „WoodC.A.R." (Wood - Computer Aided Research) research project.

The automotive industry in particular has been intensively searching for new lightweight materials for some time. In addition to metals and plastics, new vehicle concepts require an increasing amount of fiber-reinforced composites.

However, these materials are difficult to process and lead to higher product costs due to their material price and increased manufacturing costs. The aim of „WoodC.A.R." was therefore to identify new areas of application for wood as a material and to make wood calculable for these purposes.

Until this WoodC.A.R. research project, material data and material maps for hardwood for simulation under dynamic loads and in the event of a crash were not available. There was also no assessment of the technical and economic potential of the selected wood species for these applications.

As part of the research activities, hardwoods in particular were therefore investigated with



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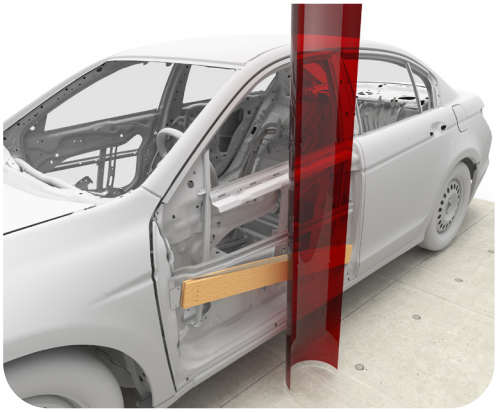
regard to their material properties and processability.
In order to transfer the complex research results into practice as early as possible, the consortium jointly defined so-called use cases: a side impact beam of a conventional passenger car, a chassis of a „Body-in-Wood“ fun car, a bus staircase for a coach, and a chassis for a tracked electric vehicle called „Ardenner.“

The use cases were developed based on the product development cycle in automotive engineering. The first step was to perform a topology analysis. Using boundary conditions (acting forces and bearing conditions), the software calculates which volume areas contribute to the stiffness of the component and which can be removed.

The structures obtained in this way were used to develop various lightweight wood-hybrid structures.
The raw concepts were further optimized through material simulations, which greatly shortened the development cycle. The four-year research project „WoodC.A.R.“ paved the way for the increased return of wood as a high-performance material for use in the mobility industry, especially in vehicle construction.

The results showed that 10 to 40% of the dead weight can be saved through the use of wood-based materials without any loss of performance. This can make a positive contribution to climate targets in the future, as weight reduction has the greatest leverage effect in terms of reducing greenhouse gas emissions. Further research will focus primarily on mastering the natural raw material..

Further information is available at
→ ***www.woodcar.eu***



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PROJECT

CARpenTiER

(2021 – 2025)

The focus of the ongoing research was not only to further advance the predictability of wood as a material and develop new production technologies, but also to digitally map production processes, thereby making them more efficient and cost-effective.

The aim of „CARpenTiER" (Modeling, Production, and Further Processing of Eco-Hybrid Structures and Materials) was therefore to continue developing production technologies for wood-based hybrid constructions in automotive, plant, and mechanical engineering.

The applications include hybrid structures made of laminated wood, plywood, or veneer strip wood, which can be reinforced with natural fibers. Although earlier research work laid a solid foundation in finite element modeling, there was a lack of suitable production technologies for industrial implementation. For this reason, the further research program focused primarily on process development and process control.

Another challenge in using bio-based materials for the intended applications is controlling material variability. In conventional wood applications (e.g., in timber construction), this is mainly compensated for by high safety factors. However, this leads to a reduction in performance. Therefore, the project aimed at wood-based hybrid structures that maximize the lightweight construction potential of wood.

To this end, a computer-aided research (C.A.R.) approach to function-oriented dynamic process control (function-oriented process control) was established for future suppliers (= tiers).
To control the processes, it was necessary to identify raw

material and process parameters for each process step that have an influence on the defined functions of the component. This control loop of the processes thus corresponds to the individual material handling by an experienced specialist or craftsman, who always takes the result and thus the fulfillment of the function into account during the various process steps.

In contrast to the experience-based decision-making of humans in manufacturing processes, in digital process control of industrial manufacturing, every decision step must be based on physical models.

This makes the processes economically efficient, controllable, and reproducible. „CARpenTiER“ enabled a virtual representation of real processes in order to automate human knowledge in individual material processing. In addition to material control, this also ensures increased efficiency and yield.

