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Analysis of geometrical deformations of furniture fronts

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Abstract: *Analysis of geometrical deformations of furniture fronts.* The aim of the study was to verify deformations of asymmetrically veneered panels using industrial glues. To realise the aim designing and building of special stand for analysis of deflections of furniture fronts was done. After veneering boards became convex as it was expected, but the level of deformations for different glues was not equal. It is possible to avoid deformation of asymmetrically veneered panels.

Keywords: asymmetrically veneering, deformations, panels, glue

INTRODUCTION

Nowadays furnitures are produced often with using wood- based panels. During last years it has been believed that the only good method of veneering wood based panels is covering it by the same material on both sides. It was like that because asymmetrical veneering causes geometrical deformations [Prządka i Szczuka, 1974]. Analysis of panels deformation is especially important when composite materials are taken into the consideration [Negri at all, 2009].

Anyway, today it is known that symmetrical veneering is more expensive than the option where unseen side of furniture is covered by a material which has less decorative and mechanical properties, but is cheaper. The cost of symmetrical veneering is the most important reason to find other solutions for veneering [Ostrowski i Roszkowski, 2009].

Unfortunately, now the asymmetrical veneering is done intuitively. It is obvious that it would be better, if this method was supported on some results of studies. Asymmetrically veneered panels are composites in which a glue, that connects materials of different properties, is a key to find the solution.

The aim of the study was to verify deformations of asymmetrically veneered panels using industrial glues. To realise the aim designing and building of special stand for analysis of deflections of furniture fronts was done.

MATERIALS AND METHODS

The measurement stand composes of elements as shown in figure 1, but the photo of the measurement stand is shown in figure 2.

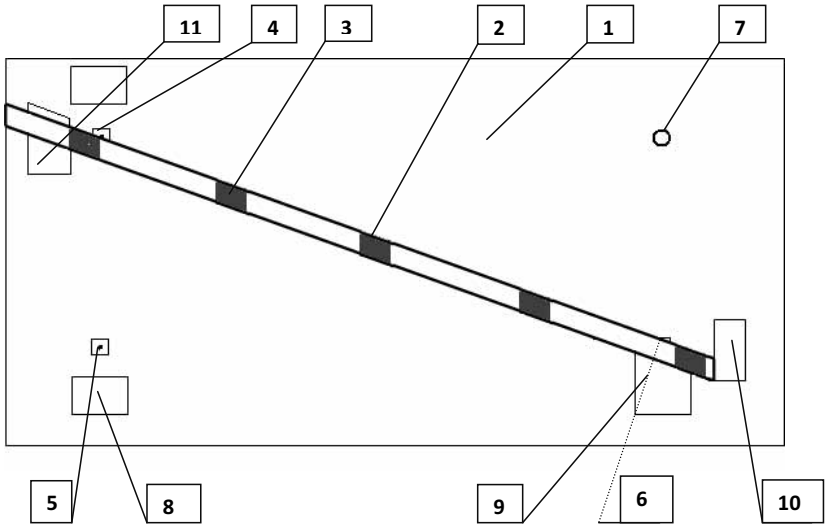

Fig. 1. The scheme of the measurement's station (1- reference plane, 2- measurement strip, 3- measurement area, 4- top constant peg, 5- left bottom peg, 6- right bottom peg, 7- top adjustable peg, 8- left block that hold sample during measurement, 9- left block that hold measurement strip and sample during measurement, 10- block, which the sample is levelled with, 11- top block that hold the measurement strip)

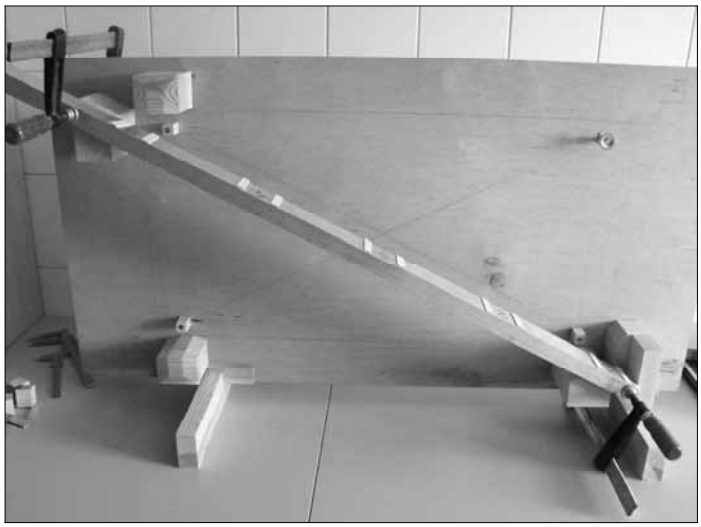

Fig. 2- The photo of the measurement stand

Designed place is destined for samples of dimensions 900x450mm and 18mm of thickness. The reference plane of this place is perfectly levelled. It has dimensions 650x1250mm and is made of plywood.

To defined plane there are fixed four pegs. Three of them have constant height (30mm). One of them is adjustable so it avoid deflections of sample. All pegs are fixed in the same distance from the edge of the base (235mm from the shorter edge and 130mm from the longer

one). During measurements of panels is situated so her edges are distant the same from each peg.

In the distance of 100mm from the longer edge of the base and 125mm from the shorter one there are fixed higher brackets. They are base for the aluminium strip. It goes from one corner to the other one that is placed diagonally. The strip can be replaced because it is useful to change its position. The strip is additionally stabilized by the blocks that are placed unchangeable on the one side of the strip. To described strip it is possible to fix correctly the depth gauge. Its precision is 0,01mm.

