Proposed Radiant Heat Panel Test

For the Evaluation of Aircraft Duct Material

STATUS REPORT




INTERNATIONAL AIRCRAFT MATERIALS FIRE TEST WORKING GROUP
ORANGE COUNTY, CALIFORNIA JUNE 2006 MEETING
WJH FAA Technical Center
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Outline

PRESENTATION OUTLINE:

- Last Quarter Tests Results
- Status of the Proposed Radiant Panel Protocol for Ducts
- Final Remarks

Results

LAST QUARTER TEST RESULTS

- Tested AI, Structural Adhesive (MSCC)
- Tested AJ, Structural Adhesive (MSCC)
- Tested AK, Taped N (RP)
- Tested AL, Taped N (RP)
- Tested AM, fire blocking insulation :

  film 1, glass insulation, Tape 1 (RP)
- Tested AN, fire blocking insulation: film 1, glass insulation, with hook & loop (RP)
- Tested AO, fire blocking insulation: film 2, glass insulation, Tape 1 (RP)
- Tested AP, fire blocking insulation: film 2,glass insulation, with hook & loop (RP)

Notes: RP = Radiant Panel Test, MSCC = Micro-Scale Combustion Calorimeter Test

Results

LAST QUARTER TEST RESULTS

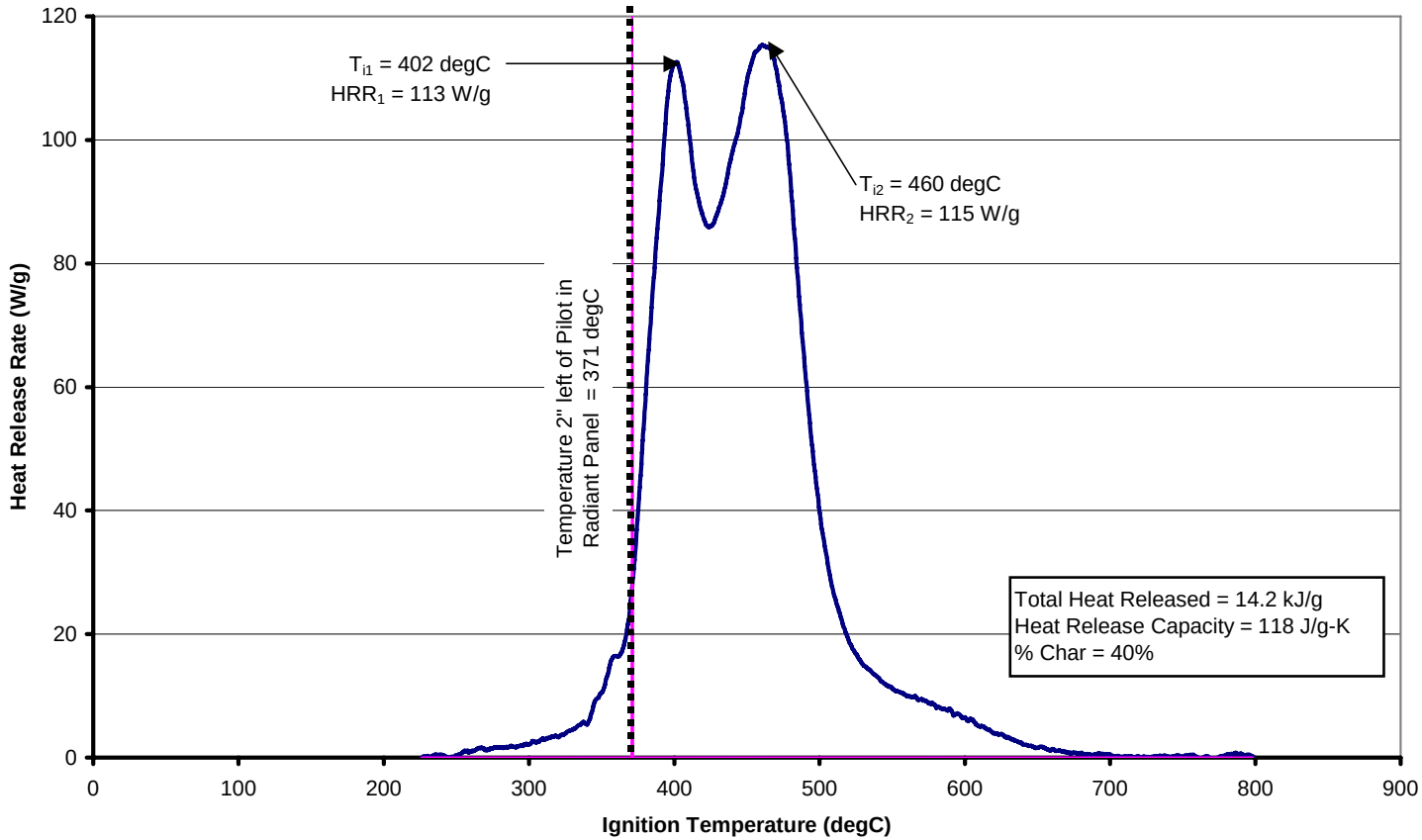
- Tested AQ, Thermoplastic (VBB12/60, OSU, RP, Smoke, MSCC)
- Tested AR, Thermoplastic (VBB12/60, OSU, RP, Smoke, MSCC)
- Tested AS, Thermoplastic (VBB12/60, OSU, RP, Smoke, MSCC)
- Tested AT, Thermoplastic (VBB12/60, OSU, RP, Smoke, MSCC)
- Tested AU, Thermoplastic (VBB12/60, OSU, RP, Smoke, MSCC)
- Tested AV, Flexible Tube (RP)

