TEST REPORT

REPORT NUMBER: 101941047MID-002
ORIGINAL ISSUE DATE: April 14, 2015
REVISED DATE: NA

EVALUATION CENTER
Intertek Testing Services NA Inc.
8431 Murphy Drive
Middleton, WI 53562

RENDERED TO
Jeff Burns
jburns1969@yahoo.com
Briteworks Global Services, LLC
4551 NE 5th Terrace
Oakland Park, FL 33334

PRODUCT EVALUATED: M.A.D. Rubber
EVALUATION PROPERTY: IMO FTP Code part 2 Smoke Density and Toxicity Test

Report of Testing of samples representative of M.A.D. Rubber for compliance with the applicable requirements of the following criteria: IMO FTP Code part 2 Smoke and Toxicity Test

1 Table of Contents

1 Table of Contents 2
2 Introduction 3
3 Test Samples 3
3.1. SAMPLE SELECTION 3
3.2. SAMPLE AND ASSEMBLY DESCRIPTION 3
4 Testing and Evaluation Methods 3
4.1. Overview 3
4.2. Instrumentation 4
4.3. ISO 5659-2 and IMO FTP Code part 2 Smoke Density and Toxicity 4
5 Testing and Evaluation Results 7
5.1. RESULTS AND OBSERVATIONS 7
5.2. EXAMINATION OF RESULTS 10
6 Conclusion 11
7 REVISION SUMMARY 11

2 Introduction

Intertek Testing Services NA (Intertek) has conducted testing for Briteworks Global, on samples representative of M.A.D. Rubber to evaluate smoke density and smoke toxicity. Testing was conducted in accordance with ISO 5659:2006 part 2 and standard methods of Part 2 of Annex 1 of the IMO FTP Code. This evaluation began April 13, 2015 and was completed April 14, 2015.

3 Test Samples

3.1. SAMPLE SELECTION

Samples were submitted by Briteworks Global. Samples were received at the Intertek Middleton Evaluation Center March 23, 2015 in good condition.

3.2. SAMPLE AND ASSEMBLY DESCRIPTION

Sample Names: M.A.D. Rubber

Sample description: Samples were prepared by the client to 3"x 3" specifications with an average thickness of 3mm (including the substrate and coating).

Samples were preconditioned at 23 +/- 2 °C and 50 +/- 10 % humidity for minimum of 24 hours prior to testing. Constant weighs were reached with two consecutive measurements at intervals of 24 hours as required by the standard.

4 Testing and Evaluation Methods

4.1. Overview

This test method employs an electrically heated radiant energy source mounted within an insulated cone and positioned so as to produce an irradiance level of 25 kW/m^2 and 50 kW/m^2 averaged over the central 1.5-in. (38.1-mm) diameter area of a horizontally mounted specimen facing the radiant heater. The nominal 75 by 75 +0/-1 mm specimen is mounted within a holder which exposes an area measuring 65 by 65 mm. The holder is able to accommodate specimens up to 25 mm thick. This exposure provides the non-flaming conditions of the test.

For the flaming condition, a burner is used to apply a single flame burner that has a flame length of 30 mm +/- 5 mm and is positioned horizontally 10 mm above the top face of the specimen. The color of the flame was blue with a yellow tip. A small spark ignition device is used. Propane with 95% purity was used with flow rates and pressure in accordance with the standard.

The test specimens are exposed to the flaming and non-flaming conditions within a closed chamber. A photometric system with a vertical light path is used to measure the varying light transmission as smoke accumulates. The light transmittance measurements are used to calculate specific optical density of the smoke generated during the time period to reach the maximum value.

This test method provides a means for determining the specific optical density of the smoke generated by specimens of materials and assemblies under the specified exposure conditions. Values determined by this test are specific to the specimen or assembly in the form and thickness tested and are not to be considered inherent fundamental properties of the material tested. Thus, it is likely that closely repeatable or reproducible experimental results are not to be expected from tests of a given material when specimen thickness, density, or other variables are involved.

4.2. Instrumentation

The test chamber (Superpressure, Newport Scientific, Inc) (ID# 1150 and #1151) is composed of laminated panels that provided inside dimensions of 36 by 24 by 36 in. (914 by 610 by 914 mm) for width, depth, and height, respectively. The interior surfaces consist of porcelain enameled metal, resistant to chemical attack and corrosion, and 2 sealed windows accommodate a vertical photometric system. When all openings are closed, the chamber is capable of developing and maintaining positive pressure during test periods.

