BCF method for determining the volume solids of intumescent coatings

Describes an industry-developed methodology appropriate to the physical and chemical properties of intumescent coatings
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1. Introduction

Determination of the "practical volume solids" is an essential parameter in the calculation of the applied wet film thickness of an intumescent coating. This is required to obtain the dry film thickness needed to achieve the required protection performance from both on- and off-site application of intumescent coatings to constructional steelwork.

Experience of the use of publicly available standard test methods for determination of volume solids, such as ISO 3233, has shown limitations for certain types of intumescent coatings, particularly with systems containing fast evaporating solvents.

This method has been developed by intumescent coatings manufacturers in the British Coatings Federation’s Intumescent Coatings Group, as a more appropriate method, in relation to the specific physical and chemical properties of intumescent coatings. It is based on another internationally- established method, ASTM D2697-03 (2003), with modifications relevant to intumescent coatings.

The method can be used as an additional assessment parameter, in the initial type testing of intumescent coatings to ETAG 018-02 for third party product certification purposes.

2. Test method

The method uses ASTM D2697-03 (2003) with the following changes:

2.1 Sampling and testing

Samples for testing are taken by the Accreditation Body from unopened production stock at the manufacturing site or storage warehouse. For preparation of panels required for determination of the dry film SG (see Paragraph 2.6), the product is applied by the recommended technique (normally airless spray) at the manufacturer’s facility under the supervision of the Accreditation Body or its designated test laboratory. Testing to the method is carried out independently by the Accreditation Body or its designated test laboratory.

2.2 Apparatus

As per ASTM D2697-03 (2003), but using the panels describes in 2.5 below.

2.3 Volume determination of uncoated discs or panels

As per ASTM D2697-03 (2003).

2.4 Sample preparation

The product is thoroughly mixed to ensure complete product uniformity, using accepted coating practices, before any product is sampled from the container for any part of this test procedure.

2.5 Determination of weight solids

An aluminium dish or foil with an area such that 3 – 10 grams of the coating gives a film of coating in the dish at 75 – 100% of the maximum wet film thickness recommended for a single coat application is selected.

Fill a pipette with the coating and weigh the contents, discharge the appropriate amount on the dish or foil. Reweigh the pipette and determine the quantity of wet coating applied.
The product should be weighed into the dish or foil keeping the wet film as uniform in thickness as is practically possible.

The measurement principles outlined in ASTM D2697-03 (2003) are followed.

A minimum drying regime of 35°C for 24 hrs is used for the determination of weight solids.

Drying is continued for a maximum of 48 hours or to constant weight, if sooner, based on minimum 4-hour interval checks between measurements.

2.6 Determination of dry film specific gravity

The coating is applied to panels by the most commonly used ‘real life’ method of application for the particular product, e.g. brush or airless spray etc. Tip sizes, tip angles, pressures etc should all be as commonly used in actual application.

The coating is applied at 75-100% of the maximum wet film thickness recommended for a single coat application. Panels are prepared in triplicate.

[Note: when applying coating by spraying, it is essential that the application is carried out in such a way that dry spray is avoided]

The measurement principles in ASTM D2697-03 (2003) are followed

A minimum drying regime of 35°C for 24 hrs is used for the determination of the weight of the coated panel in air and water.

Drying is continued for a maximum of 48 hours or to constant weight, if sooner, based on minimum 4-hour interval checks between measurements.

It is recommended that thin-gauge tin plate or aluminium panels are used to minimise their weight contribution and thus to increase precision. Panel sizes in the range 50 mm X 50 mm to 50 mm x 150 mm, with a small hole to accept a hook for weighing purposes, can be used. If films are flexible enough, coated panels may be folded for greater convenience, when weighing in water.

[Note: weighing in water must be carried out within 20 seconds of immersion – the nature of some intumescent coatings is such that they absorb water extremely rapidly, giving an erroneous result]

2.7 Calculations

As per ASTM D2697-03 (2003).

2.8 Presentation of results

If the triplicate results are within 2% (absolute) of each other, then a simple average of the three results is quoted.

If one sample is more than 2% greater than, and the others are within 0.5% of, each other, then the average of those two results is quoted.

If neither is the case then the exercise is repeated until consistent results are obtained.

3. Volume solids range (tolerances)

The acceptable tolerance on the volume solids (range) is taken as ± 5% of the actual measured values, rounded up to the nearest whole integer

e.g. if a determined volume solids is 75%,
then 5% of 75 = 3.75,
and the quoted volume solids are 75±4%.

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