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**Research-Scale Fire Performance Evaluation
of an FR-Coated Gypsum Wallboard/ Wood
Stud Wall Construction**

***ASTM E119-98: Standard Test Methods for
Fire Tests of Building Construction and
Materials ****

* Research-scale vertical test, modified in that the furnace and sample size were less than is required by the standard for conformity assessment

Conducted For:

**Albi Manufacturing
A Division of StanChem Inc.
401 Berlin Street
East Berlin, CT 06023**

WFCi Report #04042(d)

Conducted On: July 1, 2004

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INTRODUCTION

This report documents a research-scale fire test of a fire retardant coated gypsum wallboard/ 2X4 construction by Western Fire Center, Inc. (WFCi) for:

**Albi Manufacturing
A Division of StanChem Inc.
401 Berlin Street
East Berlin, CT 06023.**

Mike White of WFCi conducted the test with the assistance of Wayne Beres, Logan Byman and Tony Mansur on July 1, 2004. The testing was witnessed by G.W. "Skip" Gosser of Intumescent Technologies and Howard Stacy of WFCi.

The 4'X4' sample was built and coated with the client's product on-site by Skip Gosser and representatives of WFCi. A detailed description of the sample can be found on page six of this report.

The purpose of this test was to evaluate the fire endurance characteristics of the client's fire-protective coating when subjected to a standard fire exposure condition.

This test method is designed 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.

SUMMARY OF TEST METHOD

This is a vertical small-scale positive pressure fire test employing the fire endurance conditions described in ASTM E 119 "Fire Tests of Building Construction and Materials". *For this evaluation, the principal exception to the standard is the reduction in size of the test furnace and assembly, which allows the use of the test results only for research and development purposes.* The test conditions are also closely described by testing standards UBC 7-1, 1997, UL 263, and NFPA 251, and use a vertical exposure furnace to subject specimens to a standard time-temperature curve as specified in the referenced test procedures.

For this fire endurance evaluation, the test was to be performed for a fire resistance period of 2 hours (120 minutes) or until failure of the test assembly occurred.

DESCRIPTION OF LABORATORY TEST FACILITY

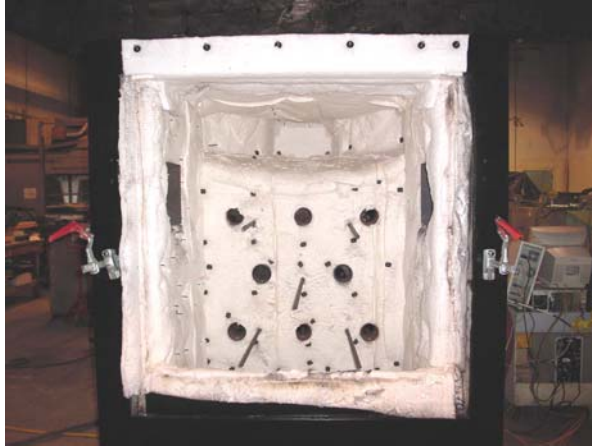


Figure 1: Small-Scale Vertical Furnace Front View



Figure 2: Small Scale Vertical Furnace Rear View

The furnace used in the test is a small-scale fire burning apparatus (Figures 1 & 2), fueled by natural gas. The test assembly was mounted onto a steel frame specimen holder and installed into the furnace vertically. The exposed surface was subjected to the time-temperature curve, with temperature measurements taken inside the furnace using thermocouples connected to a computerized data acquisition system. The furnace valves are controlled based upon the average of the interior furnace temperature that is determined from these five internal thermocouples. Windows allow viewing of the specimen surface and the taking of photographs during testing. Upon completion, or early termination of a test, the main gas supply valve is closed and the specimen frame is unlatched from the furnace, allowing for extinguishment of specimen, if applicable, and allowing for post-testing observations.

