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UNIQUE BUILDING MATERIALS: TRANSPARENT WOOD

V. M. BAKULINA, Senior Lecturer; I. V. FEDORENKO, student
National University of Life and Environmental Sciences of Ukraine
E-mail: bakulina_valentina@nubip.edu.ua; igogor505@gmail.com

Transparent wood composites *are* unique modern materials *that* were first introduced in 1992 by the German researcher Siegfried Fink, he managed to create transparent wood, and he published his technique in a niche journal on wood technology.

Later, in 2016, a research team led by Professor Lars Berglund of Sweden's KTH University, who was inspired by Fink's discovery, and together with a research team at the University of Maryland led by Professor Liangbing Hu, developed a method to remove color and some chemicals from small blocks of wood, followed by the addition of polymers such as polymethyl methacrylate (PMMA) and epoxy resin, at the cellular level, thereby making them transparent.

In 2019, researchers from China and Germany began work on optimizing transparent wood for solar panels and energy-efficient buildings. They investigated the use of biodegradable polymers instead of synthetic resins, which improves sustainability. Now, after years of experimentation, the research of these groups is beginning to bear fruit.

Research on transparent wood continues to this day, although this material is still in the early stages of commercialization, but its history shows rapid development and a strong interest in sustainable materials.

Manufacturing process.

The main manufacturing method is called "lignification". The process of creating a transparent tree may vary. However, the basics of this are as follows: the wood sample is soaked in heated (80 °C–100 °C) solutions containing sodium chloride, sodium hypochlorite, or sodium hydroxide/sulfite for about 3 to 12 hours, followed by immersion in boiling hydrogen peroxide.

The lignin is then separated from the cellulose and hemicellulose structure, turning the wood white and allowing resin penetration to begin. Finally, the sample is immersed in a suitable resin, usually PMMA, at high temperatures (85°C) and vacuum for 12 hours. This process fills the space previously occupied by lignin and the open cellular structure of the wood, resulting in a final transparent wood composite.

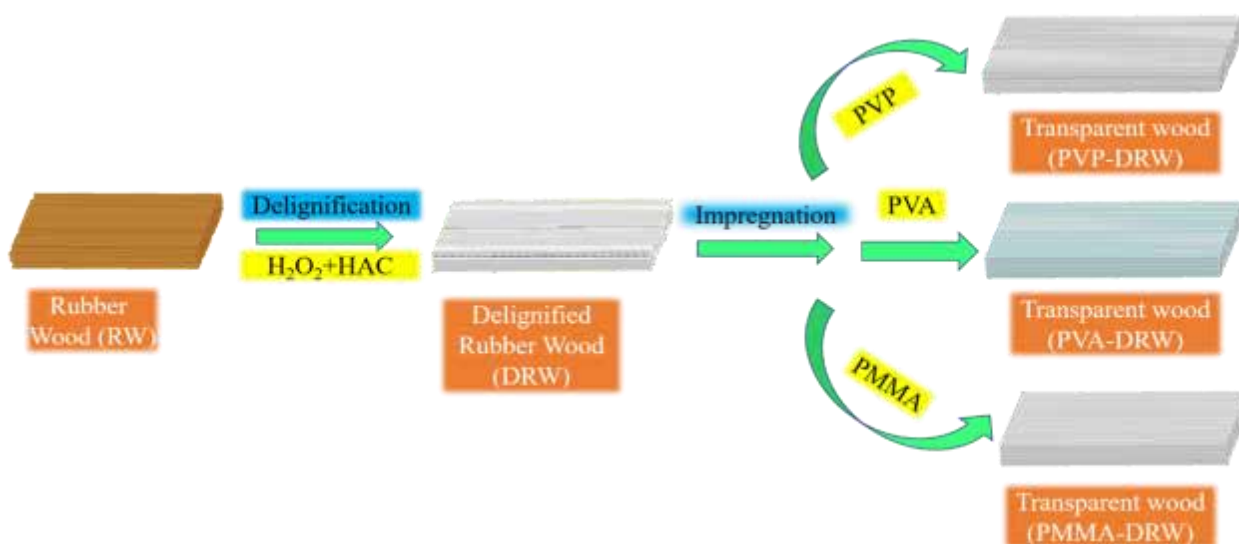


Fig. 1. Making transparent wood

Mechanical properties.

Transparent wood retains the strength inherent in natural wood fibers and acquires additional rigidity thanks to the polymer matrix. Generally, it is stronger than natural wood, but slightly less flexible, although more flexible than glass, which makes clear wood less prone to shattering under load.

Clear wood has better insulating properties than glass, making it suitable for energy-efficient construction, and it is also much lighter than glass. Compared to glass, transparent wood is less transparent because it transmits the same amount of light, but instead of letting it through like regular glass, transparent wood scatters it, meaning the objects behind it look blurry unlike regular glass.

Application examples.

Clear wood can be used to produce solar cells, especially for large surfaces, load-bearing windows and roofs, glazing systems, and some other use cases.

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**МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ БІОРЕСУРСІВ І
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