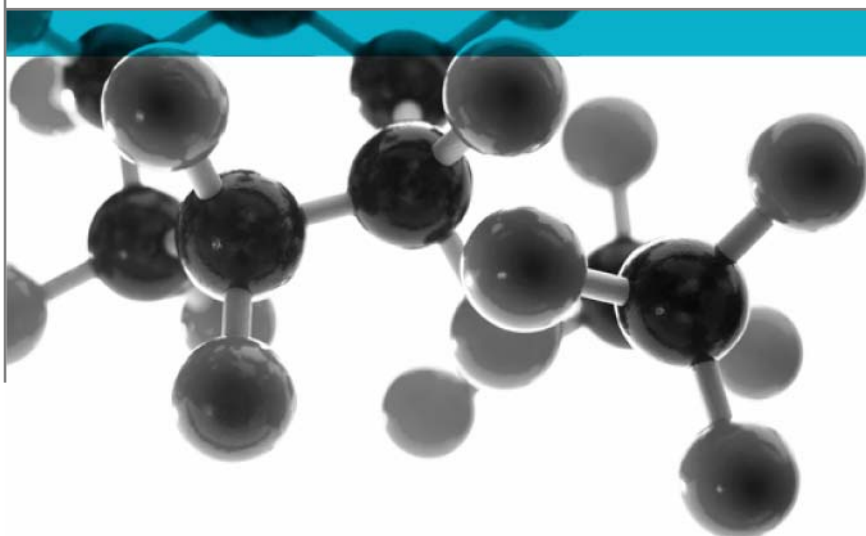


BS 6853:1999: Annex B.2



Determination of weighted summation of toxic fume, R – Area based test method

A Report To: PPG Industries (UK) Limited

Document Reference: 194346

Date: 17th July 2010

Issue No.: 1

Page 1

Testing
Advising
Assuring

Executive Summary

Objective To determine the toxic fume produced from the following product when tested in accordance with BS 6853: 1999 incorporating amendment No. 1: Annex B.2:



Generic Description	Product reference	Thickness	Weight per unit area or density
A five coat coating system applied to a 2mm thick aluminum substrate	"PPG2010009"	2.06mm*	5.57kg/m ² *
Individual components used to manufacture composite:			
2-pack polyurethane finish"	"Selemix Direct 7-533 (1 775.3300)"	3 x 25 microns	1.6
1K adhesion promoter	"Nexa Autocolor P572-2001 1K Adhesion Primer"	2 x 3 microns	0.85
Aluminium substrate	"Aluminium 6082 T6"	2mm	2.70g/cm ³
* Determined by Exova Warringtonfire			
Please see page 5 of this test report for the full description of the product tested			

Test Sponsor PPG Industries (UK) Limited, Needham Road, Stowmarket, Suffolk, IP14 2AD

Summary of Test Results: The R Value determined was 0.26.

Date of Test 1st July 2010

Signatories

	
Responsible Officer J. Lucas-Cox * Principal Chemist	Authorised C. Dean * Operations Manager

* For and on behalf of **Exova Warringtonfire**.

Report Issued: 17th July 2010

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Document No.: 194346

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Client: PPG Industries (UK) Limited

Page No.: 2 of 10

Issue Date: 17th July 2010

Issue No.: 1



0249

CONTENTS

PAGE NO.

EXECUTIVE SUMMARY 2

SIGNATORIES..... 2

TEST DETAILS..... 4

DESCRIPTION OF TEST SPECIMENS..... 5

TEST PROCEDURE 6

TEST RESULTS 7

TABLE 1 9

REVISION HISTORY 10



Test Details

Introduction

Exova Warringtonfire was commissioned to carry out an area based toxicity test in accordance with the method recommended in BS 6853:1999 Incorporating Amendment 1, Informative Annex B.2. This standard recommends that the test is carried out using the apparatus detailed in prEN2824 but the ignition cone used should conform with the requirements given in BS ISO 5659-2 and that the quantitative determination of the gases emitted should be carried out in accordance with the procedure specified in prEN2826.