An electric cone furnace is used to provide a constant irradiance on the specimen surface. The furnace is located 305 mm from the back of the chamber, and 305 mm from the right wall. The furnace control system maintains the required irradiance level at 25 kW/m^2 or 50 kW/m^2, under steady-state condition with the chamber door closed. The control system consists of an autotransformer and a voltmeter for monitoring the electrical input. Specimen holders expose a 65 by 65 mm specimen area. For the flaming exposure test, a burner is used. A flux meter is used to standardize the output of the radiant heat furnace.

The photometric system consists of a light source and photodetector, oriented vertically to reduce measurement variations resulting from stratification of the smoke generated by materials under test. The light source is an incandescent lamp operated at a fixed voltage in a circuit powered by a constant voltage transformer. The light source is mounted in a sealed box and provides a collimated light beam passing vertically through the chamber. The light source is maintained at an operating voltage required to provide a brightness temperature of 2200°K. The photodetector is a photomultiplier tube, with an S-4 spectral sensitivity response and a dark current less than 10^{-9} A. A set of nine gelatin compensating filters varying from 0.1 to 0.9 neutral density are mounted one or more as required in the optical measuring system to correct for differences in the luminous sensitivity of the photomultiplier tube. These filters also provide correction for light source or photomultiplier aging and reduction in light transmission, through discolored or abraded optical windows. A light-tight box is located directly opposite the light source and holds the photodetector housing and the associated optics. A glass window is used to isolate the photodetector and its optics from the chamber atmosphere. In addition to the above compensating filter, a neutral density range extender filter permitting the system to measure to Optical Density is mounted below the photodetector.

4.3. ISO 5659-2 and IMO FTP Code part 2 Smoke Density and Toxicity

All calibration and cleaning is run in accordance with ISO 5659-2 prior to testing.

For the IMO FTP Code part 2, three tests are conducted under flaming exposure at 25 kW/m^2 and three tests each under non-flaming exposure 25 kW/m^2 and 50 kW/m^2 on each material. For each of the individual specimens, if for no apparent reason, the value of Ds max for any

individual specimen differs from the average value for the set of three specimens of which it is part by more than 50% of that average, an additional set of three specimens are tested for the same sample in the same mode and the average of all six results obtained is recorded. Even under the same test condition, one specimen may burn with flaming while the other may not burn with flaming. This would be considered an apparent reason for a >50% difference from the average.

The specimen is wrapped is a single sheet of aluminum foil (approximately 0.04 mm thick) with the dull side in contact with the specimen. Care is taken not the puncture the foil or introduce unnecessary wrinkles during warping. Excess foil is removed after mounting the specimen on the holder. The wrapped specimen is placed with a sheet of none-combustible insulation board and layer of low density refractory-blanked under the non-combustible board.

Once the system has reached steady-state conditions, the photometer readouts are adjusted. Before positioning the test specimen, the chamber is flushed with the door and exhaust and inlet vents open for about 2 min. The exhaust vent and blower is then closed. Place the wraped specimen in the holder. Place the holder and the specimen on the support framework below the radiant cone. Remove the radiant shield from below the cone and simultaneously start the data-recording system and close the inlet vents.

All observations pertinent to the burning and smoke generating properties of the material under test are recorded. The tests are run for at least 10 minutes. If the minimum light transmittance value has not been reached during the 10-minute exposure, the test is continued for another 10-minute period. If transmittance falls below 0.01 %, the chamber window is covered with a stainless shield to avoid possible light-scattering effects from room light. The burner is extinguished on flaming exposures and the chamber was cleared of smoke 1 min after terminating the test.

The specific optical density, *Ds*, is calculated as follows and recorded at least every 5 seconds:

The chamber and the gas line is heated to 165^{o}C. The gas pump is started. . The gas pump is adjusted to about 5L/min.

Before positioning the test specimen, the chamber is flushed with the door, and exhaust and inlet vents open for about 2 min. The exhaust vent and blower are then closed. Once the system reaches steady-state conditions, the baseline for the FTIR readings is run. The Bruker Tensor 27 (ID#1046) is used. The chamber door is closed. The specimen holder is placed on the holder support and shutter is opened (with burner in position for flaming exposure). The inlet vent is closed completely when the photometer indicates the presence of smoke. All observations pertinent to the burning and smoke generating properties of the material under test are recorded. The sampling of the fumes is made during the second or third specimen at each test condition, from the geometric center of the camber within 3 minutes of the maximum specified optical density of the smoke being reached. The test is run for a period of at least 10 minutes. If the minimum light transmittance value has not been reached during the 10 minute exposure, the test is continued for a further 10 minute period. One minute after the run has completed the chamber vents are opened. The FTIR data is then processed and analyzed.

