

Wood: rediscovered and reinvented

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With these short notes we just want to testify that wood is a fascinating and interesting material not only for all the well-known properties deriving from its aesthetic appearance and its natural origin, but also and particularly for its technical characteristics that are still being investigated with consequent new and valuable applications.

Every year, this subject is put to the attention of the young students of the master degree "Production Engineering and Management" that has been held in Pordenone for some years involving the Universities of Trieste and Lemgo (Germany). This course, which partially involves also CATAS, allows students to finally get a double degree.



Therefore wood is not only a subject of study, but above all represents a starting point to consider its optimal use, for preventing possible defects and also, precisely, to look forward to discover, with curiosity and passion, innovations and researches involving this "old" material.

Students are therefore especially stimulated to conduct small studies on "innovative" topics regarding wood.

During the 2017, two groups of students started their works from one of the topics discussed during the course "Materials and Technologies of the Furniture Sector" and concerning specifically the chemical composition of wood. The properties of lignin and in particular its thermo-plasticity have been considered in practical terms during the lectures, underlining how this natural wood ingredient represents a raw material on which research and industry has long been concentrated, as well as some interesting initiatives to support it (see for example the web site of the Lignin International Institute).

This information has therefore been the inspiration that led students to deepen their knowledge on the so-called "liquid wood" and on the possibility of "wood welding".

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The liquid wood (from the presentation of Lionela Carp)

Liquid wood derives from a study begun in Germany by the Fraunhofer Institute in the 1990s.

The purpose of these researches was to use lignin deriving, as a waste, mainly from the pulp industry. For paper production, in fact, the cellulose derivatives of wood are used, while lignin is normally discarded representing, in other words, a raw material that can find interesting applications in the industrial world.

These studies have considered that the thermo-plastic nature of lignin leads to the possibility of mixing it with various additives, waxes and cellulosic fibers that can also derive from herbaceous plants such as hemp or flax.

The final result is a plastics-like material that can be moulded or extruded in a manner similar to that of normal synthetic plastics.

The main advantages over oil-derived materials is essentially based on its natural composition and its “sustainability” being a material that can be, obviously, continuously renewed.

Some companies already market products made with “liquid wood” not only in the furniture sector, but also in other areas that exploit some of its peculiar properties including, for example, the acoustic absorption.

The “welding” of wood (from the presentation by Hassan Dadabhoy, Luca Talon and Marco Zonta)

Wood welding is a process accidentally discovered by a US researcher who mistakenly puts only the wood supports, used for the preparation of the specimens, into a particular plastic welding device.

However the friction generated by this system produced the welding of the two pieces of wood, obviously invoking the curiosity and the attention of the researchers involved.

Subsequently, it was understood that the observed welding was primarily due to the partial melting of lignin, whose thermoplastic properties have already been mentioned, and the simultaneous “entanglement” of the wood fibers present on the surfaces of the two pieces reciprocally in contact.

Although there are still no large-scale practical applications, wood welding seems in any case an interesting technology as it allows to join two pieces of wood without the use of any adhesive, being also a very simple and fast process.

Given the need to increase the temperature by friction effect, the applicability of this method is limited to specific cases where it is possible to vibrate elements to be joined with linear or rotational devices. Obviously this technique also has other limitations regarding the need of specific plants, the attention to the high surface temperatures produced during the process and the different behaviour among the various wood species.

Wood welding is, however, an interesting topic that could also lead to practical developments, especially given the increased sensitivity of the market towards natural products or, otherwise, to their environmental sustainability.

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