EASTMAN

Eastman Spectar™
copolyester

Flammability testing

Information on test methods, test results, and compliance with building code requirements

Eastman Spectar™ copolyester has passed the National Fire Protection Association's (NFPA) 286 flammability test required by regional and national building codes. Its durability and resilience, combined with the industry's overall acceptance, prove Spectar to be the ideal material solution for the building and construction industry. The following information describes the test methods and results for Spectar.

Building flammability test methods for interior finishes

United States and international building codes require flammability testing for interior building materials, including wall and ceiling finishes, and thermoplastics and light-transmitting plastics. The International Building Code® and various U.S. regional and state building standards (i.e., Chicago Building Code, New York City Building Code, California Building Code) require that nontextile interior finishes be tested through one of two possible test methods: the Steiner Tunnel test—also identified as ASTM E84, UL 723, or NFPA 255—or the NFPA 286 test.

Steiner Tunnel test

Testing process

The Steiner Tunnel test provides an evaluation of the surface burning characteristics of a building material. It uses a material sample measuring 24 by 2 feet configured as one unbroken length of material or by individual sections joined end to end to form the required length. The sample is then mounted with the face surface down to form the roof of a horizontal tunnel measuring 12 inches high. Two gas burners measuring an 89 kW intensity serve as the fire source and ignite the sample from below. Combustion products are removed with a controlled linear air velocity of 240 feet per minute.

The normal output is a flame spread index (FSI) and a smoke developed index (SDI). Flame spread is assessed visually by the progression of the flame front, while smoke obscuration is determined by measuring the optical smoke density at the tunnel outlet. Because the test provides a value for the FSI and SDI, there is no "passing or failing" the test; rather, the test merely calculates FSI and SDI values. Since the test is solely a measure of surface burning characteristics, material that falls to the bottom of the test chamber is irrelevant in determining the FSI, unless that material contributes to the continued surface burning of the test specimen in the sample frame.

All three Steiner Tunnel test methods (ASTM E84, UL 723, or NFPA 255) allow the test to be terminated before the complete 10-minute duration. The criteria for early termination are the sample material in the flame area of the chamber has extinguished; the flame front has stopped advancing; and the smoke development value has returned to the baseline. At this point, surface burning is exhausted and no additional smoke from surface burning is generated. Therefore, the experiment can be terminated; however, smoke development will be recorded until the end of the test and reported as part of the results.

Usage and analysis

The Steiner Tunnel test was first used to determine the surface burning characteristics of building materials after a series of disastrous fires in the 1940s, including the Coconut Grove fire in Boston. It was intended to compare the burning characteristics of cohesive materials to burning characteristics of red oak. While it was widely recognized that the Steiner Tunnel test did not necessarily predict the true behavior of a material in a real fire, the test was the best method available at that time to evaluate the burning characteristics of building materials.

The test, however, does not effectively evaluate materials such as thermoplastics and foam insulation, which may melt to the bottom of the test chamber or need to be secured in place.

Steiner Tunnel flammability test results for Eastman Spectar™ copolyester

Underwriters' Laboratories tested sheet of Eastman Spectar™ copolyester according to UL 723: test for surface burning characteristics of building materials. The test generated the following results:

Note: The listing can be viewed online at www.ul.com in "Certifications" under file number R18462.

	Thickness	
	3 mm	6 mm
Flame spread	45–75[a]	50[b]
Smoke developed	15–120[a]	5[b]

[a]*Flame spread and smoke developed recorded while material remained in the original test position. Ignition of molten residue on the furnace floor resulted in flame travel equivalent to calculated flame spread classification of 45-75 and smoke developed classification of more than 500.*

[b]*Flame spread and smoke developed recorded while material remained in the original test position. Ignition of molten residue on the furnace floor resulted in flame travel equivalent to calculated flame spread classification of 50 and smoke developed of more than 500.*

NFPA 286 test

Background

The Steiner Tunnel test was never intended to accurately describe the actual behavior of a material in a fire. The American Society for Testing and Materials' standard ASTM E84 states in Section 1.7:

> This standard should be used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of the test may be used as elements of a fire-hazard assessment or a fire-risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard or fire risk of a particular end use.

