

## **IN-PLANE COMPRESSIVE STRENGTH OF PLYWOOD REINFORCED WITH COTTON PREPREG**

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### **ABSTRACT**

*The aim of this research is to study the in-plane compressive strength of eleven-layered beech plywood reinforced with non-wood material in its structure. Plywood reinforcement was made by inserting certain numbers of sheets of pre-impregnated cotton fabric (cotton prepreg). Methyl alcohol-soluble phenol-formaldehyde resin was used for fabric pre-impregnation as well as for veneer bonding. The thickness of the veneers used in the plywood structure was between 1.5 and 1.85 mm. Different models of plywood were made by changing the position of cotton prepreg reinforcements in the plywood structure. One control model of plywood without reinforcement was made.*

*The in-plane compressive strength of plywood models was tested in five directions: parallel to the face grain, perpendicular to the face grain, and at angles of 22.5°, 45°, and 67.5° to the face grain of the plywood panel.*

*The obtained results showed that the application of cotton prepreg in plywood structures has an impact on the values of the in-plane compressive strength of plywood.*

### **REFERENCES**

- [1] Biblis, J.; Carino, H.F., 2000: Flexural properties of southern pine plywood overlaid with fiberglass-reinforced plastic. *Forest Prod J.*, 50 (1): 34-36.
- [2] Brezovi, M.; Jambrekovi, V.; Pervan, S., 2003: Bending properties of carbon fiber reinforced plywood. *Wood Research*, 48 (4): 13-24.
- [3] Brezovi, M.; Kljak, J.; Pervan, S.; Antonovi, A., 2010: Utjecaj kuta orientacije sintetskih vlakana na svojstva kompozitne furnirske ploče. *Drvna ind.*, 61 (4): 239-243.
- [4] Choi, S.W.; Rho, W.J.; Son, K.J.; Lee, W.I., 2011: Analysis of buckling load of fiber-reinforced plywood plates for NO 96 CCS. *Proceedings of the Twenty-first International Offshore and Polar Engineering Conference, 2011, Maui, Hawaii, USA*, pp: 79-83.
- [5] Hardeo, P.; Karunasena, W., 2003: Buckling of fiber-reinforced plywood plates. *Proceedings of Second International Conference on Structural Stability and Dynamics, 2002, Singapore*, pp. 442-447. [https://doi.org/10.1142/9789812776228\\_0062](https://doi.org/10.1142/9789812776228_0062).
- [6] Hrázský, J.; Král, P., 2007: A Contribution to the properties of combined plywood materials. *J For Sci*, 53 (10): 483-490. <https://doi.org/10.17221/2087-jfs>.
- [7] Jakimovska Popovska, V., Iliev, B. 2019: Bending properties of reinforced plywood with fiberglass Pre-impregnated Fabrics, *Proceedings of 30<sup>th</sup> International Conference on Wood Science and Technology-ICWST and 70<sup>th</sup> anniversary of Drvna industrija Journal "Implementation of wood science in woodworking sector", 12<sup>th</sup> -13<sup>th</sup> December, Zagreb, 2019: 77-85.*
- [8] Jakimovska Popovska, V., Iliev, B. 2021. Janka hardness of plywood reinforced with pre-impregnated cotton fabrics, *Proceedings of the 5<sup>th</sup> International conference „Wood technology and product design“, 14-17<sup>th</sup> September, Ohrid, 2021: 7-14.*
- [9] Kohl, D.; Million, M.; Böhm, S., 2013: Adhesive bonded wood-textile-compounds as potentially new eco-friendly and sustainable high-tech materials. *Proceedings of the Annual Meeting of the Adhesion Society 2013, Florida, USA*, pp: 27-29.
- [10] Maniš, M.; Žuke, S., 2011: Textile fabrics reinforced plywood with enhanced mechanical properties. *Abstracts of the International Scientific Conference „Civil Engineering'11”, 2011, Latvia*, pp: 35.
- [11] Macedonian standards.
- [12] Rowlands, R.E.; Van Deweghe, R.P.; Launferbeg, T.L.; Krueger, G.P., 1986: Fiber-reinforced wood composites. *Wood and Fiber Science*, 18 (1): 39-57.
- [13] Xu, H.; Tanaka, C.; Nakao, T.; Nisano Y.; Katayama, H., 1996: Flexural and shear properties of fiber reinforced plywood. *Mokuzai Gakkaishi*, 42: 376-382.

- [14] Xu, H., Nakao, T., Tanaka, C., Yoshinobu, M., Katayama, H., 1998: Effects of fiber length orientation on elasticity of fiber-reinforced plywood. *Journal of Wood Science*, (44): 343-347. <https://doi.org/10.1007/bf01130445>
- [15] Z ke S.; Kalni š K., 2011: Enhanced impact properties of plywood. *Proceedings of the 3rd International Conference Civil Engineering' 11*, 2011, Latvia, pp: 125-130.