HOT SURFACE IGNITION TEMPERATURE

OF SPONGE JET MEDIA

for

Sponge Jet, Inc.
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Report No. SSR-1946

Project No. 47309

Issued: 9 January 1997

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Introduction

Upon the request of Ms. Holly Spaudling of Sponge Jet, Inc., the tests described in this report were conducted to determine the hot surface ignition temperature of a sponge jet media dust layer. The concern is the formation of a dust layer formed on the surface of a furnace as a result of the overblast process. In accordance with the ASTM Draft, "Standard Test Method for Hot-Surface Ignition Temperature of Dust Layers," the ignition temperature at which a dust layer will self-heat was determined.

Procedure

Apparatus

The testing apparatus consists of: 1) a hot plate; 2) an aluminum plate with dimensions of 8" diameter by 1" thick; and 3) an aluminum sample ring with diameter of 4" (thickness varies depending on layer requirements.) See Figure 1 for a schematic of the test set-up.

The hot plate is used to heat the aluminum test plate. It is the test plate upon which the sample is placed. A thermocouple, embedded just beneath the surface of the test plate, is used to measure the test temperature. The temperature of the test plate is maintained at the designated temperature through the use of a temperature controller. The test plate is surrounded by a 1.25 inch thick ceramic insulating block.

An aluminum sample ring is employed to establish a test sample layer of a specified initial thickness. The initial sample thickness can be varied from 0.25 inch to 1.0 inch in 0.25 inch intervals. It is emphasized that only the initial sample thickness is controlled. While it is being heated on the test surface, the sample layer may change shape and dimension due to pyrolysis, oxidation, melting, crusting, etc.

The sample temperature is measured using a fine bare wire (0.010 inch diameter) thermocouple which is positioned in the center of the sample layer. Slots in the sample retaining ring allow repeatable initial positioning of the thermocouple. A dual channel strip chart recorder is used to simultaneously record the test plate and sample temperature.

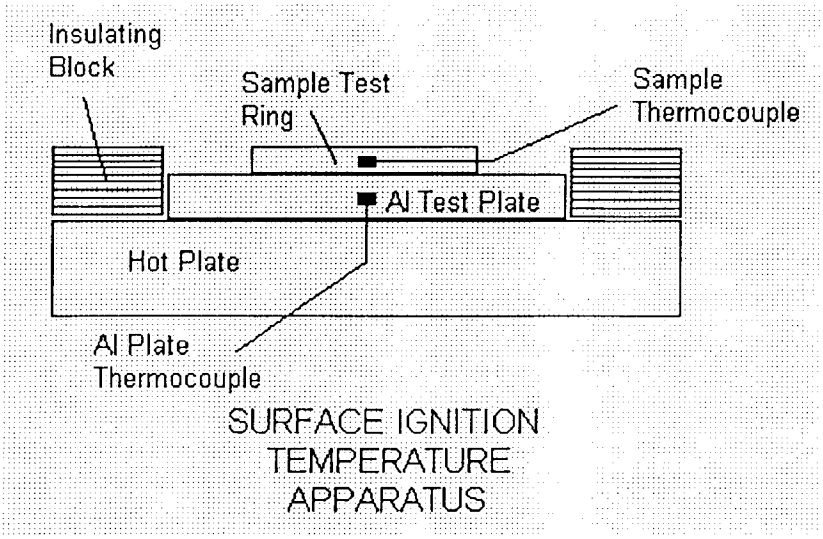


Figure 1: Test Apparatus

Test Procedure

The test plate is pre-heated to the test temperature with the sample ring and thermocouples in place. A pre-measured quantity of sample, just sufficient to fill the sample ring, is placed in the ring, surface smoothed and the start time recorded.

