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Strength properties change in birch veneered high density fiberboard

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Abstract: *Strength properties change in birch veneered high density fiberboard.* Research consists of modulus of elasticity and static bending strength of high density fiberboard veneered with birch at both sides. urea formaldehyde resin was used for gluing, at 120, 160 i 200 g/m^2 loads at back side of the board, and at 120 g/m^2 on front side of the board. Bending strength and modulus of elasticity were tested with testing machine on both sides. It was concluded that veneering boards with birch increases its mechanical properties, increase of back side glue load from 120 to 200 g/cm^2 increases strength of the composite.

Key words: composites, veneers, fiberboards, static bending strength, modulus of elasticity in static bending.

INTRODUCTION

Wood composite boards can be produced by combination of various wood materials (boards, veneers) or by combination of wood or wood-based materials with non-wood elements, such as boards, films, plastics, metal sheet and forms or ceramic products. These are multilayer complex materials and are being produced in accordance to special orders. Contemporary material base enables production of composite materials in practically unlimited variants, obtaining light, strong, technologically and aesthetically good products.

Objective of the work was to determine mechanical properties (modulus of elasticity and static bending strength) of the boards made with high density fiberboard veneered with birch wood.

METHODIC

Three-ply composite boards were made, basing on the high density fiberboard of 3,2 mm thickness and 900 kg/m^3 density, with 1.5 mm birch veneer layers on both sides. Urea-formaldehyde Silekol M 2 resin was used, prepared in accordance to producer's suggestions. Composite after pressing was seasoned for 2 weeks in normal conditions and then cut into test samples.

Three variant with variable glue load on the back side were made, on the front side single load was used - 120 g/m^2. Fiberboard was pressed both sides with veneer of parallel grain direction, gluing variant were as follows:

1. Back and front side at 120g/m^2 glue load.
2. Back side at 160g/m^2, front side at 120g/m^2 glue load.
3. Back side at 200g/m^2, front side at 120g/m^2 glue load.

Packets were pressed in 125^o C, during 5 min. at pressure of 2 MPa. Every board was cut into 150 x 50 mm strength test samples. Each samples group was randomly divided into 10 pieces of back side up and 10 pieces of front side up sets. Strength and modulus of elasticity tests were performed in ten times in both groups, frond side up and back side up. Veneer grain direction was parallel to sample length in each case. The same tests were made with regular high density fiberboard same dimensions, for comparison reasons. Determination of modulus of elasticity and bending strength was made in accordance with PN – EN 310 standard.

TEST RESULTS AND ANALYSIS

Test results are presented on figures 1 and 2 and tables 1 and 2.

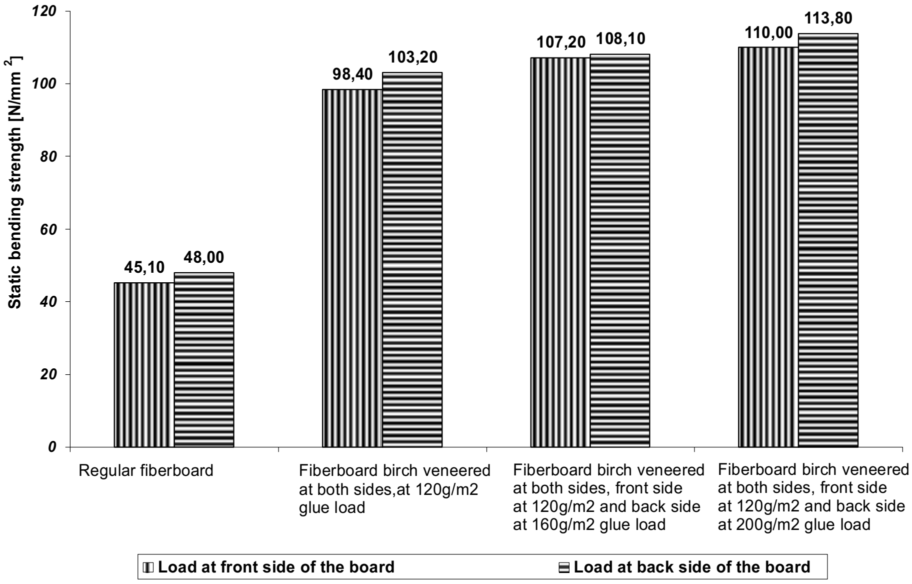

Fig. 1 Comparison of bending strength of regular fiberboards with fiberboards birch veneered at both sides with variable urea-formaldehyde glue load.

Table 1. Standard deviation and variation coefficient of bending strength of 3.2 mm high density fiberboard reinforced with 1.2 mm birch veneers at both sides.

Standard deviation S [N/mm2] and variation coefficient V [%] in static bending															
Regular fiberboard				Fiberboard birch veneered at both sides, at 120g/m2 glue load				Fiberboard birch veneered at both sides, front side at 120g/m2 and back side at 160g/m2 glue load				Fiberboard birch veneered at both sides, front side at 120g/m2 and back side at 200g/m2 glue load			
Load at front side of the board		Load at back side of the board		Load at front side of the board		Load at back side of the board		Load at front side of the board		Load at back side of the board		Load at front side of the board		Load at back side of the board	
S	V	S	V	S	V	S	V	S	V	S	V	S	V	S	V
1,70	3,8	2,55	5,3	8,90	9,0	9,97	8,7	6,68	6,2	5,33	4,9	7,99	7,3	9,72	8,5