There were assigned five areas on the surface of the measurement strip. In each area five measurements were made. In studies, the comparative quantities are arithmetic means of the measurements from each area.

There were studied samples that were asymmetrical veneered with using two kinds of rigid glues. To verify results always two samples were veneered with using the same type of glue. All samples were veneered in the same conditions: temperature t=22°C and pressure P=1,5MPa. After veneering boards were stored during 5 days. In studies, boards were veneered in described ways:

1. First group of samples was cold- pressed with using MULTIBOND 2015, which is crosslinking polyvinyl acetate emulsion adhesive. The most important properties of MULTIBON2015 are density r=1,11g/cm^3 and viscosity 3,5Pas. The press time amounted 35 minutes and the used spread amounted 140g/m^2 .
2. Second group of samples was cold- pressed with using BISON TR550, which is contact glue based on caoutchouc. The most important properties of BISON TR550 are density r=0,80g/cm^3 and viscosity 0,2Pas. The press time amounted 0,05 minutes and the used spread amounted 150g/m^2.

To make studies more useful, all boards were measured in four states, as follows: unveneered board, one-side veneered board, unvarnished, one- side veneered board, varnished once, one-side veneered board, varnished twice.

RESULTS AND DISCUSION

The results of the studies are shown in figures 3 and 4. The graphs show shape of the boards in diagonal direction. Both unveneered samples were concave on measured side. After veneering boards became convex as it was expected. The interesting result is that deformations do not have the same values. The maximum deflexion of board veneered using crosslinking polyvinyl acetate emulsion adhesive glue is 3,48 mm. The maximum deflection of contact glue based on caoutchouc is 1,89 mm. It means that study of mechanical properties of glues can lead to find a glue that will diminish asymmetrically veneered boards. In this way glue in the composite, consisted of panel and two covering it coatings of different mechanical properties, will enable that elements change dimensions in separate manner. Stresses coming from one coating will not deform board.

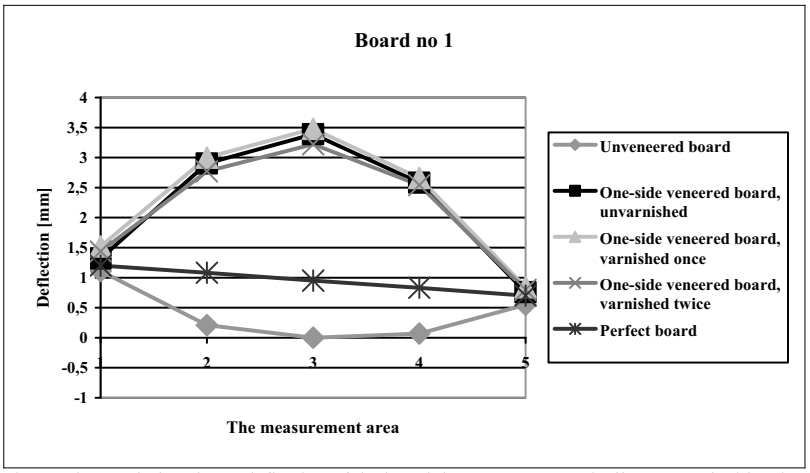

Fig. 3- The graph that shows deflection of the board that was asymmetrically veneered with using MULTIBOND2015

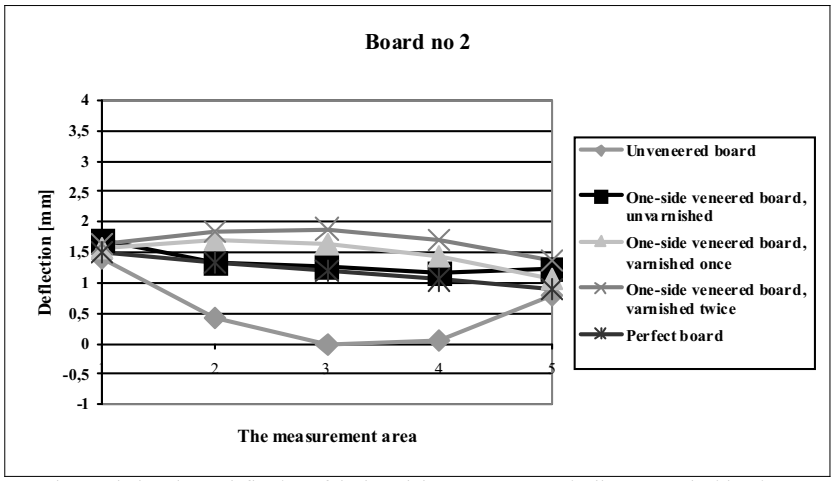

Fig. 4- The graph that shows deflection of the board that was asymmetrically veneered with using BISON TR550

CONCLUSIONS

Conducted research shows that there is a general tendency that samples asymmetrically veneered with using rigid glues are characterized by deflection. However, the most important influence on the level of geometrical deformations of the board has properties of glue. It is possible to avoid deformation of asymmetrically veneered panels.

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Streszczenie: *Analiza deformacji geometrycznej frontów meblowych.* Celem pracy była analiza deformacji płyt okleinowanych asymetrycznie przy użyciu klejów przemysłowych. Aby to osiągnąć zaprojektowano i zbudowano specjalne stanowisko do analizy zniekształceń frontów meblowych. Po okleinowaniu płyty stały się wypukłe, zgodnie z przypuszczeniami, ale stopień deformacji był zmienny dla różnych rodzajów klejów. Jest więc możliwe uniknięcie zniekształceń asymetrycznie okleinowanych płyt.

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