FIRE PERFORMANCE OF WOOD AND WOOD-BASED PANELS TOWARDS THE DEVELOPMENT OF WOOD FIRE DOORS

Matheus Alves [1], Maria Dagort [2], Luís Mesquita [3*], Paulo Piloto [4], Luisa Barreira [1], Débora Ferreira [1], Isabel Fernandes [5], Maria-Filomena Barreiro [5]

[1] Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal
[2] Federal University of Technology – Parana (UTFPR), Brazil
[3*] ISISE, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal
[4] LAETA - INEGI, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal
[5] Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

ABSTRACT

Fires in buildings continue to be responsible for high human and economic losses. The increasing demand for legal requirements in the fire safety sector has been complemented by performance criteria of construction products, increasing the requirements of their essential technical characteristics, such as thermal, acoustic, and fire behaviour, as prescribed in the European Construction Products Regulation (CPR).

This work addresses the development of an innovative system for the production of wood fire doors based on solid wood, wood-based panels, and lightweight materials with enhanced fire performance, aiming at improving the integrity and insulation (EI) fire resistance time.

For this purpose, the fire behaviour of different solid woods and wood-based panels were analysed in a cone calorimeter, under the action of a 75 [kW/m^2] radiative heat flux. The study considers pine wood (Pinus pinaster), tulip tree wood (Liriodendron tulipifera), plywood panels, and Medium-Density Fibreboard (MDF) of different thicknesses. During each test, the heat release rate, total heat release, and sample mass loss were measured and evaluated for comparison. Using a set of thermocouples type k placed on the exposed face and non-exposed faces, and in the sample interior at different depths, the temperature evolution was measured over time, allowing to determine the through-thickness heating rate.

Results show a mass loss rate that changes with the MDF thickness, resulting in a reduction of 50% mass loss after 3.73 [min] and 11.57 [min] exposure, for 10 [mm] and 22 [mm] boards, respectively. Similarly, the peak heat release rate is higher for thinner boards. Plywood boards have higher heat release rates compared to MDF boards, with the same thickness, due to the resin used between each layer. For the same exposure time, the pine wood samples release more heat compared to the tulip wood, having the latter a higher mass loss rate.

The temperature distribution measured across the thickness allowed the estimation of the charring rate and evaluate the insulation performance of each sample.

Acknowledgments: This work was developed within the scope of the project NORTE-01-0247-FEDER-072225, supported by Norte Portugal Regional Operational Programme (NORTE 2020), under the PORTUGAL 2020 Partnership Agreement, through the European Regional Development Fund (ERDF). CIMO (UIDB/00690/2020) funded by FCT/MCTES (PIDDAC). FCT, P.I., through the institutional scientific employment program-contract for Isabel Fernandes.

Corresponding Author*: Luís Mesquita, lmesquita@ipb.pt