SAMPLE DESCRIPTION

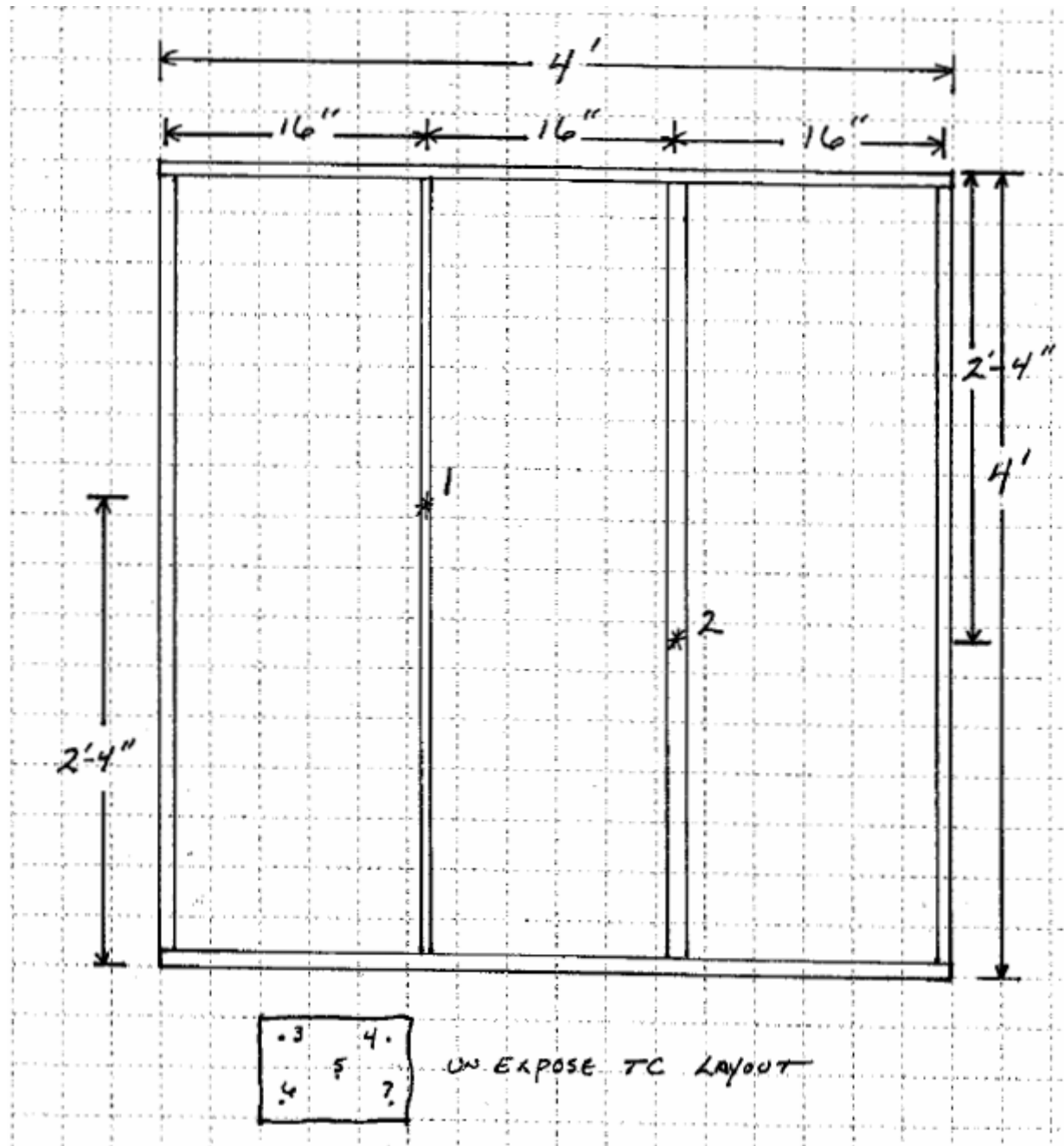
The sample in this test was a 4'X4' wood framed 2"X4" construction with the exposed and unexposed sides sheathed with 5/8" Fireguard GP ToughRock type X gypsum wallboard. The studs in the construction were spaced at 16" on center. The exposed surface was coated by the client's representative with Red 15X0505 487 water base primer and 60 mils of Albi Clad FP intumescent coating.

This sample is referred to by the client as **C1**.

Seven thermocouples were placed on the sample to record temperatures during the test. Two of these thermocouples, TCs 1 and 2, were placed inside the sample between the wood studs and the exposed gypsum layer. TC 1 was on the left stud (facing the exposed side), 2'-4" up from the bottom of the sample, and TC 2 was on the right stud 2'-4" down from the top of the sample. TCs 3-7 were on the unexposed face of the sample with TC 5 in the center 2' from each edge and the rest in corners 12" from each of the nearest two edges. TC 3 was in the top left corner (facing the unexposed sample face), TC 4 in the top right corner, TC 6 in the bottom left and TC 7 in the bottom right corner.

The data from these thermocouples can be found in graphical form in Appendix A of this report and in tabular form in the Test Data Summary section.