In recognition of this fact, other increasingly quantifiable, scientific test methods were developed and perfected to evaluate the fire response of interior finishes and building materials. This includes the NFPA 286 room-corner burn test: standard methods of fire tests for evaluating contribution of wall and ceiling interior finish to room fire growth.

Testing process

In the NFPA 286 room-corner test, a room with dimensions measuring 8 by 12 by 8 feet and a doorway are lined with the test material. The interior finish tests can be run in a variety of wall configurations; wall-only, ceiling-only, or wall and ceiling layouts. The test is conducted by placing a gas burner in one corner near the wall furthest from the doorway, which generates 40 kW for 5 minutes, simulating the start of a fire such as in a trash can. This is followed by 160 kW, simulating the spread of the fire to a piece of furniture, such as a sofa or chair, for an additional 10 minutes. Heat release (calculated by the principle of oxygen consumption calorimetry) and smoke release are then measured in the exhaust duct, and changes in temperature and heat are measured in the room. The test also records additional events such as flames reaching the ceiling during the 40 kW period; ignition of paper on the room floor; and flames exiting the doorway during the test.

Usage and analysis

NFPA 286 is a more effective simulation of the dynamics and physics involved in a fire because it accurately describes the behavior of a building material during a real fire situation. For this reason, fire scientists and fire protection engineers prefer the NFPA 286 test to other test methods when generating data to describe and model mechanics of an actual fire.

NFPA 286 flammability test results for Eastman Spectar™ copolyester

Eastman Spectar™ copolyester has been evaluated according to NFPA 286 and has passed in the following gauges and mounting methods:

0.060" Wall configuration	Rigid mount	4' X 8' sheet	16" centers	Attached to wall
0.060" Wall configuration	Perimeter mount	4' X 8' sheet	24" centers	Attached to wall
0.236" Wall configuration	Rigid mount	4' X 8' sheet	16" centers	Attached to wall
0.236" Wall configuration	Perimeter mount	4' X 8' sheet	24" centers	Attached to wall
0.060" Wall configuration	Rigid mount	4' X 8' sheet	16" centers	Sheet 1" from wall
0.354" Wall configuration	Rigid mount	4' X 8' sheet	16" centers	Sheet 1" from wall

Building code requirements and product approval for interior finishes

As outlined in various building codes, the Authority Having Jurisdiction (AHJ) has the ultimate responsibility for approving products for use as an interior finish. If necessary, a building code official reviews available technical information to determine whether a material can be approved for a particular application within the jurisdiction. The International Building Codes (I-Codes), published by the International Code Council® (ICC), are gaining wider acceptance and are being promulgated into law as state and local building codes around the U.S. The AHJs maintain the power to modify the I-Codes, as needed, to meet local needs and several larger jurisdictions. The city of New York, the city of Chicago, and the state of California, for example, publish their own building codes with different requirements for interior finishes.

A building code official can consider alternate materials and determine whether the material is at least the equivalent in quality, strength, effectiveness, fire resistance, durability, and safety as prescribed in the code.

Approved plastics and light-transmitting plastics

All building codes allow the use of approved plastics and light-transmitting plastics in interior and exterior building applications. Section 2602 of the International Building Code® defines an approved plastic as:

"Any thermoplastic, thermosetting or reinforced thermosetting plastic material that conforms to combustibility classifications specified in the section applicable to the application and plastic type."

An approved light-transmitting plastic:

" . . . shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D1929; a smoke-developed index not greater than 450 where tested in the manner intended for use in accordance with ASTM E84, or not greater than 75 where tested in the thickness intended for use, in accordance with ASTM D2843; and shall conform to one of the following combustibility classifications:"

Class CC1: Plastic materials that have a burning extent of 1 in. (25 mm) or less where tested at a nominal thickness of 0.060 in. (1.5 mm), or in the thickness intended for use, in accordance with ASTM D635.

Class CC2: Plastic materials that have a burning rate of 2.5 in. (1.06 mm/S) or less where tested at a nominal thickness of 0.060 in. (1.5 mm), or in the thickness intended for use, in accordance with ASTM D635.

