СПИСОК ЛИТЕРАТУРЫ
1. Елисеева М.С., Тарасова О.Г. О совершенствовании сверлильного оборудования для изделий из древесины. // Проблемы и перспективы инновационного развития экономики регионов России: материалы II Междунар. науч.-практ. конф. молодых преподавателей, аспирантов и студентов, 25–26 декабря 2014 г. / под общей ред. В.В. Двоеглазова. – Йошкар-Ола: Поволжский гос. технол. ун-т, 2015. – С. 66–69.
2. ГОСТ 475–78. Двери деревянные. Общие технические условия. – Введ.1979.01.01. – М.: Изд-во стандартов, 1980. – 13 с.
3. ГОСТ 6629–88 Двери деревянные внутренние для жилых и общественных зданий. Типы и конструкция. – Введ.1987.12.31. – М.: Изд-во стандартов, 1988. – 17 с.
4. ГОСТ 6449.1–82. Изделия из древесины и древесных материалов. Поля допусков для линейных размеров и посадки. – Введ. 1984.01.01. – М.: Из-во стандартов, 1983. – 20 с.

UDC 630.81

FOAMED PVAC DISPERSION FOR SOLID WOOD PANEL BONDING

J. **Sedliačik**, professor,
G. **Giertl**, assistant
Technical University in Zvolen, Slovakia.
sedliacik@tuzvo.sk

Bonding performance and quality of gluing of solid wood panel at application of reduced amount of foamed PVAC dispersion are considered in the article.

INTRODUCTION

Gluing of wood belongs among significant technologic operations. Adhesives play an important role in the production of solid wood panels. They significantly participate in improving the quality of products and they are also one of the cornerstones in the development of new wood products. Dispersion adhesives have a significant importance in the woodworking practice, at present. Foaming of adhesives with air enable to increase its total volume, the adhesive may be applied into a glue-line more efficient and more uniform. This fact creates conditions for achieving cost-efficient coatings of adhesive applied into the glued joints while achieving comparable strength of the bond in comparison with un-foamed conventional adhesive bonded joints. Foaming of adhesive is a technology that provides the ability to achieve the required bonding strength at reduced glue spread and thereby can bring positive economic aspects in the production of solid wood panels. Generally, advantages of using foamed dispersion PVAc glue in the gluing process can be summarized as follows:

- good wetting of the adherend surface – due to better and more uniform adhesive spread;
- weaker, resp. slower penetration of water from glue into the cells of wood – due to lower adhesive spread and cohesive bonds between air micro-bubbles resulting in better ensuring the flat stability of the panel and increase the quality at the interface wood – adhesive;
- cost savings – in the bonding process, there is a reduction of direct used material by reducing the amount of applied glue
- no formaldehyde emissions.

METHOD

One component PVAc dispersion RAKOLL®4340 with excellent water resistance class D4 according to EN 204 was used. This type of adhesive is specially developed for application in the micro-foam state.

Quality of gluing was tested through shear strength of the bond at pressure loading according to the standard EN 13354: 2009 Solid wood panels (SWP). Bonding quality. Test method. Based on the standard requirements, it was necessary from each tested batch, resp. from each panel to prepare testing samples (Fig. 1) for minimally 10 valid values. Based on EN 13 353: 2009, the required strength of the glued joint is expressed by lower 5% percentile form measured values on the level over 2,5 MPa.

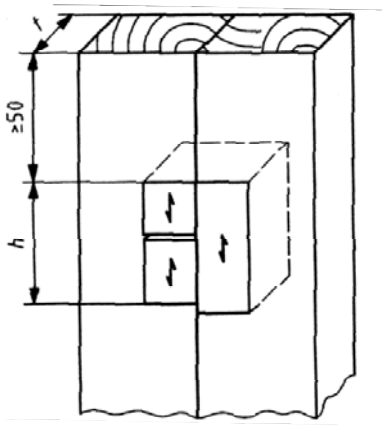

Fig. 1. Testing sample

RESULTS AND DISCUSSION

Results of the research are aimed on the verification of the assumption, that increasing of the dispersion volume by foaming enables to spread the adhesive on the surface more uniform with a better quality, but also the effect of saving is achieved.

