

## ABSTRACT

The use of engineered timber products has in recent years begun to increase in part due to environmental concerns but also in part due the speed of erection of timber buildings. A worry with this trend is due to the combustible nature of wood-based products. One does not require to dig too far back in the past to find examples of notable fires in which flame spread rapidly throughout the building. Historically testing procedures have been developed to try and determine the behaviour of building products under fire conditions. There has been an observed disparity between results of bench-scale and large-scale test due to the coupling of various complex physical processes. However, work is being conducted in the field of computational fluid dynamics (CFD) to link these two scales.

The work presented herewith is a continuation of experimental and numerical work on engineered products carried out at the Ghent University. In that work calcium silicate, MDF and Plywood panels were tested to requirements of the Single Burning Item (SBI) test procedure and were then subsequently simulated using the FireFoam computational fluid dynamics (CFD) package. This work attempts to use the Fire Dynamics Simulator (FDS) CFD code version 6.7.0 to simulate the response to fire of both the inert calcium silicate and plywood tests. The pyrolysis parameters of the plywood panels used in the work were previously determined via the inverse modelling of Fire Propagation Apparatus bench scale test in a nitrogen environment using the 1-dimensional pyrolysis model in the FireFoam package. An emphasis of this study is on the influence of the convective heat transfer models.

The calcium silicate simulations show that the flame heights are overpredicted for the triangle burner whilst the heat fluxes at three distinct locations on the panels were underpredicted. The inaccuracy of the heat flux predictions increased at locations further away from the corner. The choice of convective heat transfer model did not have a significant influence on the results although the wall model produced slightly higher heat fluxes and thus providing a more accurate result. Using the default model effective parameters for the plywood cases greatly over-predicted the total heat release rate when compared with the experiments. A sensitivity analysis was undertaken by varying the heat of combustion and the heat of reaction two significant parameters influencing the HRR. Significant overprediction of the HRR is still observed when varying these input parameters. Similarly, to the calcium silicate case, the heat fluxes are underestimated in each of the three locations with flame heights also being overpredicted. It can be deduced from these simulations that the model effective parameter previously derived are not suitable to accurately predict the fire behaviour of plywood in a corner configuration.