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## **FIRE PERFORMANCE EVALUATION TESTED IN ACCORDANCE WITH ASTM E 136-11, *STANDARD TEST METHOD FOR BEHAVIOR OF MATERIALS IN A VERTICAL TUBE FURNACE AT 750 °C***

**MATERIAL ID AND TRADE NAME: 5052**

**FINAL REPORT  
Consisting of 5 Pages**

**SwRI® Project No. 01.16052.01.620b  
Test Dates: March 21–23, 2011  
Report Date: April 14, 2011**

**Prepared for:**

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## 1.0 INTRODUCTION

This report describes a small-scale fire test conducted on a material identified as 5052 in accordance with ASTM E 136-11, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 °C*, for The Aluminum Association, Inc., located in Arlington, Virginia. Testing was conducted March 21–23, 2011, at the Fire Technology Department of Southwest Research Institute (SwRI), located in San Antonio, Texas.

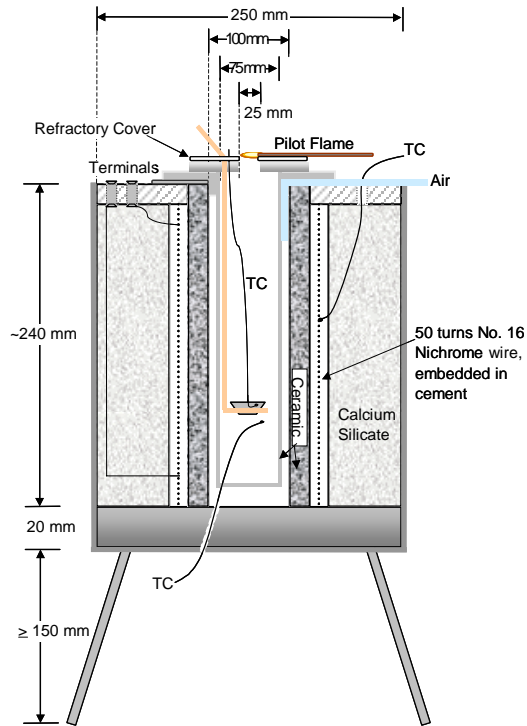
This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual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

The results presented in this report apply specifically to the specimens tested, in the manner tested, and not to the entire production of these or similar materials, nor to the performance when used in combination with other materials.

## 2.0 DESCRIPTION OF TEST APPARATUS AND PROCEDURE

The ASTM E 136-11 hot-air ignition furnace consists primarily of an electrical heating unit and specimen holder. The furnace tube is a vertical tube, with an inside diameter of  $100 \pm 5$  mm and a length of  $230 \pm 20$  mm, made of ceramic that will withstand at least 750 °C. The inner ceramic tube, with an inside diameter of  $75 \pm 5$  mm, a length of  $230 \pm 20$  mm, and a thickness of approximately 3 mm, is placed inside the furnace tube and positioned  $20 \pm 2$  mm above the furnace floor on spacer blocks. The test apparatus is shown in Figure 1.

The air temperature inside the furnace is stabilized to 750 °C prior to testing. Sheathed thermocouples are used to measure the temperature of the furnace air ( $T_f$ ), specimen surface ( $T_s$ ), and specimen interior ( $T_c$ ). The duration of flaming is recorded during the test, and specimen mass loss is determined based on weight measurements before and after testing. ASTM E 136-11 requires that a series of four tests be conducted for each sample.



**Figure 1. Schematic of SwRI's Hot-Air Furnace.**

A material passes if at least three of the four specimens tested meet the following criteria (The three specimens do not need to meet the same condition.):

1. When the weight loss is 50% or less:
  - a. The surface and interior thermocouples cannot have a temperature rise of more than 30 °C from the stabilized temperature measured by the interior thermocouple before testing.
  - b. No sustained flaming after the first 30 s of the test.
2. When the weight loss is 50% or more:
  - a. The surface and interior thermocouples cannot exhibit any temperature rise from the stabilized temperature measured by the interior thermocouple before testing.
  - b. No flaming at any time during the test.

### **3.0 DESCRIPTION OF TEST SPECIMENS**

The Aluminum Association, Inc., provided six specimens of the material, identified as 5052. The samples measured approximately 38 × 38 × 50 mm and were received by SwRI on February 28, 2011. A description of the material provided by the client can be found in Table 1. The samples were placed in a controlled environment maintained at 23 °C ± 2 °C (73 °F ± 5 °F) and 50% ± 5% relative humidity on March 5, 2011. Prior to testing, the specimens were placed in an oven at 60 °C for 24 hr, then placed in a desiccator to cool at room temperature. Due to the nature of the material, at the 750° C heat exposure from this test, the solid block changed phase to a liquid pool. To

avoid furnace damage from molten material, the specimens were slightly trimmed and placed in an open-top vessel as described in section 6.2.1 of the ASTM E136-11 standard.

**Table 1. Test Sample Description Provided by the Client.**

<b>Material ID</b>	<b>Description of Material</b>	<b>Composition</b>	<b>Nominal Thickness</b>	<b>Nominal Density</b>	<b>Color</b>
5052	5052 Cast Test Block	Nominal w/o – 2.5 Mg – 0.25 Cr – Al Balance	2.0 in. (49.4 mm*)	0.097 lbs/in. <sup>3</sup> (2550 kg/m <sup>3</sup> *)	Aluminum (silver like) (Silver*)

\* Measured by SwRI personnel.