The sample is visually observed while its temperature is continuously monitored. Ignition (defined as a "Go") is considered to have taken place if: 1) Temperature rise of at least 120 °F above the hot plate temperature occurs in the dust; or 2) There is visible evidence of combustion such as red glow or flame. Charring and smoke production associated with pyrolysis is considered non-ignition or a "No Go." If there are no sign of ignition, the test is terminated at the end of 90 minutes.

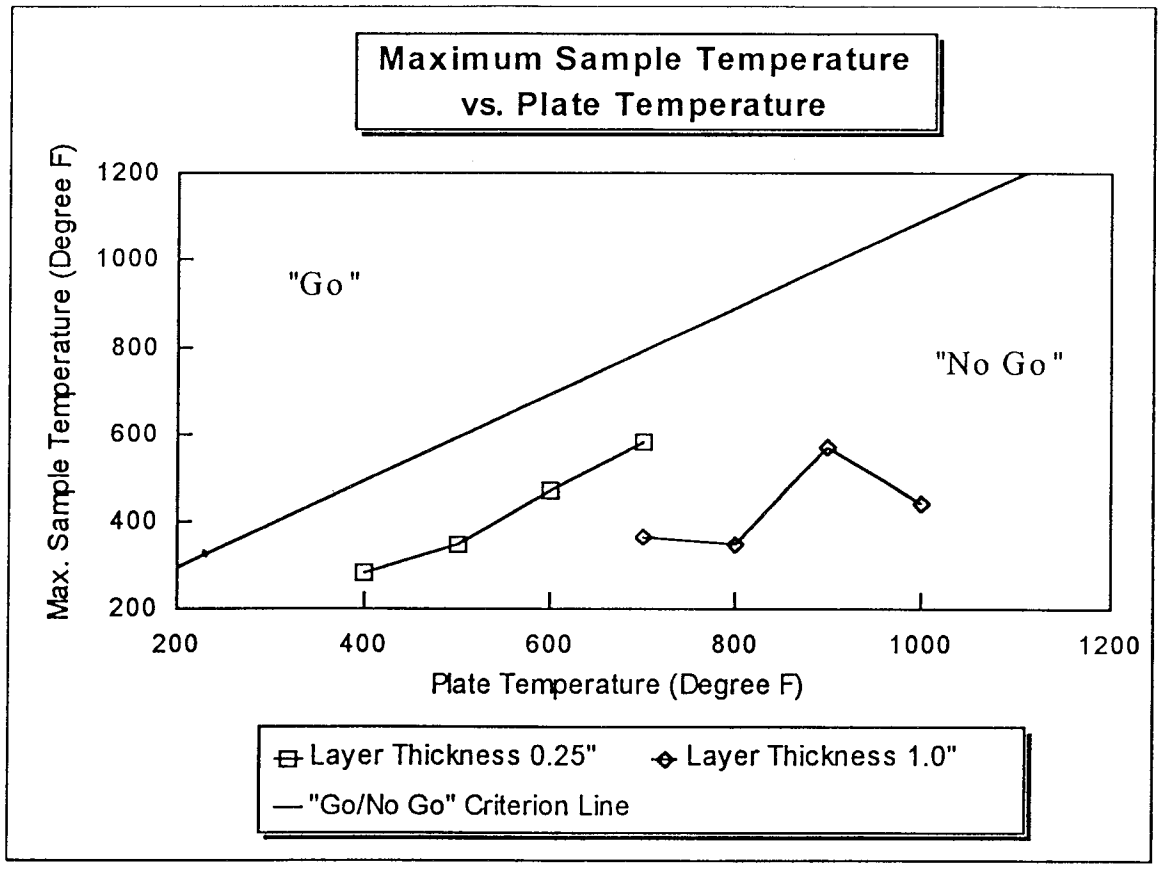
After each test, the test plate and sample ring is cleaned and the temperature adjusted for the next test. The residual sample left after testing is weighed to determine weight loss.

