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Building Code Support for Potable Water Expanding Requirements (ASTM E84)

For more than 20 years Solvay has been helping potable water equipment manufacturers discover the performance and cost advantage of using high-performance plastics in pressurized hot water systems. Their proven ability to cost-effectively outperform brass and copper in pipes, fittings, valves and manifolds accounts for their growing success.

When selecting polymeric materials for use in hot water plumbing systems, it is important to consider how the physical and mechanical integrity of thermoplastic resins are affected by the operating environment. Recent demands by the building industry have pushed manufacturers to understand flame performance capabilities in conjunction with their piping systems in order to meet stringent code requirements. These requirements are especially important for manufacturers looking at Plenum installations. Solvay is pleased to report that we have accepted these industry challenges and have chosen to support material testing needs against the ASTM E84 standard.

Evaluation of the Surface Burning Characteristics of Radel® PPSU by Means of the ASTM E84-10 Standard

Sulfone-based polymers are well known for their high heat capabilities. In addition, these amorphous thermoplastics offer more toughness, strength and hydrolytic stability than other transparent thermoplastics. Sulfones withstand prolonged exposure to water, chemicals and a wide range of end-use temperatures, ranging from –40 °C to 204 °C (–40 °F to 400 °F).

Another feature of Radel® polyphenylsulfone (PPSU) is that it has inherently flame retardant properties. Radel® PPSU standard 5000 series products have been tested by a variety of industry standards for evaluation of flame and smoke generating properties. Table 1 provides an overview of these properties.

Table 1: Properties of Radel® PPSU standard 5000 series

Test Name	Property	Typical Test Result	Standard
Oxygen index	Index	44 %	ASTM D2863
UL	Rating	V-0 at 0.8 mm	UL-94
NBS radiant panel	Flame spread index (I_5)	5.7 (no dripping)	ASTM E162
NBS smoke density	Smoke density (D_5 max)	< 5	ASTM E662
Vertical burn	Burn time	0 s	DMS 1510
	Burn length	< 7.6 cm	DMS 1510
OSU	2 min heat release	20 kW/min-m^2	FAR 25.853
	Maximum heat release	50–70 kW/m^2	FAR 25.853

Table 2: Evaluation of Radel® R-5100 BK937

	Samples		
Property	**1**	**2**	**3**
Time to ignition [minutes]	1:07	3:33	3:35
Flame front [feet]	6.0	3.0	3.0
Time to maximum spread [minutes]	10:00	10:00	10:00
Flame Spread Index (FSI)	20	5	10
Smoke Developed Index (SDI)	45	145	250
Classification rating	A	A	A

To further build on this data, Solvay submitted samples of Radel® PPSU for testing per the ASTM E84-10 standard, which is typically referred to as the "Steiner Tunnel" test. The test method is used to determine the surface flame spread and smoke generation characteristics of interior finish materials and has been widely adopted by every North America building and fire code.

The test method exposes a nominal 24-foot long by 20-inch wide specimen to a controlled air flow and flaming exposure that has been adjusted to spread the flame along the entire length of a select grade red oak specimen in 5.5 minutes. The results of the material being tested are normalized against the red oak standard's burning characteristics and smoke generation. The test results are reported as the Flame Spread Index (FSI) and the Smoke Development Index (SDI). Based on these results, samples are given a rating of A, B or C. An A rating means that the Flame Spread Index is 0 to 25 and the Smoke Development Index is ≤ 450.

Summary of Testing

Solvay contracted the services of SGS North America, Inc. (formerly SGS U.S. Testing Company, Inc.) to perform the ASTM E84 testing. Samples submitted for testing were extruded sheets of Radel® R-5100 BK 937 that were produced to the nominal dimension of 21 x 96 x 0.225 inches. Three of these samples were tested end to end for each evaluation. Evaluation of Radel® R-5100 BK 937 was conducted in triplet on October 11 and 12, 2010. Test results are summarized in Table 2 and illustrated in Figures 1 and 2.

Figure 1: Flame spread chart

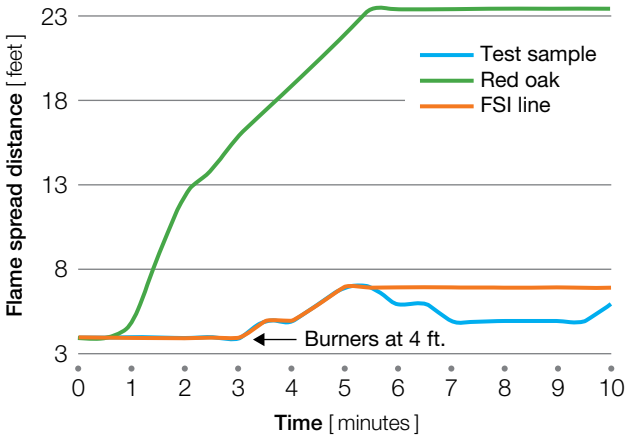
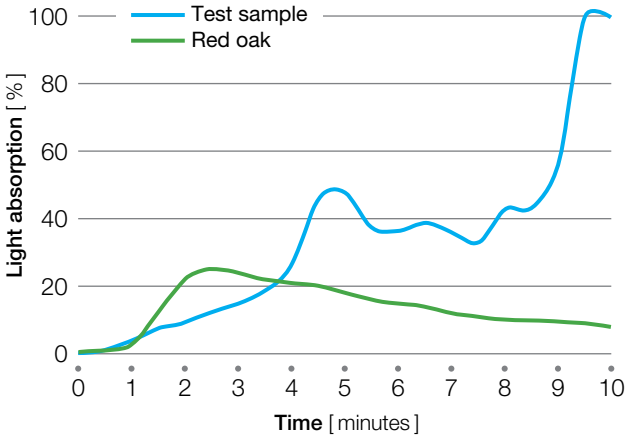


Figure 2: Smoke developed chart



Conclusions

The results of the ASTM E84-10 showed Radel® PPSU to have a Class A rating, reinforcing the list of unique properties offered by this material for a variety of demanding applications.

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