

Аналіз питання довговічності та способи її прогнозування

Наведено аналіз процесу склеювання, клеїв що використовуються у деревообробці. Проаналізовано проблеми, що виникають при дослідженні довговічності. Приведено основні способи впливу на довговічність клейових з'єднань.

Ключові слова: клейове з'єднання, вологість, адгезія, довговічність, прогнозування довговічності, міцність з'єднань.

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*Competitor B.M. Myakush – UNFU***DEVELOPMENT OF THE CONDITIONS PARAMETERS OF GLUING PARQUET BOARDS WITH THERMOPLASTIC ADHESIVES**

Presented in this work are the results of experimental study of gluing parquet board with thermoplastic polyvinylacetate adhesives (PVA). Gluing conditions parameters were developed for gluing three-layer parquet boards with polyvinylacetate adhesives.

Keywords: adhesive joint, parquet board, gluing conditions, polyvinylacetate adhesives, production process.

Among the main factors that affect the strength of glued wood structures is the type of adhesive used. In parquet manufacturing, urea-formaldehyde adhesives are commonly used for gluing. The main disadvantage of these adhesives are brittleness of the glue line, considerable shrinkage, low heat- and moisture-resistance [1, 2].

Obtaining environmentally-friendly parquet boards as well as wood adhesive jointing is of major importance today, this being the requirements for modern production process. It is possible to use polyvinylacetate-based thermoplastic adhesives instead of thermosetting urea-formaldehyde adhesives for gluing parquet boards. This was supported by investigations conducted at Ukrainian National Forestry University. According to the results of the investigations, these types of adhesive exhibit good adhesion properties as to wood, they form elastic glue line, they are nontoxic and can bear loads of D3 and D4 classes according to European standard DIN [5]

The use of these types of adhesive would make it possible to produce parquet boards on an environmentally sound basis as the adhesives meet the existing sanitary and technical standards; they can ensure low water absorption of the end product, the parquet boards are easy to machine after gluing and they will also have good heat and sound-insulation properties etc. To study the effect of thermoplastic PVA adhesives on the strength, a three-layer parquet board was used as a test specimen while gluing was done with thermoplastic PVA adhesives of D4 load class that have been formulated at Ukrainian National Forestry University. The direction of grain of each layer of the three-layer parquet board is at an angle of 90° to the grain of each other layers. The primary layer is the upper one which is called thin parquetry. It was made of oak wood. The thickness of the layer is 6 mm, its quality meeting standard GOST 862.3-86 [5].

The core of the parquet board was made of softwoods species – pine wood. For this purpose, strips of cross-section 26x9mm were fabricated. The allowable variation of the strips width is up to 1mm while the gap between the strips edges does not exceed 3mm. The selection of the stock was done according to GOST 2140, in so doing the size of the knots was determined by the smallest diameter. The strips of the core were laid

with the grain direction oriented mutually perpendicularly to the upper and bottom layers. The bottom layer of the parquet board was made of plywood 44 mm in thickness.

The test specimens of parquet boards are 250 mm in length, 95 mm in width, and 18 mm in thickness [3]. The wood species of the layers: the upper (thin parquetry) – oak wood 5 mm thick; the core – pine wood strips measuring 250x26x9 mm; the bottom layer-plywood 4 mm thick. The moisture content of the parquet boards was measured by means of moisture meter according to GOST 16588.

The adhesive was evenly applied to the face surface. The adhesive spread was controlled by means of electronic Pocket scale MH-200 200g/0.01g scales (with an accuracy of 0.01 g). The adhesive having been applied, a parquet block was assembled.

Once assembled, the parquet block was loaded into single-daylight press where the process of gluing took place. The pressing was followed by the parquet block conditioning for 120 hours, after that the parquet blocks were cut into test specimens of the following size: length – 250 mm, width – 95 mm, thickness – 18 mm, the test specimens were prepared according to the procedure of strength testing by the GOST 862.3-86 standard. By means of circular saw, a “tearing off “ spot of 48 mm wide was cut out on the face surface. On the back side of the specimen, the layout of holes was made first, then three blind holes of diameter 16mm were drilled on the upright drilling machine through the thickness of the plywood and the core of the parquet board abutting on the oak lamella. The holes and kerfs arrangement is shown in Fig. 1.

