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USE OF SMALL SIZED HARDWOOD TO DESIGN NEW COMPOSITE PANELS

Camelia Boieriu
Transylvania University of Braşov
B-dul Eroilor 29, Braşov
Romania

Ioan Curtu
Transylvania University of Braşov
B-dul Eroilor 29, Braşov
Romania

Dumitru Lica
Transylvania University of Braşov
B-dul Eroilor 29, Braşov
Romania

ABSTRACT
The paper presents several variants of composite panels using small sized hardwood from the following species: maple, cherry and nut wood, mixed together in the same panel. The lengths range of the lamellas included in the panels vary between 150 mm and 500 mm and the width is 20 mm. The final thickness of the panels is around 20 mm. The panels are designed for a decorative purpose; they could be used for interior design or furniture panels. In order to develop the designed products, some experimental tests have been performed. The flatness of the panels has been measured for several sizes of panels: 298 x 243, 500 x 243 mm, 800 x 243 mm, 500 x 500 mm and compared each other. The occurrence of the defects on the panels (lamellas delaminating or cracks) has been also observed in time. The results regarding the stability of the panels, based on the flatness measurements and on the observation are shown in the paper.
Keywords: small sized hardwood, composite panels, lamellas.

1. INTRODUCTION
Because the quantity of the used natural resources is controlled in the last years, a great importance has been given to the use of the small sized wood in the wood panels manufacturing, in order to increase the use rate of the solid wood by increasing the raw materials yield in the final product. The international and also the national tendency in manufacturing the wood panels is that of using the same species of wood in the same panel, because the joint behaviour in case of using two different species is not theoretical and practical verified and it is considered an act of courage, even the design resulted through mixing them could be quiet attractive. One of the variants of using small sized wood (lamellas with a reduced section of 20 x 20 mm) is to finger-joint them on length and edge-joint them on width, so to obtain lamellar wood panels, as can be seen in figure 1.

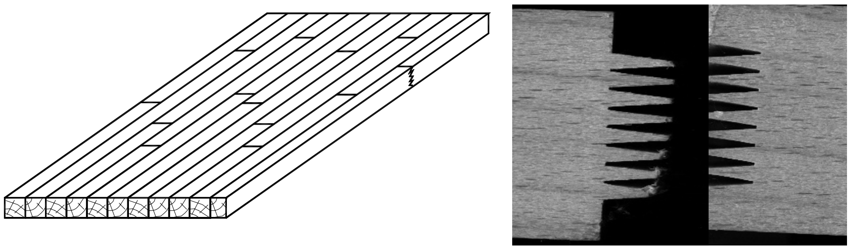
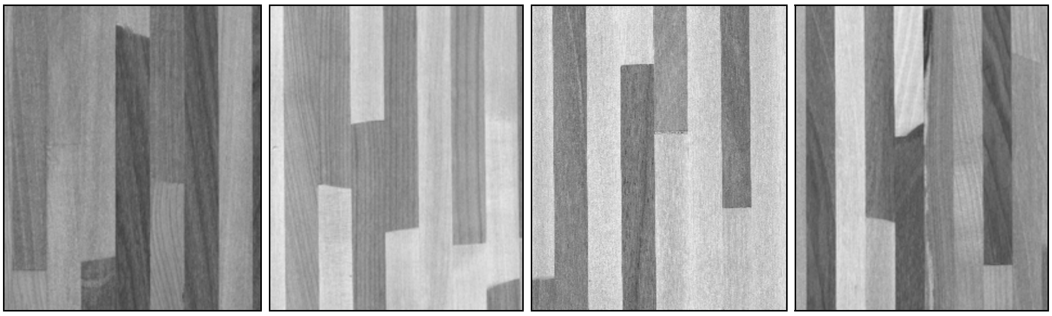


Figure 1. The structure of the composite panels and the finger-jointing

In case the lamellas are made of various species of hardwood, and they are randomly glued together, than composite panels are obtained (different materials glued together) [1]. The small sized wood can be obtain in the production process as a result of timber cutting, trimming, sorting the default elements, sizing, that being the advantage of having various length of parts with the possibility of finger-jointing them on length. There are three wood species included in the mixed panel structure and they are cherry, maple and nut wood, so the variants of composite panels shown in figure 2 were obtained as variants.



a b c d

Figure 2. The composite panels obtained by randomly gluing the hardwood lamellas of cherry, maple and nut wood; a) cherry and nut lamellas; b) cherry and maple lamellas; c) nut and maple lamellas; d) cherry, maple and nut lamellas

For each type of composite panel shown in figure 2, two sizes of panels have been made: 500 x 243 and 500 x 500, in mm. For the eight panels obtained, the flatness have been measured, after keeping them in an indoor environment (the temperature in the range of 18-22ºC and the relative humidity of air in the range of 45-55%) for one year. Thus, the influence of the panel width on the panel flatness has been determined and also the comparison between the four types of panels can be made. For the fourth variant (cherry, maple and nut lamellas) two additional sizes of panels have been made, in order to study the influence of the panel length to their flatness and they are 298 x 243 and 800 x 243, in mm. In the same time, the panels have been observed with regards to the occurring of cracks and wood delaminating, thus obtaining information of panels stability in time.

