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Experimental study of the performance of intumescent coatings

exposed to standard and non-standard fire conditions

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Keywords

Intumescent coatings, thermal resistance, heating rates, standard and non-standard fire curves, steel protection

Abstract

Three different experimental setups corresponding to three different fire scenarios were used to investigate how different heating conditions and heating rates affect the behaviour of two different thin intumescent coatings (a solvent-based and a water-based paint). Coated steel samples were exposed to different standard and non-standard fire conditions in an electric oven, in a gas furnace and in a cone heater. A general trend was observed in the thermal resistance development for the tested intumescent coatings, divided into three general phases: inert phase, transient phase and steady phase. The different stages were identified according to four critical points: activation, end of reaction, binder exhaustion and steel austenitization point. The tested water-based paint had better performance for low heating rates, while the tested solvent-based paint had better performance for high heating rates. However, for really low heating rates the solvent-based paint did not activate or provide proper insulation. In summary, the results confirm that the current procedure for the design of intumescent coatings has shortcomings, as different paints have different performances according to the heating conditions and, in particular, according to the fire heating rate.

[...]

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