Targeted timber treatment for improved fire performance of engineered timber products

Advisory Team

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Project information

Laminated engineered timber products such as cross-laminated timber (CTL), glued laminated timber (glulam) and laminated veneer lumber (LVL) can have tangible benefits when used in large construction projects for housing or commercial developments. Their low weight and carbon footprint compared to steel or concrete has driven increased use and development. The combustibility of wood makes fire safety a major design parameter to consider for timber buildings. Recent research has shown that a certain proportion of timber elements can be left exposed without risk to the occupants in the event of a fire; however, the contribution of timber to the fire has to be limited to ensure that self-extinguishment of timber occurs. The continued burning of timber after all moveable fuel load (e.g. chairs, sofas etc) has been consumed depends on formation of a char layer on the burning surface and the heat flux received from other exposed surfaces. Char-fall off has been identified as a critical failure mode for burn out of engineered timber composites and is partially dependent on the adhesive performance between timber lamellae.

Engineered timber can be modified in multiple ways to improve its fire performance. One aspect that is currently not widely utilised or considered is the modification of timber to (1) improve its char yield and thereby improve its self-extinguishing thresholds, and (2) improve the adhesive lines to improve their performance in heat and thereby reduce the contribution of the adhesive itself as well as the underlying timber to the fire. This effect can be achieved through chemical treatment methods or through targeted selection of specific timber species based on their reaction to fire properties.

Any modifications to engineered timber systems must ensure an optimised solution to multiple constraints: fire safety performance, load bearing capacity, cost, environmental and health effects, permanency, and effect on the timber durability. This work will involve close collaboration with researchers from the National Centre for Timber Durability.

The candidate for this PhD project will develop a deep understanding of the effect of treatments on timber micro and macro structure and its interaction with adhesives. Experimental investigations in the fire laboratory at The University of Queensland will assess flammability and structural properties of specifically designed timber products and develop tools to quantify the expected fire performance in compartment fires.

Qualifications

Candidates must hold a relevant undergraduate or Master's degree in Civil Engineering, Mechanical Engineering, Chemical Engineering, Physics or in another related field. Candidates with skills or interests in fire safety engineering, chemistry, heat transfer, and/or forestry are strongly encouraged to apply.

How to apply

Interested candidates should contact Dr Felix Wiesner (f.wiesner@uq.edu.au) for more information. PhD scholarships are available to exceptional candidates. Details of scholarships and the application process can be found here.