„CARpenTiER“ was thus the logical continuation of the knowledge-based engineering of wood-based hybrid components that began with the „WoodC.A.R.“ research project. In addition to the technical design, predictability, and calculability of wood-based hybrid components, manufacturing processes can now also be made predictable and controllable.
Furthermore, suitable methods for forming, coating, joining, bonding, and modifying have been found, which can now be adapted or developed in the field of process engineering.

Further information is available at
→ ***www.carpentier.eu***



PROJECT

BioLiB

(2021 – 2024)

Until now, battery housings were commonly made of steel, aluminum, or steel-aluminum hybrid constructions. Aluminum housings are lighter, more expensive, and cause significantly more CO_2 emissions during production than comparable steel housings.

They are also at a disadvantage in terms of fire protection due to their relatively low melting point. When selecting materials, the factors of safety, weight, and cost must therefore be weighed up, and suitable new approaches to materials are needed.

As a bio-based material, wood has numerous strengths that can be exploited when used as a construction material in a battery housing: low thermal conductivity, excellent vibration damping, very high specific stiffness and strength, high impact energy absorption across the



grain, abundance of raw materials, low material costs, good and cost-effective machinability, low ecological footprint, and a well-calculable burn rate in the event of fire.

By combining wood- and steel-based materials in a battery housing, the favorable structural mechanical and thermal properties of both materials can complement each other and therefore be utilized.

This so-called functional integration is intended to reduce the weight and installation space of current state-of-the-art housings, at lower costs and with a smaller ecological footprint than comparable aluminum housings, while complying with mechanical, thermal, and safety requirements.
The „Bio!LIB“ (Biobased Multifunctional Laminates in Battery Housings) project demonstrated that the other favorable physical properties of the material can also be used for functional integration.

At the same time, a battery housing with a steel-wood hybrid design was developed that meets the requirements in terms of crash safety, fire protection, and weight, but significantly reduces the ecological footprint compared to a reference housing.



PROJECT

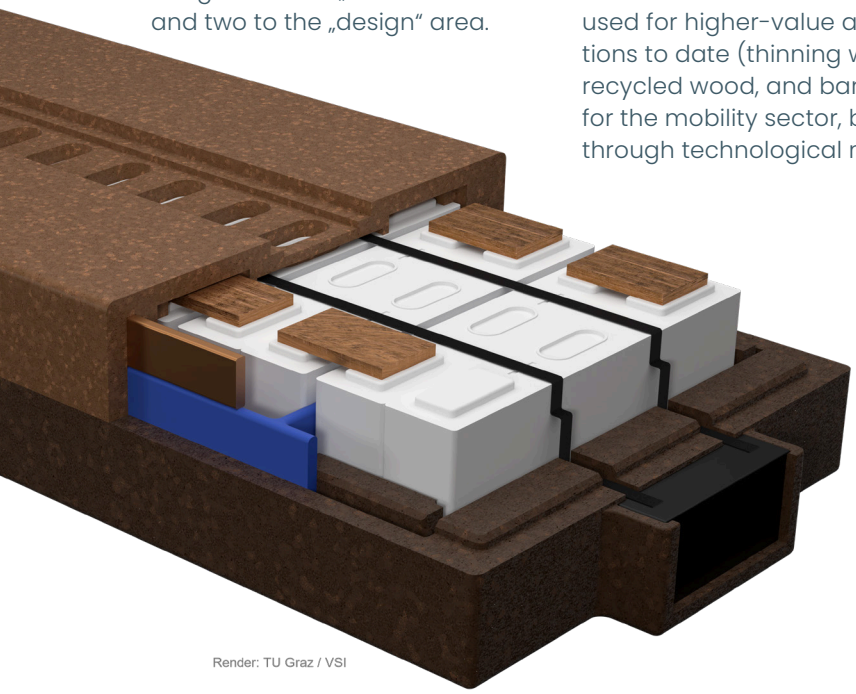
SMADBATT

(2023 – 2027)