2. EXPERIMENTAL METHOD AND EQUIPMENT

The flatness of the panels has been determined by measuring the depth in the points with the position and coordinates shown in figure 3 and figure 4, for each type of panel.

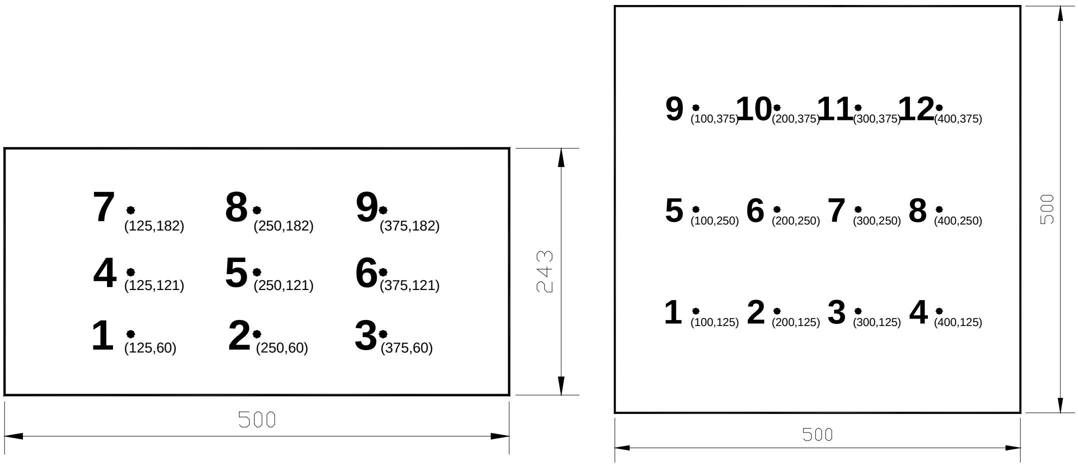


Figure 3. The points of measuring the flatness of 500x243 and 500x500 panels

The flatness is expressed by the ratio between the difference of the maximum and minimum value of the depth measured in the mentioned points and the length of the panel.

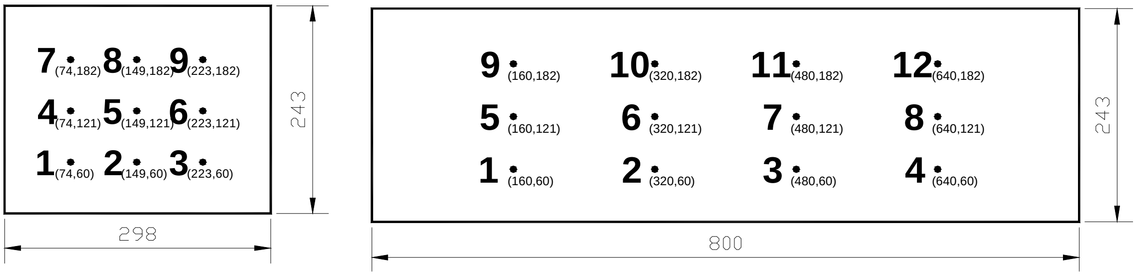


Figure 4. The points of measuring the flatness of 298x243 and 800x243 panels

The equipment used to measure the depth in the mentioned points is an optical measuring table (OptoDesQ) having an accuracy of 0,02 mm, presented in figure 5, where the measurements are programmed using the equipment software.

Figure 5. The OptoDESQ table used to measure the depth in the points indicated for each panel type

3. EXPERIMENTAL RESULTS

The measurement results were distributed on lines and columns. For the panel of 500 x 243 (mm), three lines (points 1, 2, 3 for the first line, etc.) and three columns (points 1, 4, 7 for the first column, etc.) were obtained. The diagrams in figures 6, 7, 8 and 9 show the variation of depth (Z), in mm, for the points on the lines and columns established on the panel. The same position of the points measured for all four variants of panels allowed the comparison of the panels flatness.