- **ASTM D635**
  Sheet made from Eastman Spectar™ copolyester when tested according to ASTM D635 meets the requirements for classification CC1 at nominal thicknesses of 1.5 mm (0.060 in.) to 6 mm (0.236 in.).

- **ASTM D1929**
  Sheet made from Eastman Spectar™ copolyester has a self-ignition temperature greater than 800°F (425°C). This test result exceeds the International Building Code® requirement of 650°F (345°C).

- **ASTM D2843**
  Sheet made from Eastman Spectar™ copolyester has Smoke-Density Rating of less than 75 tested in gauges from 0.080 to 0.236. This test result is less than the International Building Code® requirement of 75 maximum.

Eastman has submitted technical data to ICC-Evaluation Service for independent technical verification for several materials including Eastman Spectar™ copolyester, Eastman TiGlaze™ ST copolyester, and Eastman Kelvx™ resin. A copy of the ICC ESR report can be viewed online at http://www.icc-es.org/reports/pdf_files/ICC-ES/ESR-1407.pdf.

UL 94 vertical burning classification

Sheet made from Eastman Spectar™ copolyester, with or without the UV cap layer, is classified by UL as 94V-2 in a thickness of 3 mm (0.118 in.) or greater. A sheet thickness less than 3 mm is classified as 94HB.

European flammability ratings for Eastman Spectar™ copolyester

Test	Thickness	Rating
Great Britain BS 476: Part 7: 1987[a]	0.118-in. (3-mm) thick	1Y[c] Indicated
Germany DIN 4102: Part 1: (B1 test)[b]	0.118-in. (3-mm) thick	B1[c] Indicated
France NF P 92-501	0.118-in. (3-mm) thick	M2
Euroclass testing EN 13501-1	(1-mm thick)	B, S1,d0[d]

[a]*British Surface Spread of Flame test with Class 1 to Class 4. A suffix Y is added to the classification if any softening and/or other behavior that may affect the flame spread occurs.*

[b]*DIN 4102 Part 1 test is the principle reaction to fire test method in Germany and used to classify the majority of building products and materials, including some contents. Classification B1 only.*

[c]*Indicative testing only. Only 1 or 2 samples were tested to the specified test methods, and the full requirements of the standards were not met. The results do not include compliance with a regulatory requirement.*

[d]*Sample mounted on calcium silicate board by placing screws through the sheet into the board around its perimeter.*

Eastman is pleased to be able to offer our customers a copolyester building material that can meet the flammability requirements of an interior finish when testing according to NFPA 286. If you have any questions or need additional information, contact Bob Young, Eastman Senior Codes Expert at ryoung@eastman.com or via 1-800-EASTMAN.

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The results of **insight**™

Eastman Chemical Company
Corporate Headquarters
P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

Telephone:
U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other Locations, (1) 423-229-2000
Fax: (1) 423-229-1193

Eastman Chemical Latin America
9155 South Dadeland Blvd.
Suite 1116
Miami, FL 33156 U.S.A.

Telephone: (1) 305-671-2800
Fax: (1) 305-671-2805

Eastman Chemical B.V.
Fascinatio Boulevard 602-614
2909 VA Capelle aan den IJssel
The Netherlands

Telephone: (31) 10 2402 111
Fax: (31) 10 2402 100

Eastman (Shanghai) Chemical Commercial Company, Ltd.
Building C, No. 399 Shengxia Road,
Pudong New District
201210, Shanghai, P.R. China

Telephone: (86) 21 6120-8700
Fax: (86) 21 5027-9229

Eastman Chemical Japan Ltd.
MetLife Aoyama Building 5F
2-11-16 Minami Aoyama
Minato-ku, Tokyo 107-0062 Japan

Telephone: (81) 3-3475-9510
Fax: (81) 3-3475-9515

Eastman Chemical Asia Pacific Pte. Ltd.
9 North Buona Vista Drive
#05-01 The Metropolis Tower 1
Singapore 138588

Telephone: (65) 6831-3100
Fax: (65) 6732-4930

www.eastman.com

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