INFLUENCE OF BOILING TEMPERATURE ON THE PANELS LVL (LAMINATED VENEER LUMBER) QUALITY MADE WITH OAK (CANARIENSIS) ALGERIA WOOD

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Abstract

The panels LVL (Laminated Veneer Lumber) are less used in construction, which are produced by peeling trunk of trees, undergone baking operation which one determined the quality of plating and LVL panels made by gluing. Our study here consist to vary the boiling temperatures ranging from 40C°, 50 C°, 60 C°, to 70 C° (two panels are drawn for each temperature, and 14 specimens (20 * 20 * 336mm) for each panels) that was secure settings peeling, speed of rotation of the lathe, pressure bar, clearance angle of the knife and the thickness of the veneer, as we fix the amount of glue 400g / cm^2, the pressure pressing the panels in order to clearly identify the influence of baking temperature logs of Algerian oak wood quality. Our controls are carried out by non-destructive testing after that the specimens are tested with destructive method under four point bending, according to the perpendicular direction and parallel plating, and we took into consideration the calculation of Young's modulus and stress at break for each series of panels.

Keywords: Panels, gluing, rotary, mechanical characterization, Young's modulus

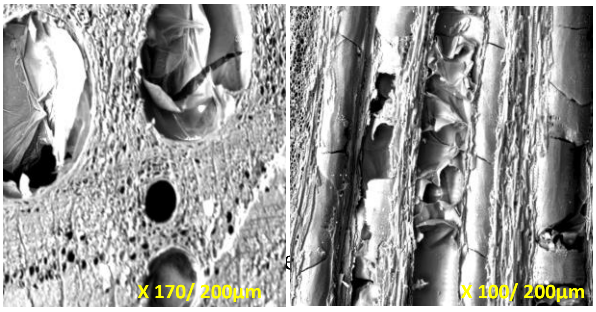
1. Introduction

Algerian Oak wood is a little gasoline used by the timber industry except for heat. This project has the goal of making a second test of these oaks in seeking the way to value them in the industry of wood [1]. We will consider these oaks have good mechanical properties (hardness, density ...).

These images have visions under the electron microscope (SEM) samples of oak Corsica.

We therefore explored in this study a recovery by peeling which allows better material yield. We held to account in the baking temperature varied from 40 C°,

50 C°, 60 C° and 70 C°, and set the thickness of



We developed LVL 8 panels (500 * 500 * 20) mm, with the parameters of unwinding after a thickness of 3.2 mm, a compression ratio of 10 %, the rake angle is 0° and temperatures annealing range from 40C ° to 70C ° with a cutting speed of 1m/s [2].

2. Preparation of panels

The logs of Algerian oak wood are steamed in an oven lab, including a rotating menu of a water thermostat temperature controller that maintains the selected temperature, in our case is steaming at temperatures 40C °, 50 C ° 60 C ° 70 C ° for 24 hours, every 24 hours removing a log and it makes the peeling process with a thickness of 3.2 mm.

The sheets obtained by peeling the logs of oak horns at different annealing temperature: 40C ° 50C ° 60C ° 70C ° are cut

Fig. 2. Semi-industrial lathe.

using the cutter, in sheets of 50 cm, and dry with a fan, to a moisture content ranging from 7 to 10%.

(1) Two pairs of pins for driving the ridges of the telescopic type with a diameter of respectively 110 and 70 mm.

(2) A slide knife 225 mm maximum stroke.

(3) A knife 950 mm long, held together by screws manual. The nozzle angle is 20 °.

(4) A bar of pressure angle, manually adjustable, its support is linked to the knife carriage.

(5) A roll anti-buckling, always willing to 36 ° from the vertical axis of the pins.

(6) An automatic retractable and removable veneer.

(7) 4 piezoelectric quartz sensors to capture efforts.