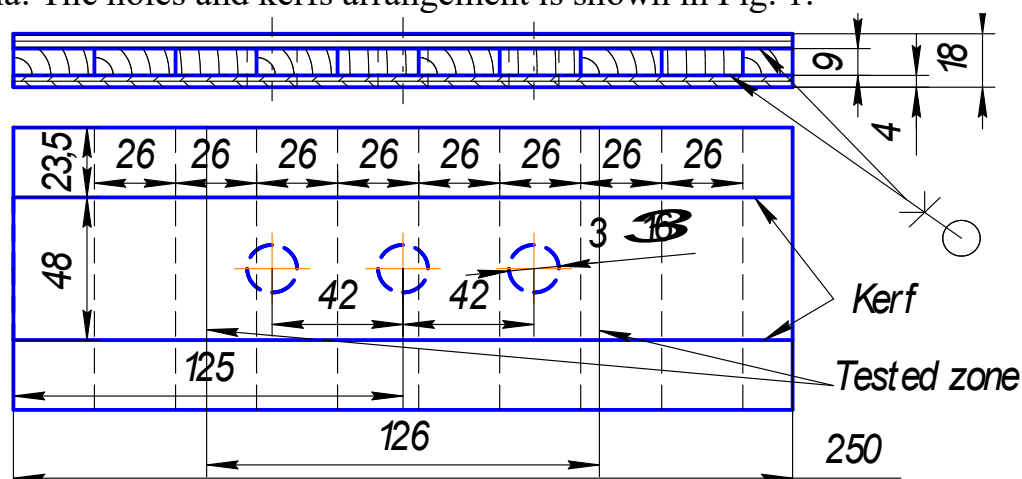


Fig. 1. Specimen for testing the parquet board strength: 1 – kerf; 2 – tested zone

The test was conducted on the versatile testing machine according to GOST 28840, the measurement error being no more than 50 N. To break the specimens, a device, as shown in Fig. 2, was used.

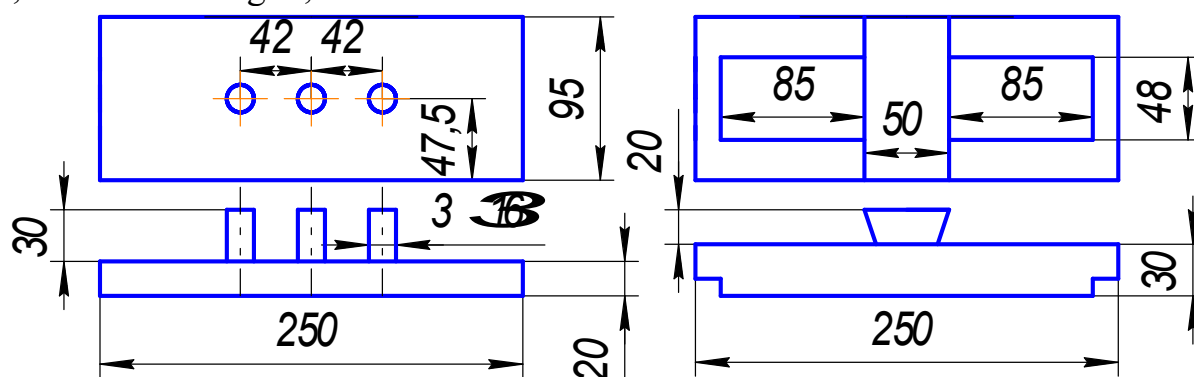


Fig. 2. Device for determining parquet board strength
1 – fork-like rods for destructing specimen

In the course of experiments, three strength-affecting factors were studied: adhesive spread (X_1) ranging from 120 to 160 g/m²; press time (X_2) ranging from 40 to 60 min, and press pressure (X_3) ranging from 100 to 160 kg/cm². These factors variations were chosen based on the previous experimental studies. The specimens were numbered according to the experiment number. The results of the investigations are shown in Table 1.

