

Assessing the Fire Retardant Mechanism of Waterborne Intumescent Coatings Hybrid With Biofiller and Industrial Filler

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Abstract

This paper presents the modification enhancement of intumescent coating system by incorporating waterborne resin, vinyl acetate copolymer (VAC) with an appropriate combination of three flame retardant additives, ammonium polyphosphate phase II, APP (II), pentaerythritol (PER) and melamine (MEL) hybrid with four different fillers, which incorporates biofillers, namely rice husk ash (RHA) and chicken eggshell (CES) as abundant by-products, with two other industrial fillers, namely titanium dioxide, TiO₂ and aluminium hydroxide, Al(OH)₃. Six coating mixtures are characterized on; (i) fire performances analysis by using surface spread of flame test (BS 476: Part 7), fire propagation test (BS 476: Part 6), fire performance test (Bunsen burner); (ii) mechanical analysis by using static immersion test, adhesion strength, char strength; and (iii) surface morphological analysis by using scanning electron microscopy (SEM) image. The coating consists of all fillers showed the best performance in all three analysis method with the certified to be Class 0 for both BS 476: Part 6 and 7 tests, lower equilibrium temperatures curve, good water repellency, secure adhesion, tough char strength and formed the densest surface structure. It could be applied the coating to be used as an effective fire protection system for steel application.

Keywords: Flame retardant, Intumescent coatings, Steel application, Coatings technology