Cutting force: The cutting forces exerted on the knife and pressure bar in the horizontal and vertical direction as a function of annealing temperature are summarized in the following table:

TABLE I. Cutting Forces During Peeling

	Cutting force on the knife (Dan)		Cutting force on the bar (Dan)	
Temperature (C°)	Fine mesh	Middle mesh	Coarse Mesh	Reference
40C°	-877.58	586.79	818.56	94.51
50C°	-464.20	597.38	552.92	584.60
60C°	818.56	2798.53	1830.16	1749.54
70C°	94.51	825.39	534.85	407.31

Several authors have mentioned that the cutting forces are very weak (Marchal et al. 2009).

To play on the cutting forces exerted on the knife, we can say that for logs steaming at temperatures of 40C ° to 50C ° there a dive knife on the subject, this is explained by the negative direction the value of the cutting force exerted on the knife, and was a civil refusal to cut logs for steaming at temperatures 60C ° to 70C °. Stable control is one that allows for a very low dipping tool, a value of Y close to zero but slightly negative [3].

The following curves refer to the efforts of cuts:

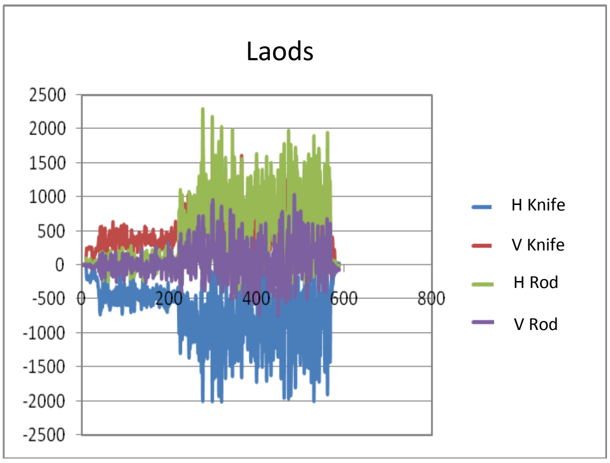


Fig. 5. Efforts peeling curve in 60 C°.

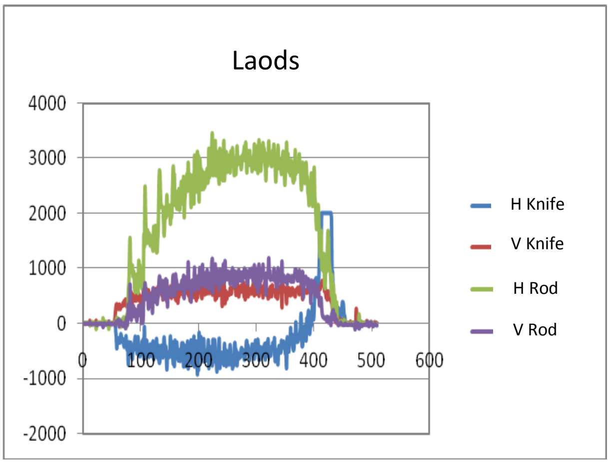


Fig. 6. Efforts peeling curve in 70 C°.

