AIDIMA INSTITUTO TECNOLÓGICO
MUEBLE, MADERA, EMBALAJE Y AFINES

EU 'CELLUWOOD' PROJECT
LAMINATED STRONG ECO-MATERIAL FOR BUILDING CONSTRUCTION MADE OF CELLULOSE-STRENGTHENED WOODS

CelluWood
www.celluwood.com

The **CELLUWOOD** project aims to develop a new range of structural elements made of wood by introducing innovative production elements and includes the use of cellulose instead of petroleum-based glue in the lamination of the timber products. The 'physical' results will be the strong eco-beams and columns and their most sustainable manufacturing technologies, in addition to significant environmental and cost benefits of the innovation. These are achieved through:

* The introduction of the (new) technologies from other sectors (e.g. cellulose velvet, bio-composite reinforcement and bio-resin) for innovative uses in the defect removal and repairing, and lamination of strong building materials.
* Facilitating innovation in the use of nano/micro cellulose and bio-resin technologies in timber re-engineering.
* The development, testing and demonstration of the novel initiative products.

This new product and technology approach would bring significant reduction in the carbon footprint of construction within the EU and, eventually, worldwide, as the proposed engineered timber became a viable and cost-effective substitute for conventional strong construction materials that are high CO2 emitters during manufacture. The proposed technology will anticipate the massive reduce of the embodied energy in building carcasses, create new opportunities for carbon capture and storage, minimise thermal bridging through insulation layers and improve the possibilities for low-impact recycling of waste materials arising following a building's eventual demolition.

STRUCTURAL TIMBER BOARDING

Utilization of small diameter and underutilized European grown timber has been investigated in detail. Processes and performance in use of small diameter wood on European, national and regional levels from a practical and technical point of view have been described. The tree types under discussion for the project are sweet chestnut (*Castanea sativa*), Douglas fir (*Pseudotsuga menziesii*), European larch (*Larix decidua Mill*), spruce, Norway spruce (*Picea abies*), and Sitka spruce (*Picea sitchensis*). Additionally, preliminary processing for timber boarding is defined.

BIO- RESIN AND REINFORCEMENTS

Different adhesion systems for **CELLUWOOD** materials have been analyzed:

* Systems of condensed tannin extracted from Quebracho Colorado (*Schinopsis Lorentzii*) trees.
* Systems of condensed tannin from pine trees.
* Kraft Lignin from hardwood and softwood.
* CNSL (*Cashew nut shell liquid*).

These natural raw materials were tested for their ability to perform cold or hot curing processes. The various adhesion systems were firstly evaluated with the lap shear testing in accordance with relevant EN or ISO standards and then applied to the timber boarding materials used in this project.

CORE MATERIAL FOR ECO-BEAMS AND ECO-COLUMNS

The core material for Eco-beams and Eco-columns is made of natural fibres and gypsum for the building application.

Four parts of complicated work were carried out with the aim to develop a new light weight in parallel with high mechanical performance of gypsum/natural fibre composite. By compared with three kinds of natural fibres, it was found that sawdust is the best selection. Three chemical agents were used to modify sawdust by using spray coating technology. Compared with the traditional immerse method, spray coating could improve the modification significantly. Among these agents, Na2SiO3 displayed the highest improvement on the final composite. The hemihydrate gypsum binder was modified with systematic experiments which included the extender, retarder, water reducer, and reinforce material.

ALTERNATIVE BIO-ADHESIVES

Two kinds of nanocellulose reinforced wood adhesives have been fabricated: nanocellulose reinforced epoxy and nanocellulose reinforced casein. It has been found that both adhesives can be used in the room temperature under a low pressure and display high performance. By using the nanocellulose reinforced epoxy, the shear strength could be increased by more than 40% when the addition of nanocellulose was 5%. It has been found that the addition of nanocellulose can improve the bonding performance. However the low water resistance and the shear strain of the natural polymers adhesive is still under investigation. The resins are applied to the defect repairing and lumber lamination.

DEVELOPMENT OF NEW BEAMS AND COLUMNS

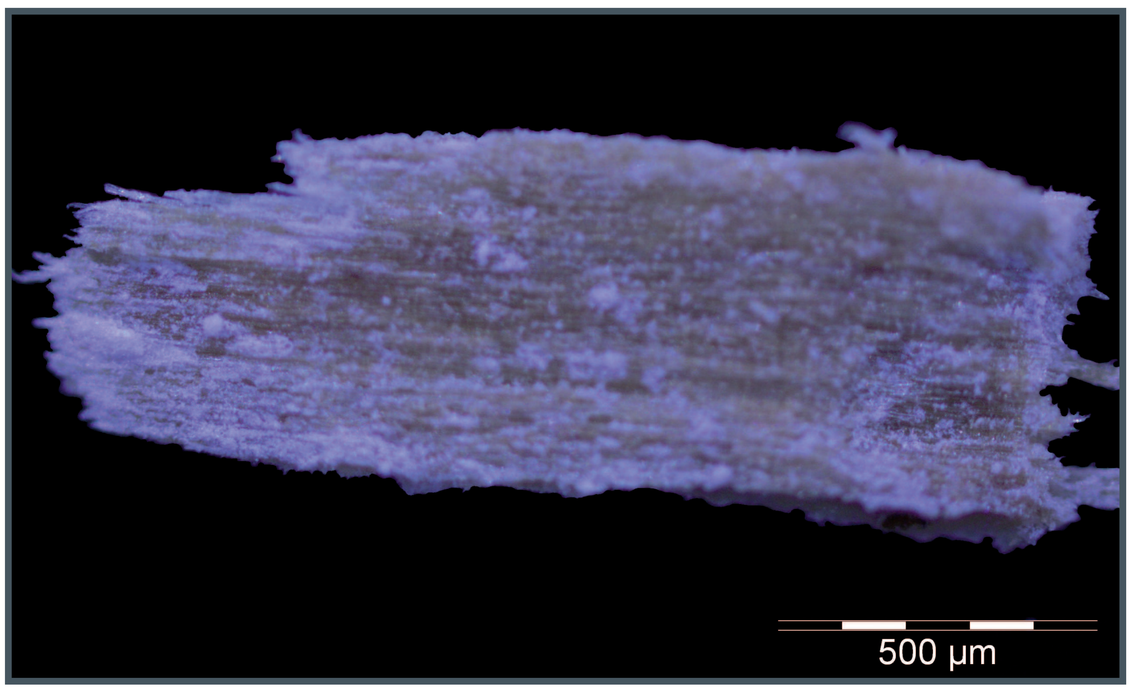
The development of new beams and columns is based on modelling results. The repaired and scarf jointed lumber is to be used to develop a number of novel, low carbon, sustainable, viable, low cost beam and column products with good environmental profiles.

IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS (LCA)

Eco-efficiency describes how environmental friendly and economical a product or process is. Through determination of the total impact on the environment and all costs from manufacture to disposal the complete value-added chain is covered. The eco-efficiency aims to achieve a balance between environmental and economic factors. This means to manufacture cost-effective products with the smallest possible amount of raw materials and energy, and to minimize emissions.

The analysis of the environmental term includes a life cycle assessment of the new materials developed in the project, versus the traditional glulam manufacturing process. This LCA is being developed currently.

CELLUWOOD beam production.



Nanocellulose CELLUWOOD core.

eco-innovation
WHEN BUSINESS MEETS THE ENVIRONMENT

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