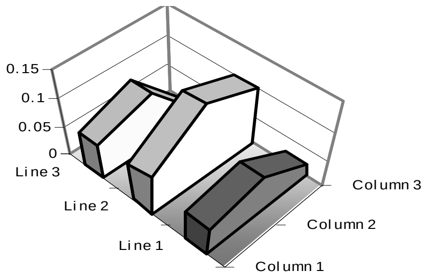


Figure 6. Depth for cherry-maple panel of 500x243, in mm

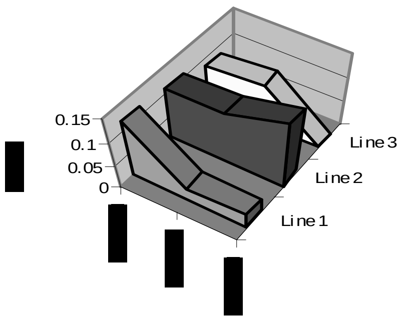


Figure 7. Depth for cherry-nut panel of 500x243, in mm

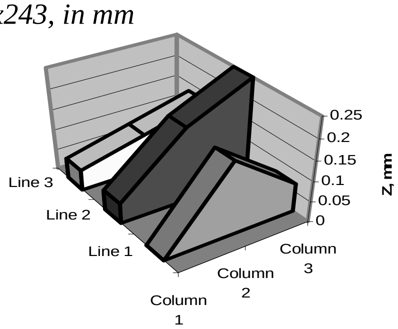


Figure 8. Depth for nut-maple panel of 500x243, in mm

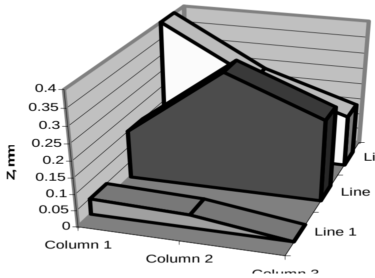


Figure 9. Depth for cherry-maple-nut panel of 500x243, in mm

For the panel of 500 x 500 (mm), three lines (points 1, 2, 3, 4 for the first line, etc.) and four columns (points 1, 5, 9 for the first column, etc.) were obtained. The diagrams in figures 10, 11 (which looks almost the same for all four types of panels) show the tendency of such panels to be curved in their central part (columns 2 and 3) [2].

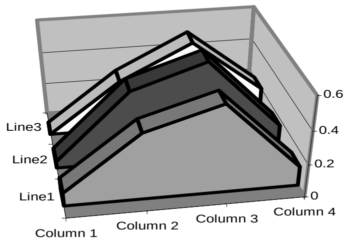


Figure 10. Depth for cherry-maple panel of 500x500, in mm

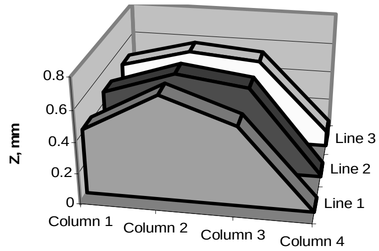


Figure 11. Depth for nut-maple panel of 500x500, in mm

The distribution of the depth for the other additional sizes of panels are shown in figures 12 and 13.

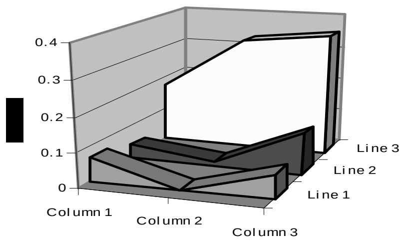


Figure 12. Depth for cherry-maple-nut panel of 298x243, in mm

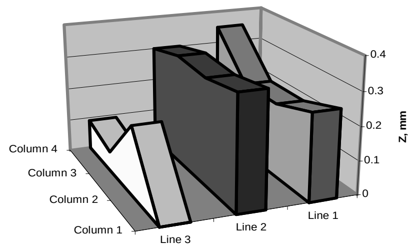


Figure 13. Depth for cherry-maple-nut panel of 800x243, in mm

4. CONCLUSIONS

The results show that the flatness of the panels is much better for the panels of 500 x 243 (mm) and 800 x 243 than for panels of 500 x 500 (mm) and 298 x 243 (mm), which means that the longer the panel is, the flatness is better and the wider the panel is, the flatness is more bad. In the same time, the flatness of the panels having in their structure mixed lamellas of cherry and maple and mixed lamellas of cherry and nut is better than for the other two variants. In all analyzed cases, the flatness is in the admitted range of 2 mm/m (STAS 770/89).

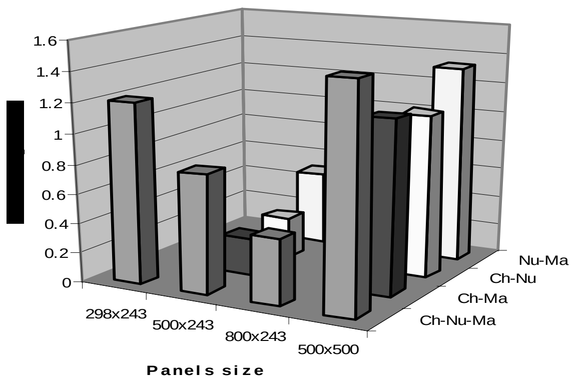


Figure 14. Flatnees, in mm/m

Table 1. Flatness of the composite panels made of various lamellas of hardwood

Type of panel	298x 243	500x 243	800x 243	500x 500
Cherry-Nut-Maple	1.21	0.8	0.44	1.48
Cherry-Maple	-	0.26	-	1.16
Cherry-Nut	-	0.28	-	1.1
Nut-Maple	-	0.5	-	1.34

5. REFERENCES

[1] Boieriu, C. - Composite panels Made of Glued Hardwood Lamellas, Editura Universităţii Transilvania din Braşov, 2007, ISBN (10) 973-635-843-7, (13) 978-973-635-843-2.

[2] Boieriu C., Lica D., Curtu I.: Experimental research regarding the deformation of the anisotropic panels, 9th International Research/Expert Conference TMT 2005, Antalya, 26-30 Sept. 2005, ISBN 9958-617-28-5.