Smoke
An average maximum smoke density for the three tests at each test condition will be calculated.

- The maximum smoke density for material used as a surface for bulkheads, linings or ceilings cannot exceed 200 in any test condition.
- The maximum smoke density for material used as a surface for primary deck covering cannot exceed 400 in any test condition.
- The maximum smoke density for material used as a surface for floor covering cannot exceed 500 in any test condition.
- The maximum smoke density for material used as a surface for pipes and electrical cables cannot exceed 400 in any test condition.

Toxicity
The gas concentration measured at each test condition shall not exceed the following limits:

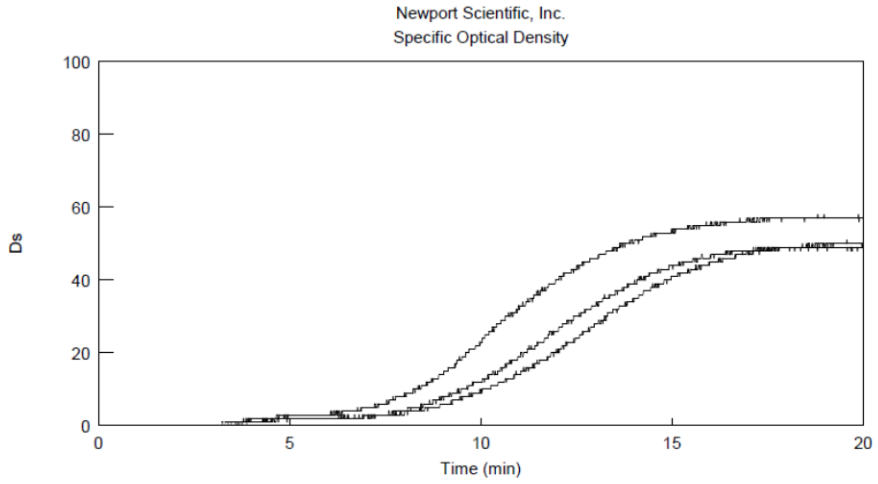
Gas Compound	Critical Concentrations (ppm)
Carbon Monoxide	1450
Oxides of Nitrogen	350
Sulfur Dioxide	120 (200*)
Hydrogen Chloride	600
Hydrogen Fluoride	600
Hydrogen Bromide	600
Hydrogen Cyanide	140

* 200 ppm for floor coverings

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

25kW/m² without a pilot flame Data:



Summary

Run	Specimen #	Ds @ 1.5 min	Ds @ 4 min	Max Ds (first 4 min)	Max Ds Time (first 4 min)	Max Ds	Max Ds Time
1	M.A.D. Rubber	0.0	2.0	2.0	3:47.9	58.0	18:48.7
2	M.A.D. Rubber	0.0	1.0	1.0	3:28.4	51.0	19:34.4
3	M.A.D. Rubber	0.0	1.0	1.0	3:34.9	49.0	17:07.8
Avg.		0.0	1.3	1.3	0:00.0	52.7	18:30.3

Avg Backwall Temp: 118.6 °Fahrenheit Min Backwall Temp: 94.2 °Fahrenheit Max Backwall Temp: 123.7 °Fahrenheit