Table 1. The results of investigations

№ experiment, n _o	Ultimate strength of par quet board adhesive joint, MPa			
	observation, n _o			
1	0.337	0.415	0.311	0.259
2	0.458	0.486	0.631	0.778
3	0.668	0.707	0.478	0.826
4	0.932	0.850	0.657	0.770
5	0.307	0.227	0.441	0.359
6	0.556	0.586	0.497	0.450
7	0.458	0.406	0.378	0.342
8	0.473	0.359	0.562	0.482
9	0.562	0.679	0.620	0.616
10	0.694	0.703	0.700	0.707
11	0.560	0.612	0.592	0.582
12	0.614	0.668	0.664	0.720
13	0.649	0.627	0.670	0.644
14	0.649	0.631	0.675	0.651

In order to construct a regression model, B-plan was used in the form of the second order polynom which is written by the formula

$$y = b_0 + \sum_{i=1}^k b_i x_i + \sum_{i=1}^k b_{ii} x_i^2 + \sum_{i \leq j}^k b_{ij} x_i x_j ,$$

where: y – response value; b – regression coefficient; x – independent variable.

In the selected plan of the experiment, each factor varies at three levels: upper (+), lower (–), and datum (0).

The statistical processing of the experimental results is done according to the procedure [4], the following regression equation was obtained in coded values of the factors: $y = 0.283 + 0.029x_1 + 0.026x_2 - 0.027x_3 - 0.020x_1^2 - 0.034x_2^2 - 0.034x_3^2 - 0.012x_1 x_2 - 0.006x_1 x_3 - 0.027x_2 x_3$

The optimization was done by means of computer, and the following optimum technological parameters of gluing condition were obtained: adhesive spread $Q = 159$ g/m²; press time $T = 57$ min; press pressure $P = 145$ kgf/cm². The analysis of the optimum conditions parameters showed that the bonding strength tends to increase with increase in adhesive spread. The influence of press time on the parquet board strength does not vary directly with increasing time, that is, gradual increase in the press time up to the mean value results in increased strength of the parquet board while its further increase up to the maximum value results in somewhat decreased strength of the parquet board, also, gradual increase in pres pressure up to the mean value leads to increased strength of the parquet board while its further increase up to the maximum value results in somewhat decreased strength of the parquet board.

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Розроблення режимних параметрів склеювання паркетної дошки термопластичними клеями

Наведено результати експериментальних досліджень склеювання паркетної дошки термопластичними полівінілацетатними клеями. Розроблено режимні параметри склеювання тришарової паркетної дошки термопластичними полівінілацетатними клеями.

Ключові слова: клейове з'єднання, паркетна дошка, режимні параметри, полівінілацетатні клеї, технологічний процес.

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THE THEORETICAL AND METHODOLOGICAL BASIS OF FURNITURE DESIGN

The article examines the problem of the formation of methodological basis and strategies of furniture design in social system environment. The basic principles, tools and patterns of furniture design in human environment have been determined.

Keywords: design, furniture, social system environment, principles, means and patterns of design.

Problem formulation: The advancement of special subject environment designing and of design culture in the conditions of the social sphere stage of constant human development, of changes in ideological orientation, of global urbanization, and discovery of new areas of knowledge in natural sciences have brought the revision of civilization strategies and change of values.

A person has become the social personality which is able to act systematically and purposefully, to form the objective world by changing the environment, his/her own life and essence. A person has already become, in his/her development, less dependent on biotic factors or need to adapt to variable environmental conditions. Both mass media sphere and social sphere has become one common environment for the existence of mankind. Design is now viewed in the broad socio-cultural context when integral socio-cultural situations are being formed through harmonic structuring of objective and processual aspects of the system "man–environment" as well as through programming such systems according to the principles of constant development.

There appear a number of fundamentally new tasks and functions which require the theoretical and methodological principles of design to be significantly updated. There is an actual need to comprehend new social, ecological, economic, technical and technological conditions and to form the theoretical and methodological basis of design.

The aim of the article is to determine the theoretical and methodological foundations of furniture design, to identify the principles, methods and patterns of their formation.