Experimental study of the performance of intumescent coatings exposed to standard and non-standard fire conditions - DTU Orbit (01/01/2019)

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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 common trend was observed in the thermal resistance development of the tested coatings and three phases (inert phase, transient phase and steady phase) were identified according to four critical points: activation, end of reaction, binder exhaustion and steel austenitization point. The results also showed that the water-based paint performed better at low heating rates, while the tested solvent-based paint performed better at high heating rates and did not activate or provide proper insulation at very low heating rates. In summary, the study confirms 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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