Development of Flammability Tests for Magnesium Alloys Used in Commercial Aircraft

Tim Marker

A laboratory-scale flammability test for magnesium alloys was developed for seat structural components. The test method was based on the findings of realistic full-scale tests conducted previously. The intent was to expose an appropriately-sized test sample to the flames of an oil-fired burner for a period of time that allowed the test sample to melt, as preliminary testing indicated the magnesium alloys would not ignite until melting had occurred. Numerous test sample shapes, sizes, and exposure levels were trialed in an effort to replicate the outcome of the full-scale tests, namely, the amount of time required to melt and ignite a sample, and the approximate amount of time required for the sample to self-extinguish. The final configuration utilized a 0.25-inch thick by 1.5-inch wide by 20-inch long horizontally-oriented bar test sample that was exposed to the oil burner for a period of 4 minutes.

Following the development of a flammability test for magnesium alloy seat components, industry expressed their desire to use magnesium alloys in other cabin applications besides seats. Some of these applications included inaccessible areas, where an electrical arc or other small fire may be the prevailing threat. With this in mind, various small-scale tests were conducted on thin magnesium alloy samples. The objective of the research was to develop an appropriate test for magnesium alloy components that could be located in hidden, or inaccessible areas of the pressurized aircraft cabin. The FAA experimented with various types of electrical power equipment in an effort to produce an electrical arc capable of consistently igniting magnesium alloy samples. Creating a consistent arc proved to be difficult, since various alloy types and thicknesses react differently. The FAA then conducted trials with the vertical Bunsen burner, the radiant panel apparatus, and the new vertical flame propagation equipment. Since the most important parameter for any magnesium alloy component located in an inaccessible area is the ability to self-extinguish, the tests used piloted ignition that forced the samples to ignite, and then measured their ability to self-extinguish. The amount of burning was tracked by calculating the percentage of weight lost during the tests.