The test was performed in accordance with the procedure specified in prEN2825 and prEN2826 amended in accordance with the recommendations given in BS6853: 1999 Annex B and this report should be read in conjunction with these and other related standards.

Test method

The principle of the test methods detailed in prEN2825 and prEN2826 is to expose a material to specified thermal conditions of pyrolysis and combustion in a continuous procedure. The change in optical density of the smoke produced when dispersed within a fixed volume of air is recorded throughout the period of test. Quantitative determination of toxic gases emitted is carried out using wet analysis.

The test method provides a means for the comparative assessment of products, however, it does not model a real fire situation and the results cannot therefore be used to describe the fire hazard of materials under actual fire conditions.

Fire test study group/EGOLF

Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group and EGOLF have identified a number of such areas and has agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Groups. Where such Resolutions are applicable to this test they have been followed.

Instruction to test

The test was conducted on the 1st July 2010 at the request of PPG Industries (UK) Limited, the sponsor of the test.

Provision of test specimens

The specimens were supplied by the sponsor of the test. **Exova Warringtonfire** was not involved in any selection or sampling procedure.

Conditioning of specimens

The specimens were received on the 15th June 2010.

The specimens were conditioned at temperatures of $23 \pm 2^\circ\text{C}$ and a relative humidity of $50 \pm 5\%$ RH, for a minimum period of 24 hours prior to testing.

Test Face

The coated face of the specimen was exposed to the radiant heat source.

Description of Test Specimens

The description of the specimens given below has been prepared from information provided by the sponsor of the test. All values quoted are nominal, unless tolerances are given.

General description		A five coat coating system applied to a 2mm thick aluminum substrate
Product reference of coating system		"PPG2010009"
Overall coating system thickness		Approx. 81 microns
Overall thickness of composite		2.06mm (determined by Exova Warringtonfire)
Overall weight per unit area of composite		5.57kg/m ² (determined by Exova Warringtonfire)
Final coating product (Test face)	Generic type	2-pack polyurethane finish
	Product reference	"Salemix Direct 7-533 (1 775.3300)"
	Name of manufacturer	PPG Industries
	Colour	"White (RAL 9010)"
	Number of coats	3
	Application thickness per coat	25 microns per coat
	Application method	HVLP spray
	Specific gravity	1.6
	Flame retardant details	See Note 1 below
Curing process per coat	1 st coat – 10 mins flash off 2 nd coat - 10 mins flash off + 30 mins at 60°C	
First coating product	Generic type	1K adhesion promoter
	Product reference	"Nexa Autocolor P572-2001 1K Adhesion Primer"
	Name of manufacturer	PPG Industries
	Colour	Clear
	Number of coats	2
	Application thickness per coat	3 microns
	Application method	HVLP spray
	Specific gravity	0.85
	Flame retardant details	See Note 1 below
Curing process per coat	1 st coat – 10 mins flash off at RT 2 nd coat - 10 mins flash off before recoating.	
Substrate	Product reference	"Aluminium 6082 T6"
	Generic type	Aluminium
	Name of manufacturer	Pro-Test Panels Ltd.
	Thickness	2mm
	Density	2.70g/cm ³
	Flame retardant	The substrate is inherently flame retardant
	Preparation details	Machine sand with P240 paper and degrease with Nexa Autocolor P850-1378 Spirit Wipe
Brief description of manufacturing process of coatings		All paint systems manufactured by HSD / Beadmill process. All products used as per Product Data Sheet

Note 1. The sponsor of the test has confirmed that no flame retardant additives were utilised in the production of the component

Test Procedure

Specimens were tested in the flaming mode in a horizontal position by exposure to the heating arrangement specified in ISO 5659-2. The heat flux was 25kW/m².

The sampling and analysis of the fire gases generated during the test is conducted using a variety of methods as defined in the internal operating procedure.