Results

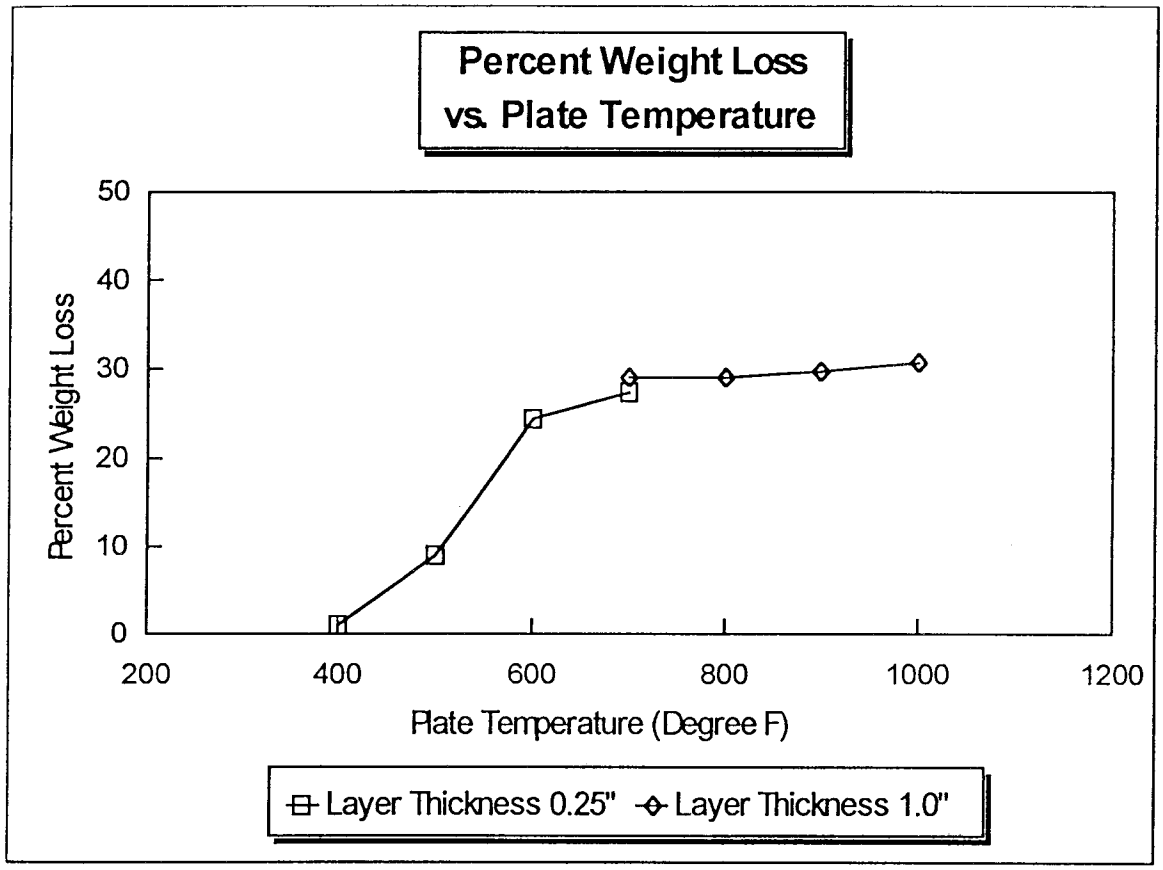
The Sponge Jet sample was found to be incapable of self-sustaining combustion in all nine tests that were conducted at different temperatures in the range of 400°F to 1000°F. The details of each individual test as well as the test results can be found in Appendix A. During the course of testing, there was no evidence of ignition. The sample began to produce smoke and char as soon as it was

placed on the hot plate, especially at the higher temperatures. This could be due to pyrolysis or low intensity smoldering combustion. However, during the course of testing, the samples never burst into flames. The temperature history indicated that at no point did the sample temperature rise above the plate temperature. This indicates that the material is incapable of self-sustaining combustion under the test conditions (i.e. up to a 1" thick layer and up to 1000^{0}F surface temperatures.) However, it is known that the sample can be easily ignited by an open flame.