Diagram 1: Sample Layout



TEST DATA SUMMARY

Test Observations

Test Date: 7/01/2004, 3:12 PM

Specimen Tested: Sample C1- 2X4 construction covered with Albi Clad FP coated 5/8" Type X gypsum wallboard (see p6)

Furnace: Small-Scale Vertical Exposure Furnace

Cameras: 1 digital still camera and 1 video camera

Ambient Temp/Humidity: 74F/54%

Test Time (h:mm:ss)	Event
0:00:00	Ignite Furnace, Test Started
0:01:00	Sample intumescent on exposed surface
0:02:10	Entire surface has intumescent
0:06:32	Sample surface is black with minor cracks around perimeter
0:17:10	Small spots have appeared where the intumescent has divots, may be over nail locations
0:20:30	Intumescent material discoloring to an ash grey or white
0:30:00	Flaming on exposed surface at top right corner
0:34:04	Flames trying to attach along top edge
0:36:15	Exposed intumescent is white and fluffy, portions approx. 1/2" thick are falling from the sample
0:40:00	Pad covering TC 4 fell from sample and was re-attached
0:41:28	Approx. 1/2 of the exposed intumescent has fallen from the sample, mostly on the lower half
0:46:30	Two small areas seem bared to the substrate with no intumescent material left
0:50:35	Intumescent material continues to crumble and fall from the sample
1:04:10	Gypsum surface is visible on most of the exposed side
1:07:19	Attached flames on exposed face on center/left side
1:10:59	Attached flames at bottom portion across sample
1:15:44	Flames around entire exposed sample perimeter
1:34:38	Sample failed test; Temp. on unexposed surface passed 200C
1:35:00	Stop Test

Average Furnace Temperatures (every 5 min.)

Time	Total % of Standard Curve	Temperature (Celsius)	Standard Temperature
0:00:00	0	0	0
0:05:00	83.4	618.8	556.8
0:10:00	102.6	655.3	658.6
0:15:00	100.3	712.1	718.7
0:20:00	99.3	743.8	761.5
0:25:00	98.9	780.0	794.7
0:30:00	98.4	797.7	821.9
0:35:00	97.9	811.4	844.9
0:40:00	97.4	828.8	864.8
0:45:00	97.0	840.8	882.4
0:50:00	96.8	868.2	898.1
0:55:00	96.7	878.7	912.4
1:00:00	96.6	880.5	925.4
1:05:00	96.3	889.5	937.3
1:10:00	96.2	920.3	948.4
1:15:00	96.5	952.2	958.7
1:20:00	96.9	959.6	968.4
1:25:00	97.1	966.0	977.5
1:30:00	97.3	973.3	986.0
1:35:00	97.5	970.3	994.1

Interior Thermocouple Temperatures (every 5 min.)

(See description on page 6 and diagram on page 7 for locations)

Time	Temperature (Celsius)	
	TC1	TC2
0:00:00	23.1	23.3
0:05:00	97.3	100.2
0:10:00	99.8	100.0
0:15:00	96.4	100.2
0:20:00	97.2	100.3
0:25:00	97.0	100.7
0:30:00	97.1	104.5
0:35:00	97.0	111.2
0:40:00	109.1	125.0
0:45:00	117.0	133.5
0:50:00	124.6	172.9
0:55:00	220.4	316.6
1:00:00	324.0	380.6
1:05:00	389.3	530.5
1:10:00	486.4	552.7
1:15:00	534.7	550.4
1:20:00	579.8	587.3
1:25:00	614.0	613.2
1:30:00	641.3	649.0
1:35:00	668.1	668.5

Unexposed Thermocouple Temperatures (every 5 min.)
(See description on page 6 for locations)

Time	Temperature (Celsius)				
	TC3	TC4	TC5	TC6	TC7
0:00:00	24.3	25.0	24.6	23.9	24.9
0:05:00	26.1	26.3	26.5	27.3	25.9
0:10:00	62.1	56.4	59.1	58.4	48.7
0:15:00	81.8	78.3	80.2	78.1	70.8
0:20:00	86.6	85.8	87.8	87.9	82.6
0:25:00	88.2	89.3	90.3	90.2	88.2
0:30:00	89.2	90.5	91.1	90.4	89.8
0:35:00	89.5	90.9	91.4	89.7	90.3
0:40:00	89.0	80.1	90.9	88.7	89.5
0:45:00	88.1	86.7	89.8	88.2	88.2
0:50:00	86.9	87.9	89.4	87.3	87.3
0:55:00	87.7	90.2	90.9	88.8	89.3
1:00:00	91.0	93.5	94.0	91.8	92.8
1:05:00	92.4	95.2	95.5	92.3	94.1
1:10:00	93.2	96.1	96.3	93.5	95.2
1:15:00	94.0	97.7	97.2	95.5	96.4
1:20:00	98.2	99.3	101.2	102.0	98.8
1:25:00	114.2	108.0	116.4	120.5	114.6
1:30:00	125.8	123.3	134.5	131.9	120.9
1:35:00	188.7	158.1	222.4	213.4	166.9