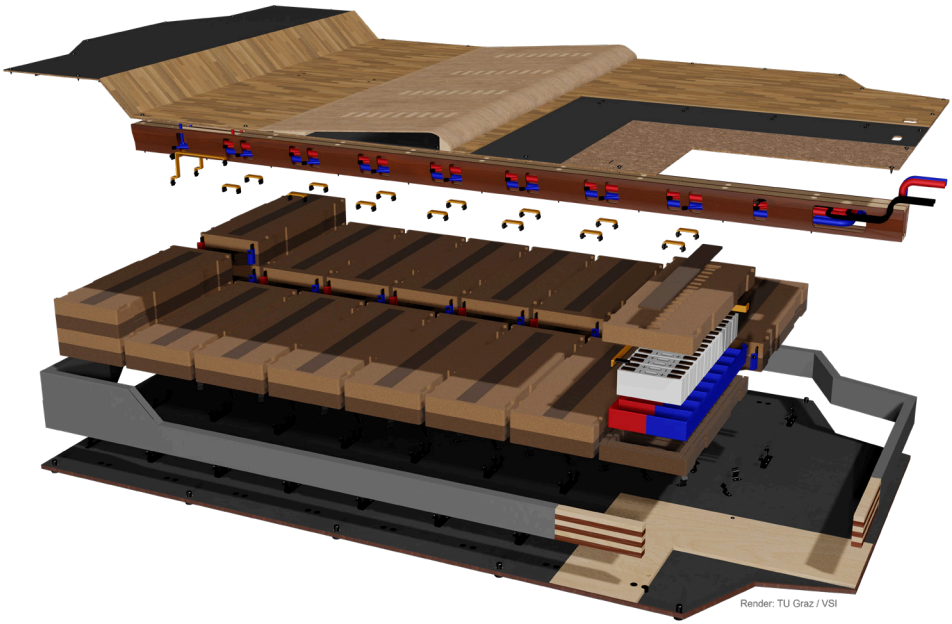
The follow-up project „SMaDBatt“ (Sustainable Materials and Design for Electric Vehicle Batteries) builds on the final demonstrator of the „Bio!LIB“ project as a study vehicle with the aim of developing ecologically and economically sensible solutions for the choice of materials and the design of battery housings.

The project consists of five sub-studies, three of which are assigned to the „material“ area and two to the „design“ area.

In the area of „materials,“ the project aims to make material resources that have hardly been used for higher-value applications to date (thinning wood, recycled wood, and bark) usable for the mobility sector, both through technological measures



Render: TU Graz / VSI



(upgrading, modification) and by identifying accessible material flows in terms of sources, quantity, quality, and price.

In the „Design“ area, the project aims to improve the quality of secondary raw materials and the recyclability of battery housings and their components through design that facilitates disassembly. In addition, the energy efficiency of electric vehicles is to be increased through adapted thermal management.

The „SMaDBatt“ research project is driving forward the circular transformation of the mobility sector through environmentally friendly raw material selection, dismantling capability, recyclability, substitution of problematic raw materials and innovative design.

wood-vision-lab.com



Wood VISION LAB

Cooperation Creates the Future

The Wood Vision Lab is made possible through the collaboration of renowned shareholders from industry, the public sector, and academia. The principal investors are the City of Weiz, together with W.E.I.Z. Immobilien GmbH, and Weitzer Woodsolutions, which have played a leading role in driving the existing research and industrialisation journey within the established network. The shareholder consortium is further complemented by Steirische Wirtschaftsförderungsgesellschaft mbH (SFG), JOANNEUM RESEARCH Forschungsgesellschaft mbH, Graz University of Technology, and the Catholic Church of Styria.

A total investment volume of approximately EUR 16 million is planned for the implementation of this pioneering centre. Of this amount, around EUR 9.5 million will be invested in the construction of the new pioneering centre, contributing to employment and economic growth.

The start-up phase is supported through various funding programmes of the European Union, the Federal Ministry for Innovation, Mobility and Infrastructure (BMIMI), the Austrian Forest Fund initiative of the Federal Ministry of Agriculture, Forestry, Climate and Environmental Protection, Regions and Water Management, as well as the Province of Styria.

The shareholders of the Wood Vision Lab GmbH.:

Innovationszentrum W.E.I.Z. · Weitzer Woodsolutions · SFG · JOANNEUM RESEARCH · TU Graz · Katholische Kirche Steiermark

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