Notes: VBB12/60 = Vertical Bunsen Burner Tests (12 & 60 sec), OSU = Heat Release Test, RP = Radiant Panel Test, MSCC = Micro-Scale Combustion Calorimeter Test

Results

MICRO-SCALE COMBUSTION CALORIMETER TEST 1

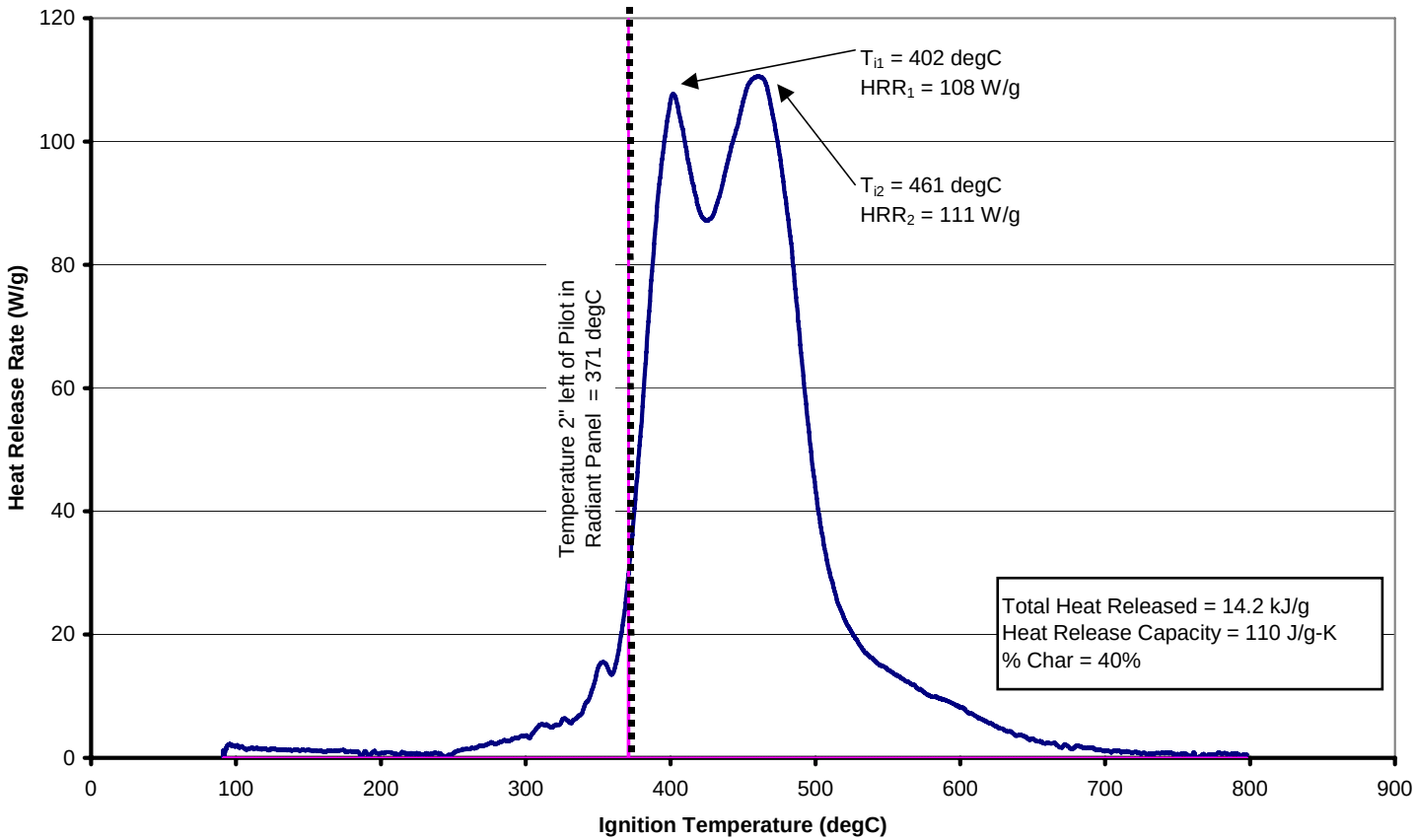
Material: Structural Adhesive AI



Results

MICRO-SCALE COMBUSTION CALORIMETER TEST 1

Material: Structural Adhesive AJ



Results

LAST QUARTER TEST RESULTS

MATERIAL	RPHT FLAME PROPAGATION (cm)	FAA ACCEPTANCE CRITERIA (cm)	(sec)	(sec)	PASS/ FAIL	COMMENTS
AK	3.5	5.08	60	45	Failed	Taped N
AL	3.2	5.08	60	45	Failed	Taped N
AM	7.6	5.08	16.3	45	Failed	Film and tape shrunk away exposing fiberglass insulation
AN	1.4	5.08	2.7	45	Passed	Hook & Loop. Film shrunk away exposing fiberglass insulation
AO	10.2	5.08	TBD	45	Failed	Adhesive of tape burned
AP	2.9	5.08	2.0	45	Passed	
AQ	2.5	5.08	0	45	Passed	
AR	2.5	5.08	1	45	Passed	
AS	2.5	5.08	0	45	Passed	
AU	2.8	5.08	1	45	Passed	
AV	3.18	5.08	7.67	45	Passed	Helix parallel (critical fire path) to pilot flame
AV	5.72, 4.44, 4.44	5.08	11	45	Failed	Helix perpendicular to pilot flame

Results

LAST QUARTER TEST RESULTS

TESTS	MATERIAL ID				
	AQ	AR	AS	AT	AU
12-sec Vertical Bunsen Burner					
Burn Length (cm), BL< 20.32 cm:	1.2	0.9	1.7	1.1	1.3
After Flame Time (sec), AFT < 15 sec:	0.0	0.0	0.0	0.0	0.0
Drip Flame Time (sec), DFT < 5 sec:	0.0	0.0	0.0	0.0	0.0
60-sec Vertical Bunsen Burner					
Burn Length (cm), BL< 15 cm:	7.1	5.8	7.6	5.9	6.5
After Flame Time (sec), AFT < 15 sec:	0.0	0.0	0.0	0.0	0.0
Drip Flame Time (sec), DFT < 3 sec:	0.0	0.0	0.0	0.0	0.0
Radiant Panel Test					
Burn Length (cm), BL < 5.08 cm:	2.5	2.5	2.5	N/A	2.8
After Flame Time (sec), AFT < 45 sec:	0.0	1.0	0.0	N/A	1.0
OSU Heat Release					
Peak Heat Release (kW/m^2), PHR < 65 kW/m^2:	47.7	51.9	36.8	46.2	34.6
Total Heat Release ($kW*min/m^2$), THR < 65 $kW*min/m^2$:	4.2	1.9	3.5	2.3	4.3
Smoke					
Smoke Density (D_s), D_s < 200:	1.1	0.0	0.1	0.2	0.3
Micro-Scale Combustion Calorimeter					
Peak Heat Release (W/g):	122.6	148.6	106.0	175.0	136.5
Total Heat Release (kJ/g):	9.0	7.7	9.8	9.1	8.0
Ignition Temperature (degC):	573.1	617.0	584.0	615.4	618.4