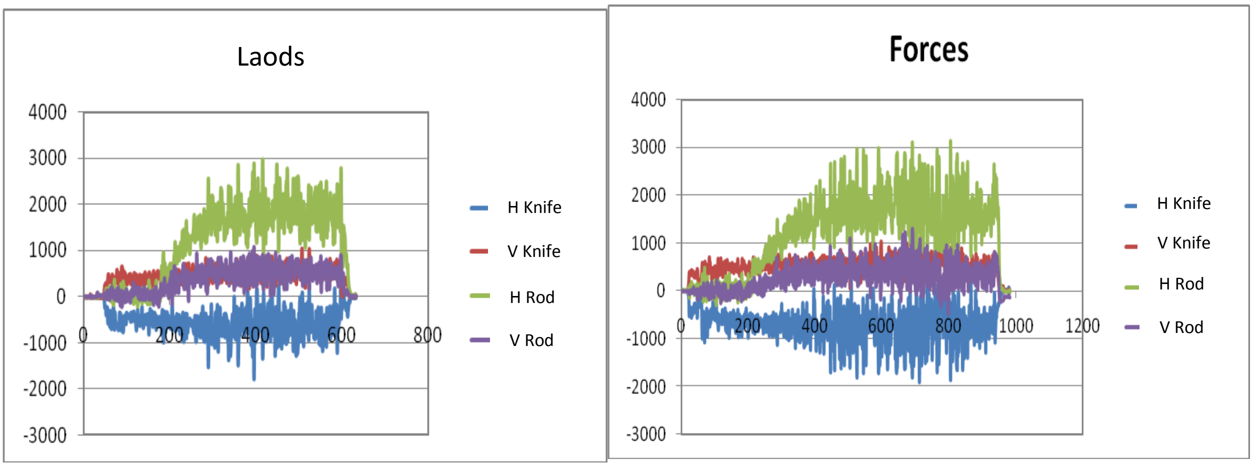
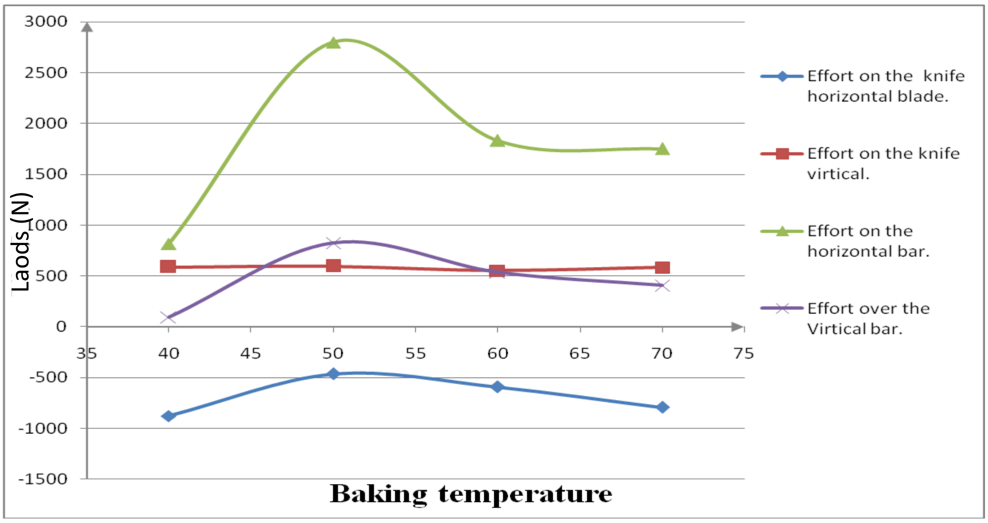


Fig. 7. Variation of cutting force and boiling temperature.

The following graphs summarize the forces exerted on the knife and pressure bar.



We notice a change in cutting forces applied to the knife and pressure bar, based on efforts to apply the knife, we had a good veneer for the baking temperature of 40C ° to 50C °, it is explained by negative values of cutting forces obtained, and a lower quality for logs steaming at 60C ° and 70C ° [4].

3. Bonding of panels

The veneer is cut into sheets (50 * 60) cm from the guillotine, and then dried to moisture of 6-9%.

The sheets are impregnated by glue witch is an adhesive vinyl wood glue SUPERA 303, the bonding is meowing effector, the amount of glue used varies between 300-500 g/m^3. We work in conditions of room temperature 20 C ° and a pressure under 10 bar for 20 minutes kept under this pressure, these conditions are met for the development of all panels [5].

These photos go up signs developed of the specimens after cutting boards.

4. Nondestructive testing

The 112 specimens (28 specimens for each temperature of annealing) cut were tested with Bing (nondestructive mechanical characterization) along the direction perpendicular and parallel sheets of LVL, and compression.