TEST RESULTS AND CONCLUSION

Charts illustrating data collected from the tests are included in Appendix A. Photographs from the tests are included in Appendix B.

Following is an excerpt from ASTM E-119:

18.1.3 Transmission of heat through the wall or partition during the fire endurance test shall not have been such as to raise the temperature on its unexposed surface more than 250°F (139°C) above its initial temperature.

The initial temperatures on the unexposed surface were approximately 25 degrees C. According to the standard, failure of the sample occurred when the average of the unexposed thermocouple readings reached temperatures higher than 164 C, which occurred slightly after 90 minutes into the test.

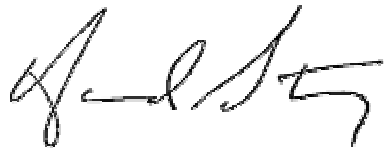
SIGNATURES

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**WESTERN FIRE CENTER INC. AUTHORIZES THE CLIENT NAMED
HEREIN TO REPRODUCE THIS REPORT ONLY IF REPRODUCED IN ITS
ENTIRETY.**

APPENDIX A: **CHARTS**

Chart 1: Furnace Temperature Vs. Standard Curve

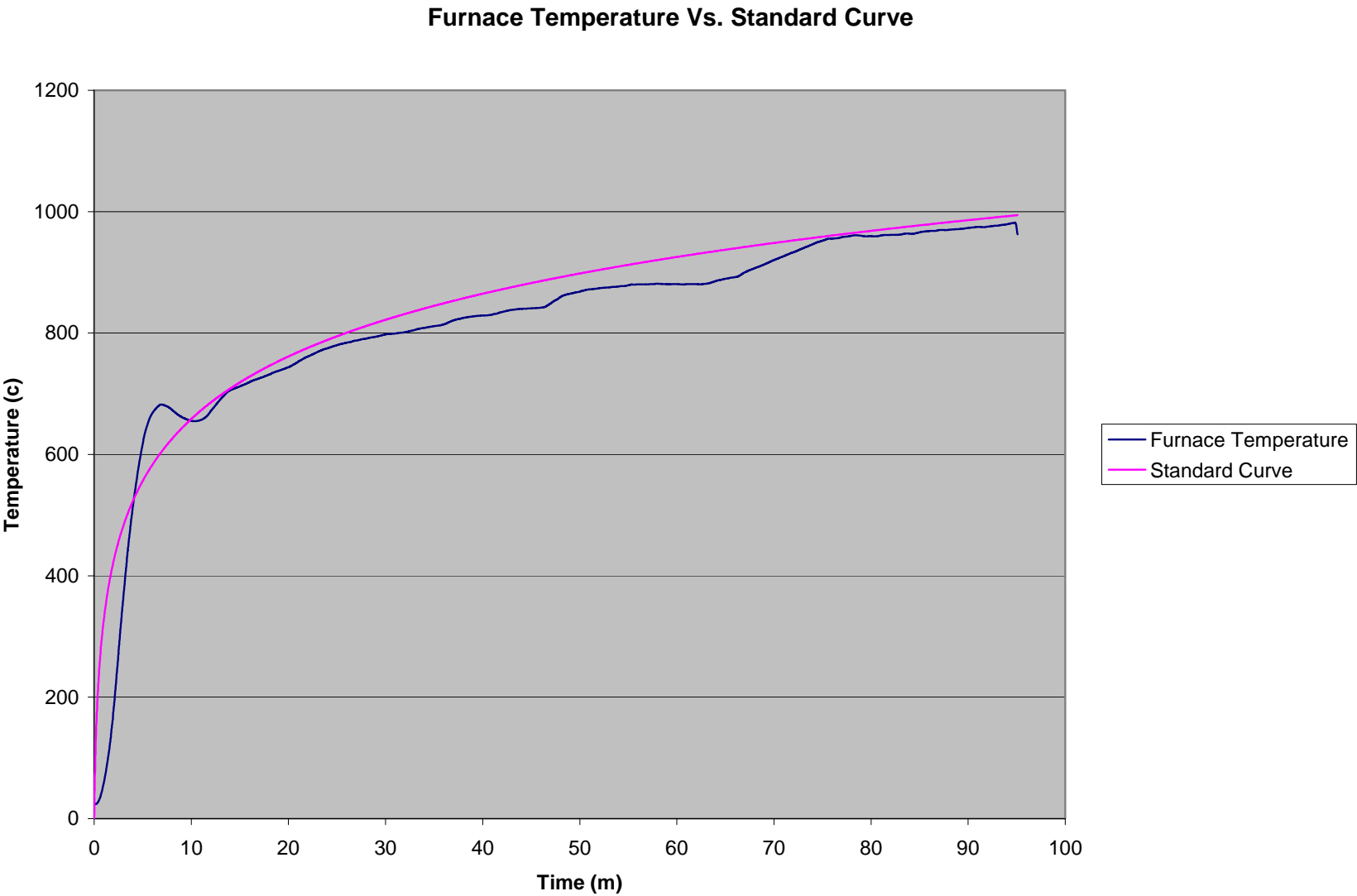


Chart 2: Interior Thermocouple Temperatures

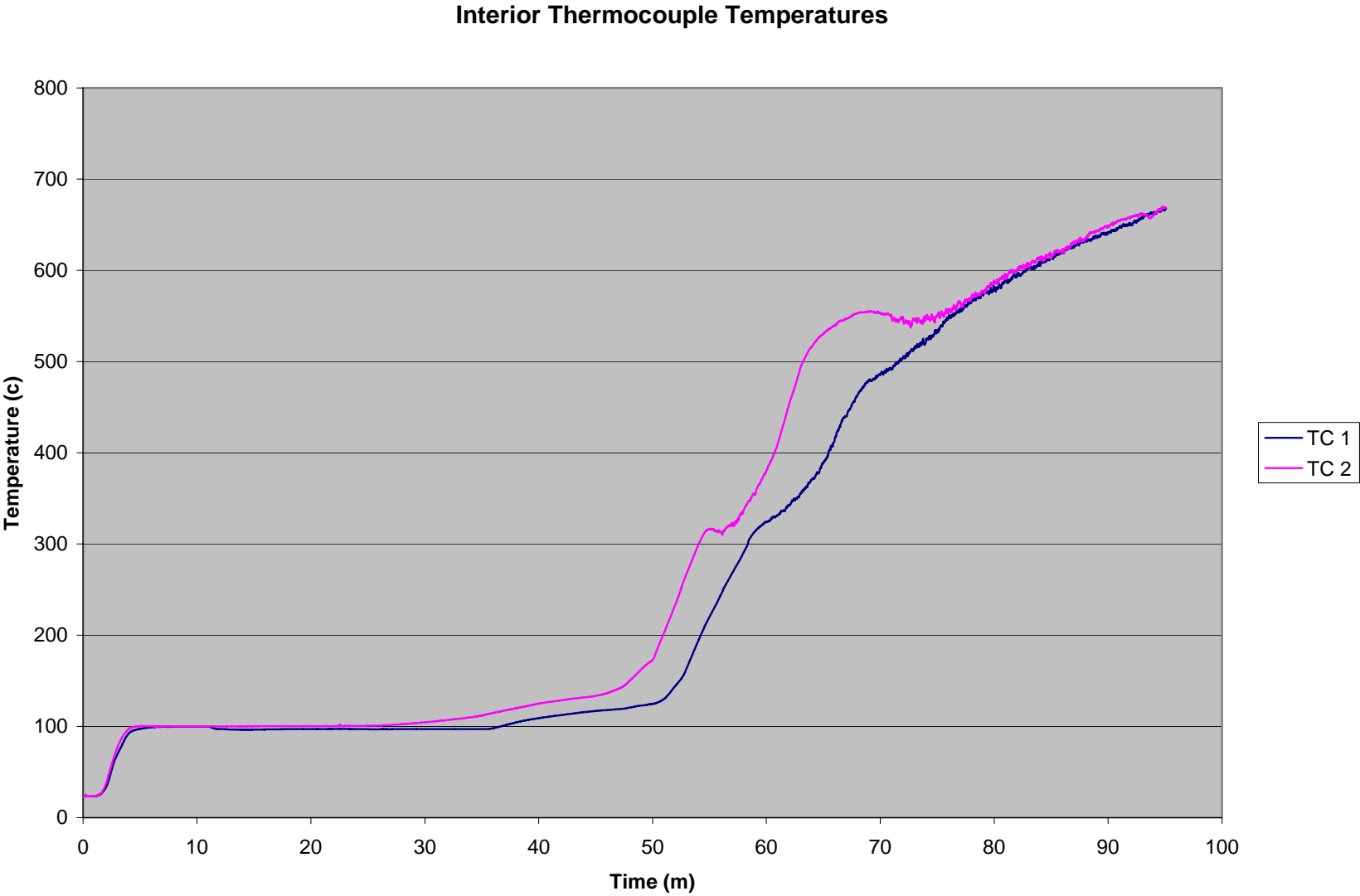
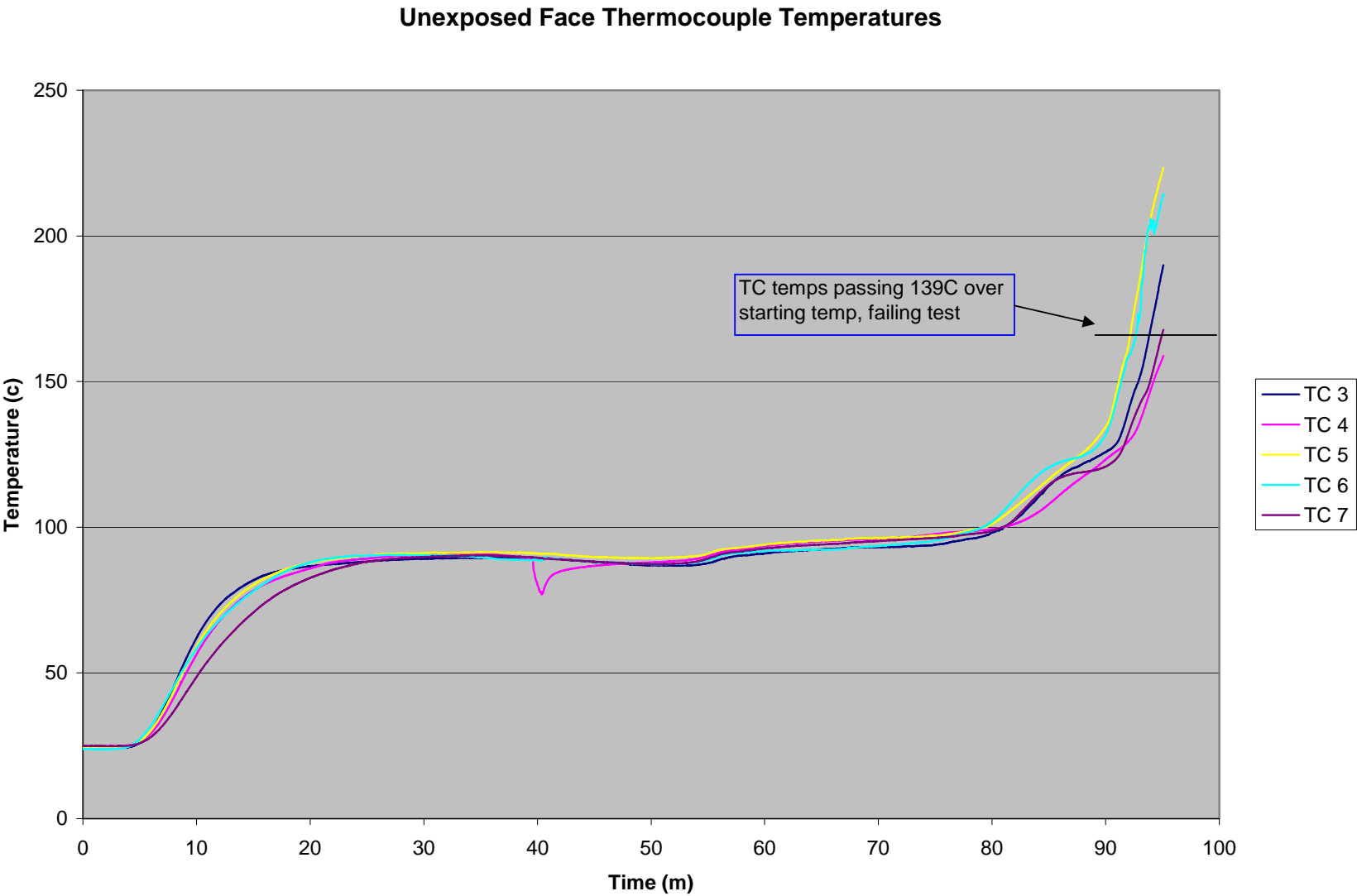