We tested 5 sets of samples with different glue spread. Based on obtained results, we counted the dependence of the shear strength (Y) on the glue spread (X) within the interval <113 g/m^2; 180 g/m^2> by the mathematic function (Fig. 2).

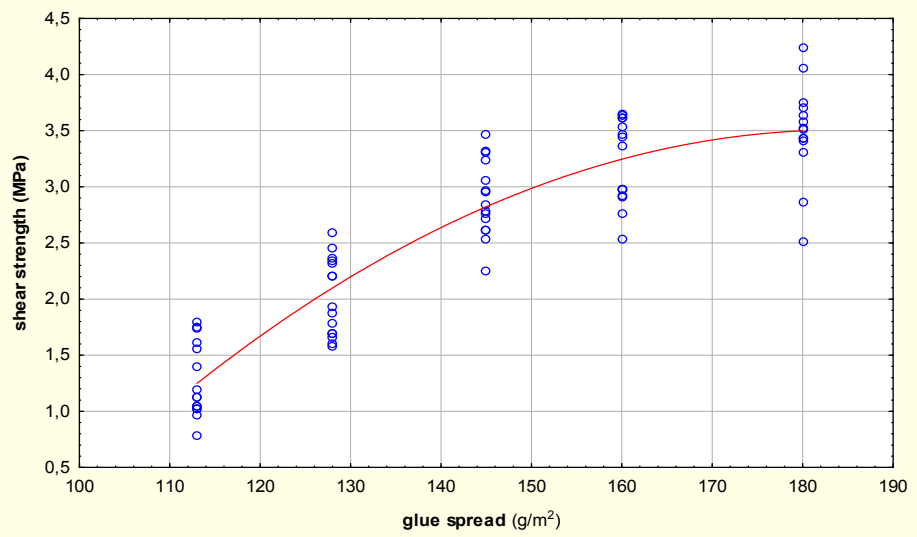

Fig. 2: Regression analysis

We also verified the statistical significance of parameters and model as a whole as well as the adequacy of the model. The results showed that all the parameters are statistically significant and adequate. The equation of the regression line has the form:

$$y = -11{,}6137 + 0{,}1642x - 0{,}0004x^2.$$

On the basis of homogeneity of the variance in the residual component we have calculated and converted mentioned above quadratic equation by using mathematical program Wolfram Mathematica 7.0. Based on the obtained results, we can assume that the samples with application of 30 % of foamed adhesive RAKOLL® 4340 with the glue spread of 142,15 g/m^2 can be achieved such shear strength where the lower 5 % percentile is on the level of 2,5 MPa.

From the evaluation of the results, we can conclude, that the glue spread oscillating around 140 g/m^2 of used dispersion adhesive which is foamed up to 30 % of its volume should be achieved such shear strength of samples which meets the requirements of the EN 13 353: 2009 Solid Wood Panels (SWP). Requirements.

CONCLUSION

The practical benefit of the research from the technologic point of view can be expected within the optimisation of wood gluing processes, with the aim to ensure such production assumptions, which will bring effective minimisation of the production costs at required quality level. Final effect from the economic view can be expected in an effort to at least partially manage the production costs and maintaining a strong link between the quality characteristics of the final product, technology, production costs and the final price of the product, which can create a strong competitive advantage for the business company.

ACKNOWLEDGEMENT

This research was supported by a Marie Curie International Research Staff Exchange Scheme Fellowship within the 7th European Community Framework Programme, project PIRSES-GA-2011-295260, “ECONANOSORB”.

REFERENCES

1. Gereke T., Gustafsson P.J., Persson K., Niemz P. 2007. Experimental and numerical determination of the hygroscopic warping of cross-laminated solid wood panels // Holzforschung. – 2007. – Vol. 66. – P. 340–347. ISSN 0018-3830.
2. Guzlow A., Richter K., Steiger R. 2009. Influence of wood moisture content on bending and shear stiffness of cross laminated timber panels // European Journal of Wood and Wood Products. ISSN: 0018-3768. – 2011. – Vol. 69. – P. 193–197.
3. Hass P., Wittel F.K., Mendoza M., Herrmann H.J., Niemz P. Adhesive Penetration in Beech Wood. Part I: Experiments. – Zurich: Institute for Building Materials, 2011. – 22 s.