UQ Fire Project #2020.09

INTUMESCENT COATINGS UNDER A RANGE OF FIRES

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Steel, thin intumescent coatings, thermal properties, radiant heat flux

Background and motivation

Intumescent coatings (or reactive coatings) are nowadays the dominant passive fire protection system used to protect structural steel systems during fire. During heating, these coatings swell to form a low density, highly insulating foamed char, hence preventing steel from reaching critical temperatures. According to current regulations, the performance of an intumescent coating is typically based on compliance to standard fire resistance tests (i.e. furnace test). However, unlike other non-reactive passive fire protective systems, several researchers have emphasized the high influence of the heating conditions in the effectiveness of intumescent systems. Moreover, some studies have shown that a slow heating regime may have a negative impact in the insulating performance, or even shown propensity for melting and/or delamination. As a consequence, current intumescent design procedures must be revised before they can be used with confidence. Therefore, conditions imposed during a furnace test are potentially not the most onerous conditions for steel structures protected with intumescent coatings.


Fire Lab (UQ)

Research objectives

There are limited research studies that have performed a comprehensive experimental gauging of the expanded coating during testing. The main aim of this project is to characterise the thermal and physical response of reactive coatings throughout different fire scenarios. In particular, high precision sensors will be installed in order to monitor any propensity for melting and/or delamination of the intumescent coating exposed to different slow heating fire conditions.

Methodology

Steel plates coated with a commercially available intumescent paint will be fire tested using an array of high-performance radiant heaters. The specimens will be exposed to several time-histories of incident radiant heat flux (up to 200 kW/m2) by moving the radiant panels towards or away from the sample as necessary. Melting temperature, delamination and debonding of the intumescent coating will be precisely measured during testing with a high density and precision of thermal sensors and thermocouples. The proposed project will have an approximate 60/40 ratio between experiments and modelling

Recommended literature

Elliott A, Temple A, Maluk C, and Bisby L. 2014. Novel testing to study the performance of intumescent coatings under non-standard heating regimes, *Fire Safety Science – Proceedings of the Eleventh International Symposium*, pp. 652-665, 2014.