#### **4.0 TEST RESULTS**

Testing was conducted on March 21–23, 2011. During testing, flaming was not observed in any of the four test runs. Tabular test data and graphs of the measured temperatures plotted with respect to time are presented on page 5.

#### **5.0 CONCLUSIONS**

The material identified as 5052 **meets** the performance criteria presented in ASTM E 136-11.

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ASTM E 136 TEST DATA SHEET

Client: The Aluminum Association, Inc.  
 Operator: Z. Holt  
 Test Date(s): March 21, 22, and 23, 2011  
 Material ID\*: 5052  
 Trade Name\*: 5052  
 Description\*: 5052 Cast Test Block

Receipt Date: February 28, 2011  
 Date Prepared by SwRI: Prepared on test date  
 Color: Silver  
 Original Thickness: 50 mm  
 Test Sample Thickness: 50 mm  
 Average Sample Mass: 183.05 g

\* Information/instructions provided by the Client

RESULTS

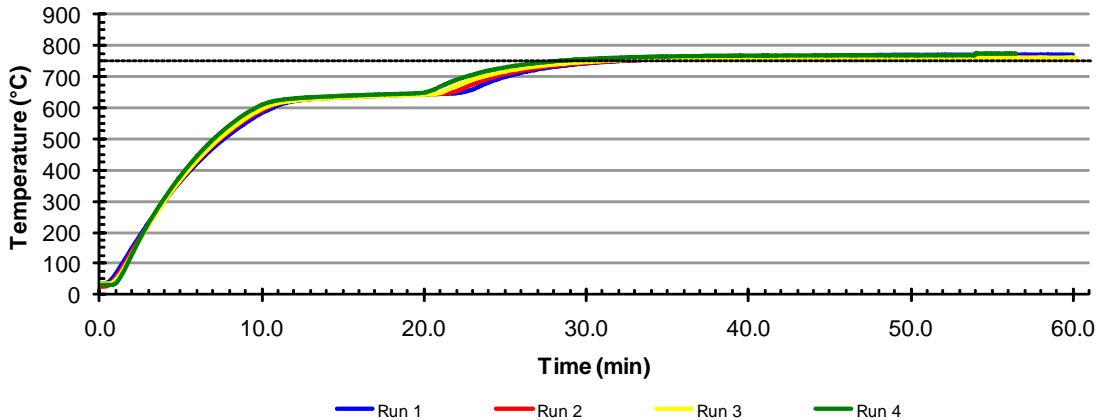
Run	Initial Mass (g)	Final Mass (g)	Percent Mass Loss	Specimen Center			Criteria* $\Delta T < 30\text{ }^{\circ}\text{C}$	Specimen Surface			Criteria* $\Delta T < 30\text{ }^{\circ}\text{C}$
				Stabilized ( $^{\circ}\text{C}$ )	Maximum ( $^{\circ}\text{C}$ )	$\Delta T$ ( $^{\circ}\text{C}$ )		Stabilized ( $^{\circ}\text{C}$ )	Maximum ( $^{\circ}\text{C}$ )	$\Delta T$ ( $^{\circ}\text{C}$ )	
1	178.95	178.71	0%	751	761	10	Pass	751	768	17	Pass
2	183.50	183.35	0%	750	762	12	Pass	750	768	18	Pass
3	187.26	187.06	0%	750	764	14	Pass	750	770	19	Pass
4	182.48	181.75	0%	751	771	20	Pass	751	767	17	Pass

\*Criteria for when percent mass loss < 50%

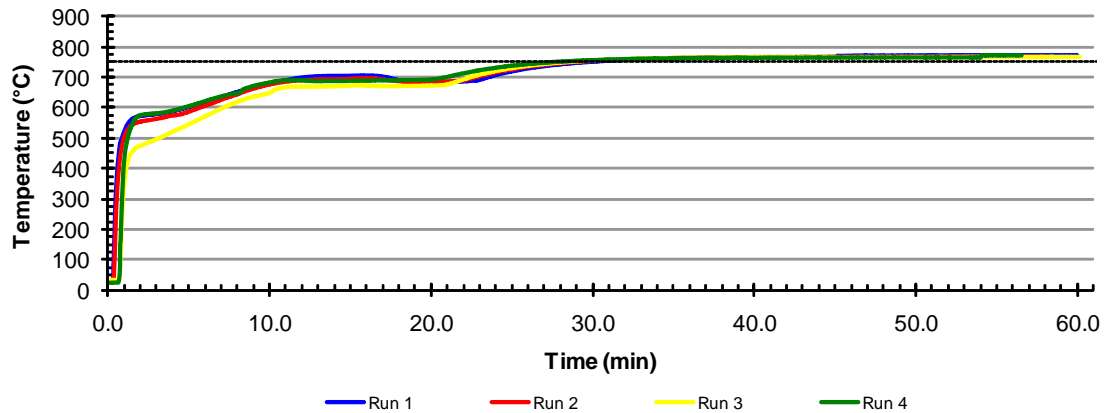
TEST OBSERVATIONS

	Insertion Time (s)	Ignition Time (min:s)	Flameout (min:s)	Duration of flaming (min:s)	Criteria: No flaming after first 30 s	Observed Smoke (min:s)	Observed Soot (min:s)	Total Test Time (s)
1	20	N/A	N/A	0:00	Pass	None	None	2686
2	26	N/A	N/A	0:00	Pass	None	None	3462
3	48	N/A	N/A	0:00	Pass	None	None	3606
4	48	N/A	N/A	0:00	Pass	None	None	3190

Center Temperature Graph



Surface Temperature Graph



p