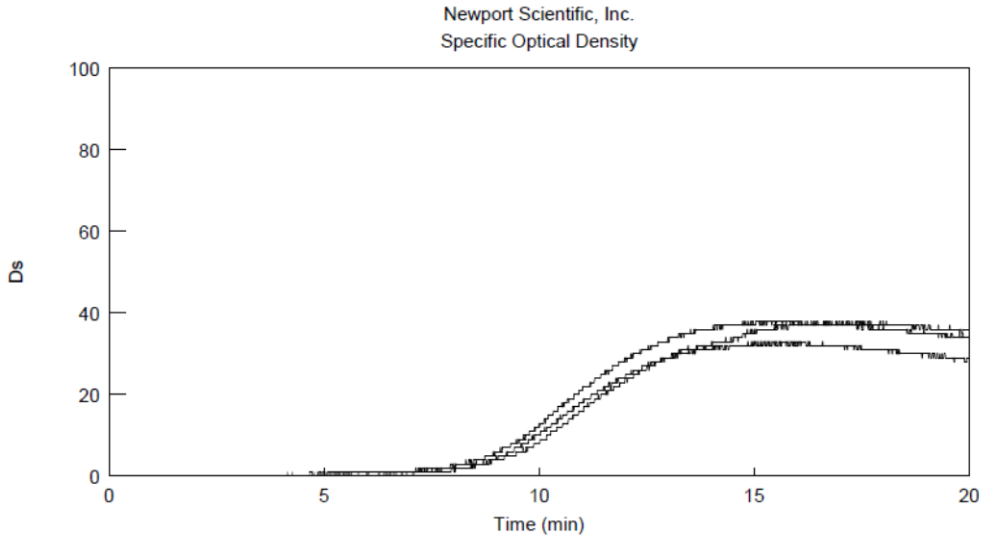
Smoke Toxicity for 25kW/m² without a pilot flame:

Gas Compound	Observed (ppm)	Analysis Detection Limits (ppm)	Critical Concentrations (ppm)
Carbon Monoxide	Not detected	20	1450
Oxides of Nitrogen	Not detected	10	350
Sulfur Dioxide	Not detected	5	120
Hydrogen Chloride	Not detected	10	600
Hydrogen Fluoride	Not detected	20	600
Hydrogen Bromide	Not detected	25	600
Hydrogen Cyanide	Not detected	7	140

Observations for 25kW/m² without a pilot flame:

Specimen	Observation during the test: Events like delamination, intumescence, shrinking, melting, and collapse noting time of start of events. Time of ignition and duration of flames. Smoke characteristics like color and nature of settled practical matter.
1	Coating chars.
2	Coating chars.
3	Coating chars.

25kW/m^2 with a pilot flame Data:



Summary

Run	Specimen #	Ds @ 1.5 min	Ds @ 4 min	Max Ds (first 4 min)	Max Ds Time (first 4 min)	Max Ds	Max Ds Time
1	M.A.D. Rubber	0.0	0.0	0.0	0:00.0	38.0	14:44.1
2	M.A.D. Rubber	0.0	0.0	0.0	0:00.0	33.0	14:51.3
3	M.A.D. Rubber	0.0	0.0	0.0	0:00.0	38.0	16:23.3
Avg.		0.0	0.0	0.0	0:00.0	36.3	15:19.6

Avg Backwall Temp: 126.8 °Fahrenheit Min Backwall Temp: 98.3 °Fahrenheit Max Backwall Temp: 131.7 °Fahrenheit

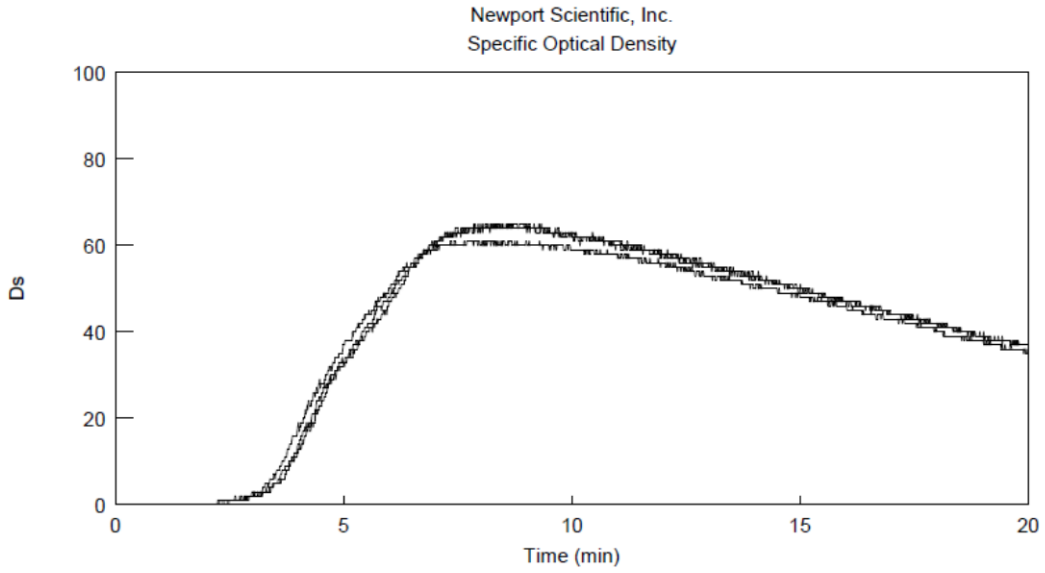
Smoke Toxicity for 25kW/m^2 with a pilot flame:

