DIMENSIONAL STABILITY OF MULTIPLEX PLYWOOD WITH MAINLY UNIDIRECTIONAL GRAIN ORIENTATION

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ABSTRACT

Multilayer plywood made from wood veneers with mainly unidirectional grain orientation known as multiplex panels represent a significant group of modern wood-based panels. Application of these panels in modern construction and in other application areas necessitates achieving higher physical and mechanical characteristics of these materials, their consistency during prolonged water impact, humidity, heat, as well as their dimensional stability.
The aim of the research presented in this paper is to study the dimensional stability of experimental multiplex plywood reinforced with cotton based prepreg. The cotton prepreg was made form cotton fabric pre-impregnated with alcohol-soluble phenol-formaldehyde resin.
The experimental multiplex plywood was made of eleven layers of peeled beech veneers with thickness of 1,85 mm. Alcohol-soluble phenol-formaldehyde resin was used as plywood binder. The orientation of the veneers in the plywood structure is parallel to the longitudinal axis of the panel, with exception of the subsurface layers whose orientation is transverse to the longitudinal axis of the panel. The cotton prepreg reinforcements were inserted in each adhesive layer of plywood.
To define the dimensional stability of the panels, laboratory tests on the most important physical properties were performed, as well as on bonding quality through the shear strength test. Tests of water absorption and thickness swelling were performed during prolonged water treatment.

REFERENCES

Biblis, E.J.; Carino, H.F., 2000: Flexural properties of southern pine plywood overlaid with fiberglass-reinforced plastic. Forest Prod J., 50 (1): 34-36.

Brezović, *M.;* Jambreković V.; Kljak, J., 2002: Utecaj karbonskih vlakana na neka relevantna svojstva furnirskih ploča. Drvna ind., 53 (1): 23-31.

Brezović, M.; Jambreković, V.; Pervan, S., 2003: Bending properties of carbon fiber reinforced plywood. Wood Research, 48 (4): 13-24.

Brezović, M.; Kljak, J.; Pervan, S.; Antonović, A., 2010: Utjecaj kuta orientacije sintetskih vlakana na savojna svojstva kompozitne furnirske ploče. Drvna ind., 61 (4): 239-243.

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.

Davalos, J.F.; Qiao, P. Z.; Trimble, B.S., 2000: Fiber-reinforced composite and wood bonded interfaces: Part 1. Durability and shear strength. Journal of Composites Technology & Research, 22 (4): 224–231. https://doi.org/10.1520/ctr10544j.

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.

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.

Jakimovska Popovska, V., 2014: Researches of the characteristics of structurally reinforced constructive plywood, Doctoral dissertation, SS. Cyril and Methodius University in Skopje, Faculty of design and technologies of furniture and interior, Skopje, 2014.

Jakimovska Popovska, V., Iliev, B. 2019: Bending Properties of Reinforced Plywood with Fiberglass Pre-Impregnated Fabrics, Proceedings of 30th International Conference on Wood Science and Technology - ICWST and 70th anniversary of Drvna industrija Journal "Implementation of wood science in woodworking sector", 12th -13th December, Zagreb, 2019: 77-85.

Jakimovska Popovska, V., Iliev, B., Mihajlova, J., 2019: Physical properties of plywood during prolonged water exposure, Proceedings of the 4th International Scientific Conference "Wood Technology & Product Design", 4-7 September, 2019, Ohrid.

Jakimovska Popovska, V. and Iliev, B., 2021: Water absorption and thickness swelling of reinforced plywood during prolonged water exposure (not published, submitted for the 5th International Scientific Conference "Wood Technology & Product Design", 14-17 September, Ohrid, 2021.

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.

Maniņš, M.; Zīke, S., 2011: Textile fabrics reinforced plywood with enhanced mechanical properties. Abstracts of the International Scientific Conference „Civil Engineering'11", 2011, Latvia, pp: 35.

Macedonian standards – MKS, 1995.

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.

Xu, H.; Tanaka, C.; Nakao, T.; Nisano Y.; Katayama, H., 1996: Flexural and shear properties of fiber reinforced plywood. Mokuzai Gakkaishi, 42: 376-382.

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

Zīke S.; Kalniņš K., 2011: Enhanced impact properties of plywood. Proceedings of the 3rd International Conference Civil Engineering'11, 2011, Latvia, pp: 125-130.