The average results of 14 samples are summarized in this table:

TABLE II. Results of nondestructive testing.

Specimens-Manufactured-temperature annealing.	Average density (kg/m3)	Young's modulus E / / (MPa)	Young's modulus E ⊥ (Mpa)	Compression module bing (Mpa)
Panel 1 40 C°	925.21	16255.00	16878.21	18946.93
Panel 2 40 C°	870.46	14859.14	15415.00	17917.36
Panel 1 50 C°	890.12	14134.14	14680.14	16608.07
Panel 2 50 C°	900.00	15089.43	16973.57	16756.43
Panel 1 60 C°	893.12	14408.93	15204.43	16600.93
Panel 2 60 C°	959.80	15030.07	16230.93	17166.00
Panel 1 70 C°	874.74	13929.29	15311.29	15576.00

The results show Young's moduli of interest, we also note that the Young's moduli obtained from the stress in the direction perpendicular sheets of LVL are higher than those obtained in the solicitation in the direction parallel sheets of LVL.

It is difficult to interpret the influence of baking temperature on Young's moduli obtained by nondestructive testing, but a point to specimens from logs steaming at 70 C °, they have Young's moduli lower than those other specimens. Note that there is work done on solid wood, and who claim the reduction in mechanical properties as a function of increasing temperature.

The second stage of mechanical characterization is performed by four-point bending with the machine INSTRO.

The number of specimen tested is 112 pieces, from 8 panels. Specimens were tested along the direction parallel and perpendicular, the average scores for each 7 specimens according to the baking temperature and stress management are mentioned in the following table:

TABLE III. Results of nondestructive testing.

Specimens	Young's modulus E / / (MPa)	Breaking stress σ (MPa)	Specimens	Breaking stress σ (MPa)
LVL P1 // 40C°	12603,84	115,74	LVL P1 ⊥ 40 C°	12424,20
LVL P2 // 40C°	9219,81	87,16	LVL P2 ⊥ 40C°	15789,79
LVL P1 // 50C°	8034,32	74,41	LVL P1 ⊥ 50 C°	13143,78
LVL P2 // 50C°	10030,12	89,76	LVL P2 ⊥ 50C°	14528,58
LVL P1 // 60C°	10909,85	87,86	LVL P1 ⊥ 60C°	11713,09
LVL P2// 60C°	8299,23	87,20	LVL P2 ⊥ 60C°	14595,33
LVL P1 // 70C°	7471,10	85,49	LVL P1 ⊥ 70C°	13127,66
LVL P2 // 70C°	7955,36	90,72	LVL P2 ⊥ 70C°	12274,47

We notice a drop in Young's moduli from the steaming temperatures of 50 C °, what motions in the literature, the material is subjected to temperatures above 50 ° C, structural changes will occur in the form of dehydration, swelling, shrinkage, phase change and thermal degradation. These alterations induced by the heating affect its mechanical properties (Polyana Dias de Moraes, 2003) [6]. Note also that Faix and al. (1988) [7] reported some differences regarding the behavior of lignin. They found that lignin may be altered at 47 ° C, while Schaffer (1973) reports a value of 55 ° C for the early alterations of the polymer.

In this work there 's a parameter which can be water accelerates the dissolution of chemical compounds from wood, which affects the mechanical behavior of wood, that is not found in the literature, so that additional work treats the influence of water at different temperatures will be supported to confirm the results.

5. Conclusion

This work has allowed us to confirm the influence of temperature on the mechanical behavior of wood, such work (Polyana Dias de Moraes, 2003), Faix and al. (1988), Schaffer (1973) [8], but further study will be a great support to confirm the behavior of wood immersed in water at different temperatures, following the dissolution of polymers which are within the composition of wood, which will explain behavior lumber steamer, and understand its influence on the elastic constants of LVL panels.

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