The figure below shows the peak sample temperature recorded in each test which is plotted against the plate temperature for that test. It is seen that in all tests the sample temperatures were always less then the plate temperature.



The fraction of the sample weight lost during the tests are plotted against the test temperature below. The sample weight loss is seen to plateau around 30 percent.



Appendix A: Individual Test Results

Individual test results are listed below in a tabular format.

Test 1

Test Temperature	400 °F
Layer Thickness	0.25 in.
Initial Sample Amount	20 g
Final Sample Amount	19.8 g
Test Length	90 mins
Maximum Temperature Reached by Sample	278 °F
Ignition Results	No Go

Observations:

1) no change in physical appearance or structure (i.e. melting or softening)
2) little smoke production

Test 2

Test Temperature	400 °F
Layer Thickness	0.5 in
Initial Sample Amount	40 g
Final Sample Amount	39.5 g
Test Length	90 mins
Maximum Temperature Reached by Sample	312 °F
Ignition Results	No Go

Observations:

1) same as Test 1

Test 3

Test Temperature	500 °F
Layer Thickness	0.25 in
Initial Sample Amount	20 g
Final Sample Amount	18.2 g
Test Length	90 mins
Maximum Temperature Reached by Sample	346 °F
Ignition Results	No Go

Observations:

1) smoke production
2) charring (gray to brownish yellow)

Test 4

Test Temperature	600 °F
Layer Thickness	0.25 in
Initial Sample Amount	20 g
Final Sample Amount	15.1 g
Test Length	90 mins
Maximum Temperature Reached by Sample	466 °F
Ignition Results	No Go

Observations:

1) rapid production of smoke and charring
2) complete charring of material resulted in melting and adherring to the aluminum plate

Test 5

Test Temperature	700 °F
Layer Thickness	0.25 in
Initial Sample Amount	20 g
Final Sample Amount	14.5 g
Test Length	65 mins
Maximum Temperature Reached by Sample	581 °F
Ignition Results	No Go

Observations:

1) same effects as Test 4
2) charring completed in 7 minutes
3) no visible ignition

Test 6

Test Temperature	700 °F
Layer Thickness	1.0 in
Initial Sample Amount	80 g
Final Sample Amount	56.8 g
Test Length	33 mins
Maximum Temperature Reached by Sample	362 °F
Ignition Results	No Go

Observations:

1) Due to melting of the sample, the thermocouple was exposed in 10 minutes after the test started. Test continued for an additional 23 minutes to see if charred sample would ignite. No visible ignition occurred.

Test 7

Test Temperature	800 °F
Layer Thickness	1.0 in
Initial Sample Amount	80 g
Final Sample Amount	56.7 g
Test Length	30 mins
Maximum Temperature Reached by Sample	343 °F
Ignition Results	No Go

Observations:

1) same observations as Test 6 except the thermocouple was exposed in 3 minutes. No visible flames or any temperature rise above the plate temperature.

Test 8

Test Temperature	900 °F
Layer Thickness	1.0 in
Initial Sample Amount	80 g
Final Sample Amount	56.2 g
Test Length	20 mins
Maximum Temperature Reached by Sample	571 °F
Ignition Results	No Go

Observations:

1) sample reaction to heat began as soon as sample touched aluminum plate.
2) thermocouple was exposed after 3 minutes.
3) pungent, dense, yellow smoke was given off
4) no flame or significant temperature rise

Test 9

Test Temperature	1000 °F
Layer Thickness	1.0 in
Initial Sample Amount	80 g
Final Sample Amount	55.3 g
Test Length	15 mins
Maximum Temperature Reached by Sample	441 °F
Ignition Results	No Go

Observations:

1) same results as Test 8 at a faster time scale.