**Abstract**

The current trends in the construction industry push toward materials that are more sustainable and environmentally friendlier than more traditional building materials such as concrete and steel. Timber and timber composites are one of the most popular materials on this list, due to both their mechanical strength and pleasant aesthetics. Oriented strand board (OSB) is one of these timber composites gaining traction in the construction field due to its low cost and sustainable use of timber products in manufacturing.

The major barrier to the effective use of OSB panels in construction is their susceptibility to fire and high thermal conditions. The impact of high thermal conditions on the mechanical strength of OSB must be quantified, so that accurate predictions can be made. This would allow the timber composite manufacturing industries to develop thermal and fire-retardant solutions to improve the thermal-mechanical behavior of OSB.

The goal of this research work was to gain an understanding of the thermal degradation of OSB and its relative impact on the behavior of thermal material properties and mechanical degradation. The scope of the research was limited to pre-ignition behavior. The work in this thesis was split into three major parts. First, a series of thermal material property tests (TGA, thermal conductivity, and cone calorimeter tests) were performed to gain an understanding of the thermal degradation of the OSB. Second, a series of thermal-mechanical combination experiments were conducted to identify a trend between thermal -decomposition and mechanical degradation of OSB. Finally, a heat transfer model based on the cone calorimeter test was simulated and compared with results from experimental measurements.

Major findings from the research work include the trend of thermal degradation of OSB. Until a temperature of 225 °C, the mass loss is minimal (1.9 ± 0.1 %) after which, a large mass loss of a further 66% is observed by the temperature range 380 ± 10 °C. Another finding is regarding the thermal decomposition-mechanical degradation behavior of OSB. The failure stress trend associated with thermal degradation was found to be different for specimens tested immediately after removing from the furnace and for specimens tested after a 24-hour period of cooling. For specimens tested immediately after removal from the furnace, the failure stress had a continuous, non-linear degradation for the test temperature range of room temperature to 200 °C. However, for the specimens allowed to cool for 24 hours, an upward trend was observed between 75 ° and 100 °C for the failure stress. For the specimens heated at 100 °C, 150 °C, 175 °C, and 200 °C, it was also found that the 24-hour cooling period allowed strength to be regained in the OSB.