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Abstract

Title: Improving the performance of bended laminated veneer products

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Improving the performance of bended laminated veneer products

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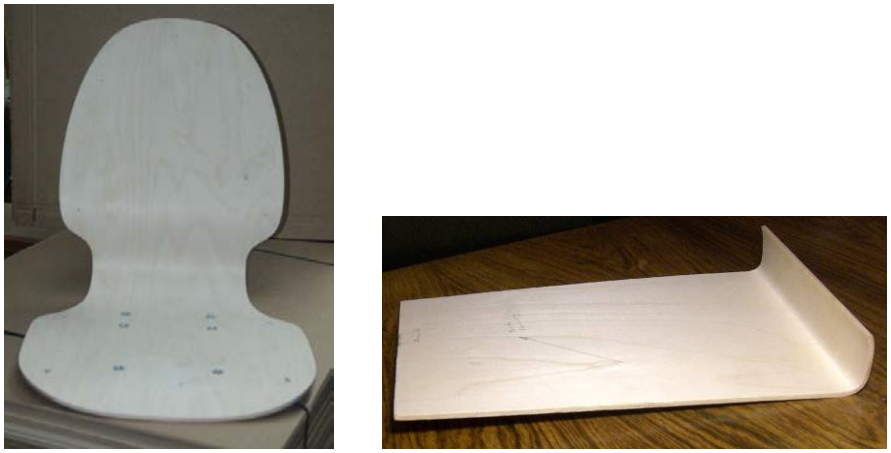
Abstract

Laminated bending of veneers mean that dried, thin veneers or thin wood sheets are glued together under influence of pressure and eventually increased temperature. At the same time the product is given its desired shape, most often curved. This thermo hydro mechanical process offers several benefits. For example thick bends of small radiuses of any species of wood may be formed and poor quality wood containing knots, splits and other defects may be utilised. Laminated bends can usually be set more readily and made to conform better to the shape of the form than similar bends of solid wood. Further no softening treatment is generally required before the pieces are bent. However, there are also disadvantages e.g. more technical skill and better equipment are usually required than for solid wood bending. The presence of glue may be somewhat detrimental to the machines used for the final cleaning up of the bent pieces. Further the glue lines which are usually visible on the sides may be an aesthetical unappreciated effect [1],[2].

The quality of the laminated bended veneer products are obtained as an interaction between the process, the veneers and the glue [3]. In industries designing and producing these products it is of interest to obtain better understanding of how processing- and material parameters affect the product quality. With an improved understanding of the material and processing parameters it may be possible to increase the efficiency of wood utilisation and promote the development of new processes and products that manipulate the viscoelastic nature of wood. In particular the possibilities to obtain narrower radius of curvature and better possibilities of bending in more than one plane would be advantageous.
This study has focused on the moisture content (MC) and the grain angle orientation in the veneers. These two specific aspects were assumed to have a great influence on spring-back and distortions of the laminated bended veneer products. Spring-back and distortions were therefore studied in separate tests where MC and the grain angle orientation was varied separately in manufactured laminated bended wood products. After manufacturing the products were exposed to variations in humidity and temperature whereupon the spring-back and distortions were measured

Three tests were performed. For the first and the second test a seat shell was selected as test product, figure 1a. To the third test another product was selected, figure 1b. This product was a small bookshelf. The company producing this shelf had experienced large problems considering distortions of this product. Further the product was very simple in shape with only one bend and therefore suitable for measurements.



(a) **(b)**

Figure 1. a) Describes the seat shell used for measurements in study one and two. b) Describes the bookshelf that was used for study three.

In the first test the influence of MC of the veneers was investigated. In the second and third test the influence of grain angle of the veneers was studied.

For the study veneers of birch and beech were selected in the production. For the first and third study only birch veneers were used. The veneers were initially conditioned to equilibrium moisture contents (EMC) according to setups in different test groups. For the first study a test group was also built up from veneers taken directly out of production to study the industrial conditions. The seat shells in this test group contained veneers conditioned to EMC 4 %, except for the surface veneers that had been stored in the production hall. The humidity and temperature conditions in this room corresponded to MC 7 %.
The manufacturing of the products were performed in industrial conditions. In the tests the products were built up from a number of veneers and the studied factors were varied between the veneers in a controlled manner.

The results from the first test showed that the MC of the veneers influenced the spring-back and the distortions. A large moisture gradient between veneers and especially unsymmetrical placements of these in the construction were especially critical. The results from the second and third tests showed that grain angle deviation has large effect on the distortions of the products. Even a small grain angle deviation as in study two (5°) resulted in large problems with distortions. The study also showed that when crossing two or more veneers with deviating grain angles there were cases when these faults interacted and multiplied the distortions. In production grain angle deviations can be a result of inaccurate placement of the veneers during pressing, incorrect cutting of the veneers, inherent from the growth of the tree or a combination of these factors. Deviations of the grain angle were, however, shown to have only small effects on spring-back.

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