

Flammability Testing

Flammability is one of the many material properties of concern when designing a plastic part. Most plastics will burn. Material manufacturers can add various kinds of flame retardants to the plastic to alter its flammability properties. There are many ASTM tests to define a plastic's flammability characteristics, and an important set of UL tests to give the material certain ratings.

ASTM TESTS

Flammability Test (ASTM D 568 for flexible plastics and D 635 for self-supporting plastics)

ASTM D 568 supports the sample vertically, whereas D 635 supports the sample horizontally. A flame from a Bunsen burner is exposed to a plastic test bar for 30 seconds. The sample is allowed to burn until it either extinguishes itself or burns past a gage mark (100 mm) on the bar. If the sample does not burn past the 100 mm gage mark, time and extent of burning are reported. If it burns past the gage mark, and average burn rate, in centimeters per minute, is reported. Materials that do not burn to the gage mark are said to be *self-extinguishing*.

Oxygen Index Test (ASTM D 2863)

This tests the minimum concentration of oxygen in a pure oxygen / nitrogen environment that is necessary for the sample to maintain combustion. The sample is hung vertically in a special chamber, and then ignited. The oxygen concentration is then reduced until the combustion is just maintained. The Limiting Oxygen Index (LOI) represents this percentage of oxygen.

Radiant Panel Test (ASTM E 162)

A radiant panel is maintained at 670°C (1238°F) as a heat source to ignite a plastic sheet. The plastic sheet (152mm x 457mm, 6" x 18") is maintained at a set distance from the panel, with the top tilted at a 30° angle toward the panel. The rate of burning and the heat evolved in the burning are measured and combined to form a flame-spread index.

Smoke Density Test (ASTM D 2843)

This test measures the loss of light transmission through smoke produced from a burning plastic. A sample is burned inside of a special chamber. A light is passed between two photoelectric cell plates, and the light transmission is plotted against time. The area under this curve is the total smoke produced.

UNDERWRITERS LABORATORY TESTS

UL 94 Flammability Tests

The Underwriters Laboratories have developed a series of flammability tests, all designated under UL 94. For a plastic to receive a certain UL rating, it must pass certain criteria of a test. The different ratings are outlined below.