In all cases, the sample is taken from the geometric centre of the chamber with sample lines being kept as short as possible to minimise sample losses.

For the analysis of oxides of carbon and nitrogen, continuous measurements are made throughout the duration of the test.

Carbon dioxide (CO₂) and carbon monoxide (CO) are determined continuously using precalibrated non-dispersive infra-red analysers. The values reported are those measured at 85% smoke obscuration.

Oxides of nitrogen (NO_x) are determined continuously using a chemiluminescence analyser. Again, the values reported are those measured at 85% smoke obscuration.

For the other gases, single point analysis is conducted, the gases being absorbed into an aqueous media and analysed remotely. Two types of media are used, 0.1M sodium hydroxide solution and 0.3% hydrogen peroxide solution. The gases are sampled over a two minute period commencing when smoke density has reached 85% obscuration by bubbling the gases through the aqueous media using a fitted funnel Dreschel bottle arrangement.

Hydrogen cyanide (HCN) is determined from gases absorbed into a 0.1M solution of sodium hydroxide and analysed using ion chromatography. The concentration determined is an average over each 2 minute period beginning at 85% smoke obscuration.

Hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen fluoride (HF) and sulphur dioxide (SO₂) are absorbed into a 0.3% solution of hydrogen peroxide and are also analysed by ion chromatography. The concentration determined is an average over each 2 minute period beginning at 85% smoke obscuration.

Test Results

Applicability of test results

The test results relate only to the behaviour of the specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential smoke and toxicity hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and will therefore invalidate the test results. It is the responsibility of the supplier of the product to ensure that the product which is supplied is identical with the specimens which were tested.

Gases sampled

One specimen was tested to determine the $D_{s_{max}}$ and time to $D_{s_{max}}$. From the results of this test time to reach 85% of $D_{s_{max}}$ was calculated. The results are given below:

$D_{s_{max}}$	11
Time to $D_{s_{max}}$ (T_{max})	15:00
Time to 85% of $D_{s_{max}}$ (T_{max} 85%)	12:00

Three further specimens were then tested. Gases generated were sampled after twelve minutes test duration. The quantitative determinations were then carried out using the procedures described. The test results obtained are provided below and test observations are detailed in Table 1.

Gas	Specimen No. 1	Specimen No. 2	Specimen No. 3	Average
Carbon Monoxide	4.83	5.33	5.73	5.29
Carbon Dioxide	1394.41	1391.25	1405.62	1397.09
Sulphur Dioxide	ND	ND	ND	ND
Hydrogen Chloride	ND	ND	0.19*	0.06
Hydrogen Bromide	ND	ND	ND	ND
Hydrogen Fluoride	ND	ND	ND	ND
Hydrogen Cyanide	ND	ND	ND	ND
Nitrogen Oxides	0.99	1.16	0.99	1.05

Where: ND indicates non-detected.
 * indicates \leq limit of quantification
 Note: All values given are in g/m^2 .

Weighted Summation of Toxic Fume, R

The test results obtained for toxicity measurements were used to calculate the weighted summation index, R, as described in BS 6853: 1999: Annex B.4.2.

The R Value determined was 0.26.

Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

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Table 1

Testing with Flame Application									
Specimen	D _s after t in minutes							D _s max. within 1.5 min	D _s max. within 4 min
	1	1.5	2	3	4	5	6		
Smoke run	0	0	0	0	0	1	1	0	0

Observations during test

Specimen No.	Initial Smoke Production Test	Toxicity Tests		
		1	2	3
Colour of smoke produced	Light	Light	Light	Light
Expansion distance towards heater (mm)	N/A	N/A	N/A	N/A
Ignition time in seconds (if applicable)	N/A	N/A	N/A	N/A
Extinction time in seconds (if applicable)	N/A	N/A	N/A	N/A
0 = Did Not Occur * = Did Not Re-ignite N/A = Not Applicable				

Revision History

Issue No :	Issue Date:
Revised By:	Approved By:
Reason for Revision:	

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