A Weather Resistance Performance of Intumescent Coating

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Introduction

This chapter discusses the performance of different intumescent coatings in terms of water resistance. Different types of filler Kaolin Clay (KC), Multiwall carbon nanotube (MWCNT), Zirconium Sulphate (ZS), and E glass fibers were introduced in the coating to observe effects of water absorption on fire performance of the coating. The samples were tested using weathering chamber and immersed in seawater. No hole or crack was observed at the end of the test for all the samples. The Weathering test was performed according to ASTM Standard ASTM D 6695-03, and a water immersion test was done for two optimised samples to investigate the effect of sea mineral salt. After 90 days of immersion in seawater, the coating surface is rougher than before immersion, and a slight colour observation is reported. Char expansion of the samples decreased after the immersion. It may be due to the reaction and dissolution of ingredients of the coating in the seawater.

Weathering chamber (Q-Sun Xenon Test Chambers)

Q-Sun Xenon Test Chambers was used for the accelerated weathering test. It is designed to create a highly flexible mix of UV light, temperature, and moisture conditions. In this research, ASTM D 6695-03 was used to study the effect of weathering on the optimised sample of ICFs. The tests are intended to reproduce the damage caused by sunlight, rain, and condensed surface moisture or dew. The test materials

were subjected to alternating cycles of light and moisture at controlled elevated temperatures in the test chamber. The literature reported that the weathering environment affects the coating's physical appearance and expansion [1]. The coated samples were tested for three months (90 days) under these conditions: the weather ability of specimens was assessed in an accelerated weathering chamber (Atras Ci4000) according to JIS K5600-7-7 (xenon lamp method) for up to 2000 h. The accelerated weathering regime involved continuous exposure to xenon arc UV radiation (0.35 ± W/m^2 at 340 nm = 41.5 W/m^2 for 300–400 nm), 18 mins light and water spray 6 h dark using 95% relative humidity (no water spray) with a black panel temperature of 65° ± 2°C and a chamber temperature of 35° ± 2°C. Weathered intumescent coatings' physical appearance, char expansion, and char morphology were compared to those not subjected to weathering conditions.

The physical appearance of all the selected formulations (IF1-MWCNTs, IF2- MWCNTs, IF3-MWCNTs, IF3-KC, IF4-KC, IF5-KC, IF3-ZS, IF4-ZS, and IF5-ZS) changed from light black colour to light yellow due to ultraviolet light after weathering test. The physical appearance of the coated substrate before and after the weathering test is reported in Tables 1 to 2. There was no hole or cracks observed on the entire coating surface by physical inspection. The physical appearance of all the selected coatings is described in Figures 1 and 2. The char expansion of IF1-MWCNTs, IF2-MWCNTs, IF3-MWCNTs, IF3-KC, IF4-KC, and IF5-KC decreased to 2, 0.4, 1.1, 3.17, 2.53, and 0.92 times, respectively, from the original coating thickness after weathering test due to the penetration of ultraviolet rays on the surface of the coating [2]-[3].