Gas Compound	Observed (ppm)	Analysis Detection Limits (ppm)	Critical Concentrations (ppm)
Carbon Monoxide	38	20	1450
Oxides of Nitrogen	Not detected	10	350
Sulfur Dioxide	Not detected	5	120
Hydrogen Chloride	Not detected	10	600
Hydrogen Fluoride	Not detected	20	600
Hydrogen Bromide	Not detected	25	600
Hydrogen Cyanide	Not detected	7	140

Observations for 25kW/m^2 with pilot flame:

Specimen	Observation during the test: Events like delamination, intumescence, shrinking, melting, and collapse noting time of start of events. Time of ignition and duration of flames. Smoke characteristics like color and nature of settled practical matter.
4	Coating chars, no ignition.
5	Coating chars, no ignition.
6	Coating chars, no ignition.

50kW/m^2 without a pilot flame Data:



Summary

Run	Specimen #	Ds @ 1.5 min	Ds @ 4 min	Max Ds (first 4 min)	Max Ds Time (first 4 min)	Max Ds	Max Ds Time
1	M.A.D. Rubber	0.0	18.0	17.0	3:59.4	61.0	7:20.6
2	M.A.D. Rubber	0.0	14.0	13.0	3:59.3	65.0	8:14.5
3	M.A.D. Rubber	0.0	12.0	12.0	3:59.4	65.0	7:51.5
Avg.		0.0	14.7	14.0	0:00.0	63.7	7:48.9

Avg Backwall Temp: 145.8 °Fahrenheit Min Backwall Temp: 112.8 °Fahrenheit Max Backwall Temp: 152.7 °Fahrenheit

Smoke Toxicity for 50kW/m^2 without a pilot flame:

Gas Compound	Observed (ppm)	Analysis Detection Limits (ppm)	Critical Concentrations (ppm)
Carbon Monoxide	38	20	1450
Oxides of Nitrogen	Not detected	10	350
Sulfur Dioxide	Not detected	5	120
Hydrogen Chloride	Not detected	10	600
Hydrogen Fluoride	Not detected	20	600
Hydrogen Bromide	Not detected	25	600
Hydrogen Cyanide	Not detected	7	140

Observations for 50kW/m^2 without a pilot flame:

Specimen	Observation during the test: Events like delamination, intumescence, shrinking, melting, and collapse noting time of start of events. Time of ignition and duration of flames. Smoke characteristics like color and nature of settled practical matter.
7	Coating chars, no ignition.
8	Coating chars, no ignition.
9	Coating chars, no ignition.

5.2. EXAMINATION OF RESULTS

Smoke Density

Sample M.A.D. Rubber has passed the smoke density portion of the IMO FTP Code Part 2 for material used as a surface for primary deck covering (max Ds of 400) and material used as a surface for floor covering (Max Ds of 500). The maximum Ds of M.A.D. Rubber was 65.0.

Smoke Toxicity

The gas concentration measured at each test condition shall not exceed the following limits:

Gas Compound	Critical Concentrations (ppm)
Carbon Monoxide	1450
Oxides of Nitrogen	350
Sulfur Dioxide	120 (200*)
Hydrogen Chloride	600
Hydrogen Fluoride	600
Hydrogen Bromide	600
Hydrogen Cyanide	140

* 200 ppm for floor coverings

Sample M.A.D. Rubber meets these criteria for smoke toxicity.

6 Conclusion

Intertek Testing Services NA (Intertek) has conducted testing for Briteworks Global on M.A.D. Rubber to evaluate smoke density and toxicity production characteristics. Testing was conducted in accordance with and following the standard method IMO FTP Code part 2.

The Briteworks Global sample M.A.D. Rubber **passed** the requirements of IMO FTP Code part 2 for material used as a surface for primary deck covering and as a floor covering.

The conclusions of this test report may be used as part of the requirements for Intertek product certification. Authority to Mark must be issued for a product to become certified.

INTERTEK

Reported by:
Joseph Beckstrand
Lab Technician III, Verification Center

Reviewed by:
Bryan Bowman
Chemist, Verification Center

7 REVISION SUMMARY

DATE	SUMMARY
April 14, 2015	Original date of report