Status of Test

STATUS OF PROPOSED RADIANT PANEL TEST FOR AIRCRAFT DUCTS

- As ducting materials are tested (in different scenarios), data collected and analyzed, the proposed radiant panel test protocol will continue to be modified. This document will continue to morph until the FAA is satisfied that the new test protocol is capable of discriminating between fire worthy and a non-fire worthy materials when exposed to the accepted fire threat.
- As of today, the proposed test protocol is as follows:
  - ✓ Pre-heat sample for 1 minute with the 1.5 BTU radiant panel
  - ✓ Impinge pilot flame on specimen for 15 seconds
  - ✓ Acceptance Criteria: fire propagation length < 2”, after flame time < 45 seconds

Summary

FINAL REMARKS

- By looking at the MSCC results, there is a high probability that the structural adhesives AI and AJ will perform well when tested in the radiant panel test.
- The tapes 1 & 2 alone could not protect material N when challenged against the new radiant panel test protocol.
- During the evaluation of fire blocking covers using the new RP protocol, film 1 shrunk away exposing the blanket, hook & loop and tape. It did not provide a structurally sound protection to the non-fire worthy material (N).
- During the same evaluation, the best fire blocking configuration resulted when film 2 was combined with two layers of blanket, and closed with the hook and loop.

Summary

FINAL REMARKS

- Materials AQ, AR, AS, AT, and AU performed outstandingly when challenged to VBB, OSU, Smoke, RP, and MSCC tests.

- Material AV had two different results when tested at different axis. This material is a flexible duct that has a protruding helix spine in order to maintain its shape. When this spine is perpendicular to the pilot, the pilot flame attaches to the spine and travels through it during the 15-second impingement period; this causes the fire propagation to exceed the 2” threshold. But this does not occur when the spine is parallel to the pilot, so it passes the test. The FAA is examining this case in order to determine a logical solution that is fair and safe at the same time.