Chart 3: Unexposed Thermocouple Temperatures



APPENDIX B: **PHOTOGRAPHS**



Photograph 1: Sample exposed face pre-test



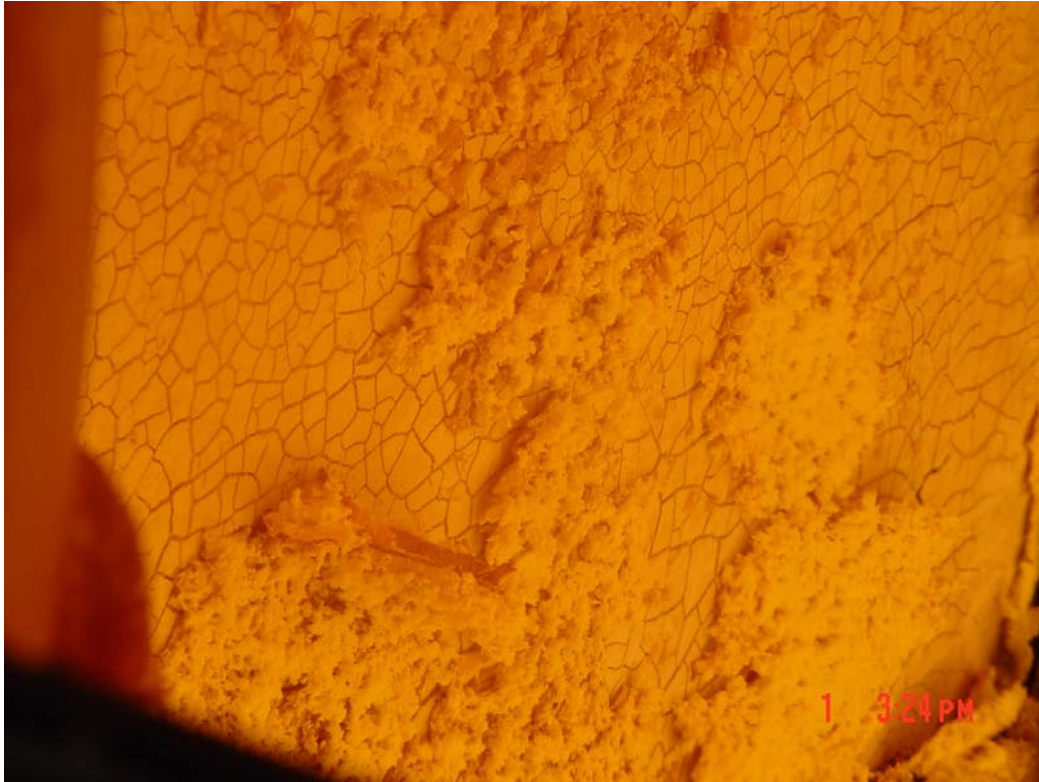
Photograph 2: Sample unexposed face pre-test, showing thermocouples



