



THERMOMECHANICAL BEHAVIOUR OF BONDED JOINTS OF WOOD AND WOOD-BASED PANELS AT ROOM AND ELEVATED TEMPERATURES

Djems Andrade ¹, Matheus Alves ¹, Luís Mesquita ², Luísa Barreira ¹, Jocyla Manhique ³, Santamaria Echart ³, Maria-Filomena Barreiro ³, Filipe Mofreita⁴

¹ Instituto Politécnico de Bragança, campus de Santa Apolónia, 5300-253 Bragança, Portugal

² ISE, Instituto Politécnico de Bragança, campus de Santa Apolónia, 5300-253 Bragança, Portugal

³ CIMO, Instituto Politécnico de Bragança, campus de Santa Apolónia, 5300-253 Bragança, Portugal

⁴ Carpintaria Mofreita, Rua da Cegonha n.º 12, 5340 Macedo de Cavaleiros, Portugal

ABSTRACT

Wood is a natural material traditionally used in the construction industry. In recent decades, developments in scientific research have turned wood into a high-tech construction material. Increased interest in bonded joints in wood construction is due to the advantages of adhesive technology compared to traditional mechanical joining techniques. It is very important to understand the influence of elevated temperatures on adhesives due to their use in multilayer systems such as compartmentation walls and fire-resistant doors, which require adequate mechanical and thermal resistance in fire situations. The purpose of this study is to investigate the mechanical behaviour of different structural adhesives on bonded connections of wood and wood-based panels at room and elevated temperatures through experimental testing. The performance of the adhesives was evaluated at room temperature and at 50 °C, 100 °C, 150 °C, and 200 °C. The resins tested were a polyurethane prepolymer resulting from the reaction between polyols and diphenylmethane diisocyanate (MDI), Flexpur151, and urea resin glue for hot pressing. The tensile shear tests with lap joints were performed using combinations of pinewood-pinewood and MDF-MDF. The experimental tests were done according to EN 205:2016, which allows for determining the tensile shear strength of bonded joints. The failure mode of the tested specimens was classified according to ASTM D5573. The results show that the bonding strength and the displacement of the specimens decrease with the increase of the temperature. The failure mode presents a different result for different temperatures. For example, for the urea resin, the shear resistance of MDF-MDF panels decreases about 50 % when exposed to 100 °C with the failure mode usually occurring on the panel, and 98 % when exposed to 200 °C with the failure mode in the adhesion plane. For the MDI based resin, the shear resistance of MDF-MDF panels decreases about 35 % when exposed to 100 °C with the failure usually occurring on the panel, and 65 % when exposed to 200 °C with the failure mode occurring in the adhesion plane.

Corresponding Author: Matheus Alves