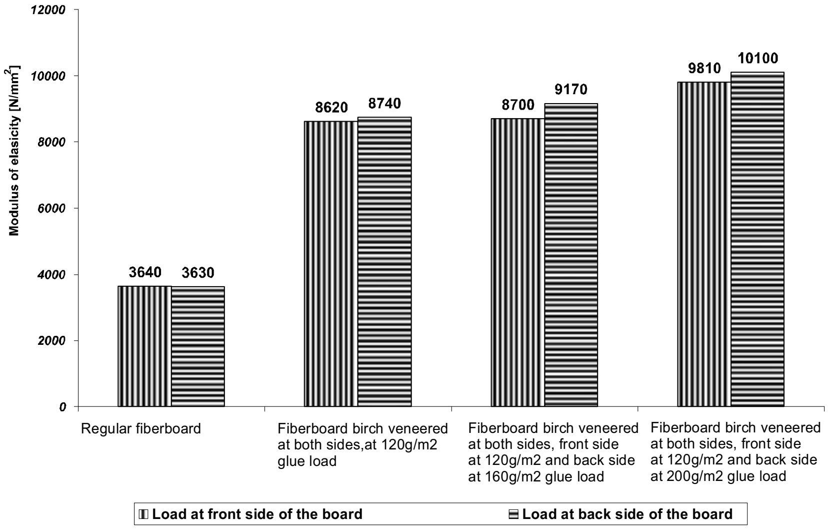

Fig. 2 Comparison of modulus of elasticity of regular fiberboards with fiberboards birch veneered at both sides with variable urea-formaldehyde glue load.

Table 2. Standard deviation and variation coefficient of static bending modulus of elasticity of 3.2 mm high density fiberboard reinforced with 1.2 mm birch veneers at both sides.

Standard deviation S [N/mm2]and variation coefficient V [%] of static bending modulus of elasticity															
Regular fiberboard				Fiberboard birch veneered at both sides, at 120g/m2 glue load				Fiberboard birch veneered at both sides, front side at 120g/m2 and back side at 160g/m2 glue load				Fiberboard birch veneered at both sides, front side at 120g/m2 and back side at 200g/m2 glue load			
Load at front side of the board		Load at back side of the board		Load at front side of the board		Load at back side of the board		Load at front side of the board		Load at back side of the board		Load at front side of the board		Load at back side of the board	
S	V	S	V	S	V	S	V	S	V	S	V	S	V	S	V
159	4,4	186	5,1	285	3,3	339	3,9	580	6,7	542	5,9	575	5,9	480	4,8

Average bending strength of regular samples loaded from front side reached N/mm^2 and was lower than bending strength wit load at back side, which reached 48,00 N/mm^2.

Average modulus of elasticity of regular samples loaded at front side equaled 3640 N/mm^2 and was practically identical with samples loaded from the back side (3630 N/mm^2).

Birch veneered boards showed higher values of bending strength and modulus of elasticity in all variants in comparison to regular samples, in both front side and back side loads. Strength increase depended on the glue load used during veneering. Birch veneering with glue load of 120 g/m^2 on both sides increased bending strength by 118% with front side load, and by 115% with back side load in comparison with control samples. Application of 120 g/m^2 glue load for front sides and 160 g/m^2 and 200 g/m^2 for back sides increases strength by 138% and 144% for front side load and by 125% and 137% for back side load respectively, in comparison to control samples.

Average modulus of elasticity values similarly as strength values increased with back side glue load increase. For front side loaded boards of 120 g/m^2 glue load modulae of elasticity increased by 137%, back side loaded boards increased by 141% in comparison to control samples. Application of higher glue loads for back sides of 160 and 200 g/m^2, increased modulus of elasticity for front side load by 139% and 170%, for back side load by 153% and 178% respectively, in comparison to control samples.

Variation coefficients presented in tables 1 and 2 show high concentration around average values for all variants tested.

Strength gain noticed for the veneered fiberboard with increase of back side glue load can be explained by increased amount of glue filling the grid at the fiberboard's back turns into composite of wood fibers and glue mass. Grid becomes a matrix filled with resin and becoming a composite similar to laminate.

CONCLUSION

Results combined with the statistical calculation allow to conclude:

1. Veneering of 3,2 mm high density fiberboard with 1,5 mm birch veneer increases static bending strength and modulus of elasticity with static bending.
2. Increased glue load from120 g/m^2 up to 200 g/m^2 on back side of the board being composite's core, increases static bending strength and modulus of elasticity in static bending.
3. Change of fiberboard's back side glue load from 120 g/m^2 up to 160 g/m^2 does not give significant increase on strength properties in most cases.

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12. PN – EN 310 Płyty drewnopochodne „Oznaczanie modułu sprężystości przy zginaniu i wytrzymałości na zginanie”.

Streszczenie: *Zmiany wybranych właściwości wytrzymałościowych płyt pilśniowych twardych oklejonych łuszczką brzozową.* W ramach badań wykonano oznaczenia modułu sprężystości i wytrzymałości na zginanie statyczne płyty pilśniowej twardej oklejonej z obu stron łuszczką brzozową. Do klejenia użyto masy klejowej sporządzonej z żywicy mocznikowo-formaldehydowej, którą nanoszono na lewą stronę płyty (kratkę) w ilości 120, 160 i 200 g/m^2 oraz na prawą stronę płyty pilśniowej w ilości 120 g/m^2 we wszystkich wariantach. Zginanie statyczne i moduł sprężystości przy zginaniu statycznym przeprowadzano przy działaniu napory maszyny wytrzymałościowej na prawą i lewą stronę płyty. Stwierdzono, że oklejenie płyty pilśniowej twardej obłogiem brzozowym zwiększa jej właściwości wytrzymałościowe. Wzrost naniesienia masy klejowej na lewą stronę płyty ze 120 do 200 g/cm^2 powodował również wzrost badanych parametrów wytrzymałościowych.

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