Photograph 3: Sample exposed face beginning to intumesce



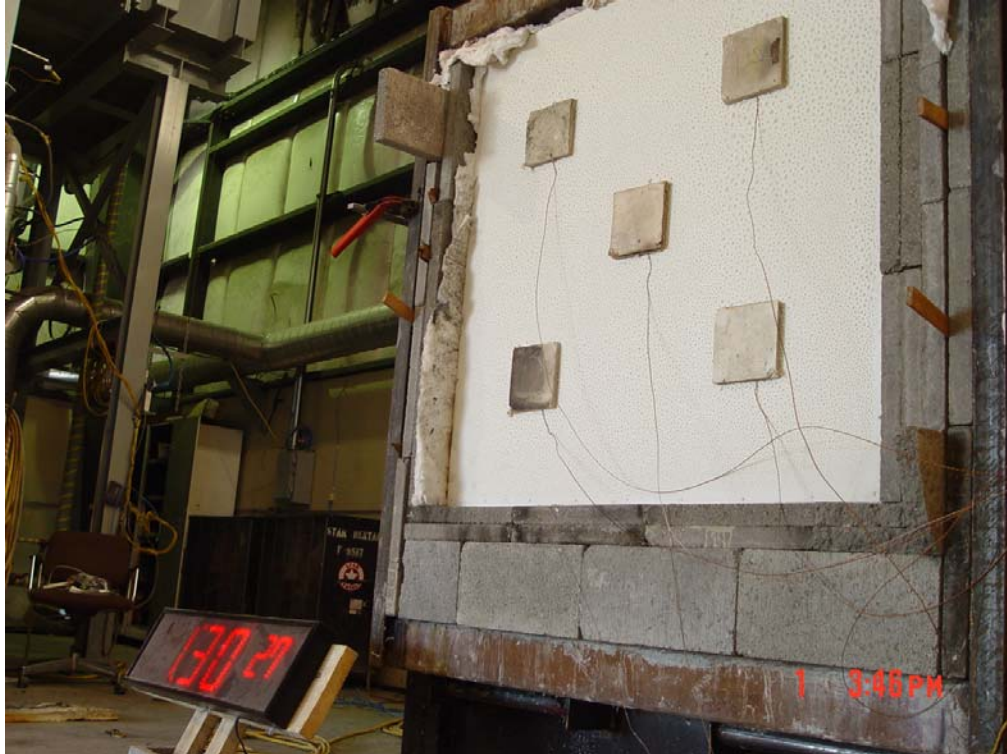
Photograph 4: Large pieces of intumescent falling from exposed face



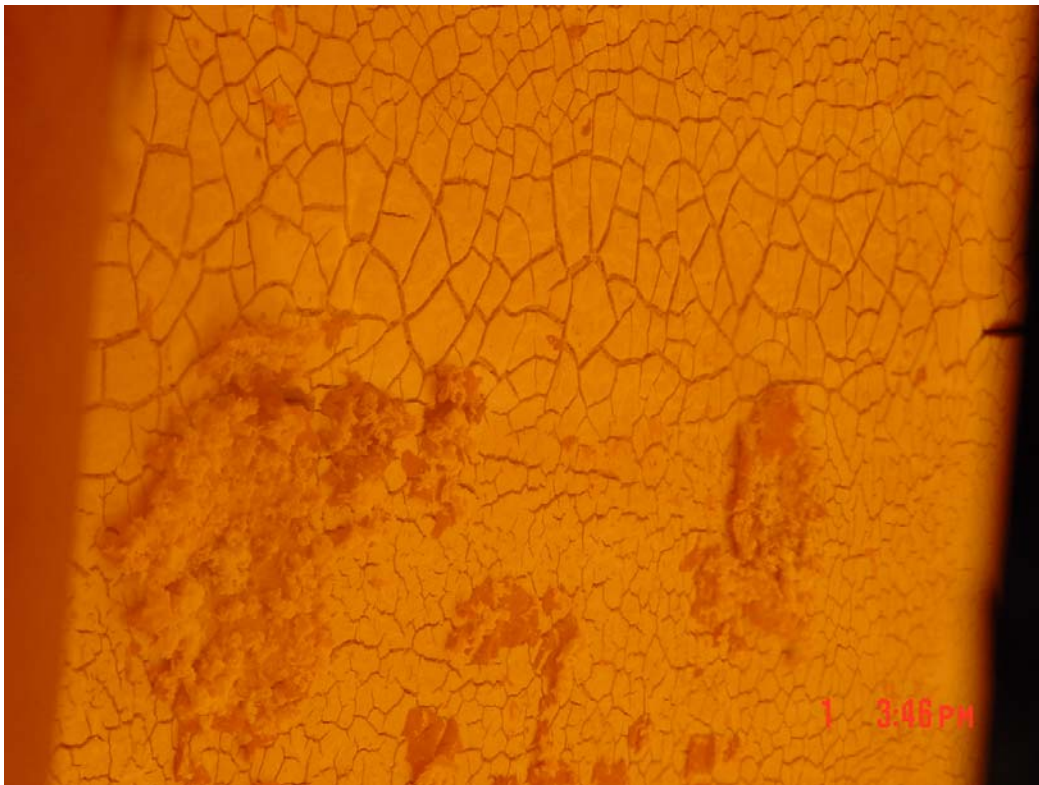
Photograph 5: Exposed intumescent continues to flake from sample



Photograph 6: Little intumescent remains and flames at bottom of sample near end of test



Photograph 7: Sample unexposed face near end of test



Photograph 8: Exposed face of sample near end of test



Photograph 9: Exposed sample face post-test



Photograph 10: Closer view of studs post-test



Photograph 11: Close-up of stud post-test



Photograph 12: Another post-test sample photo