Radiant Panel Insulation Test Update

Presented to: International Aircraft Materials Fire Test Forum
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Introduction

- **Handbook update**
  - Updated June 2019
- **Electric Panel aging testing**
  - Panel runs hotter as it ages, can affect test results
  - Need “borderline” material to test
- **Backing board study**
  - Superwool 607 vs. Fermacell Gypsum Fibreboard vs. JM Super Firetemp M

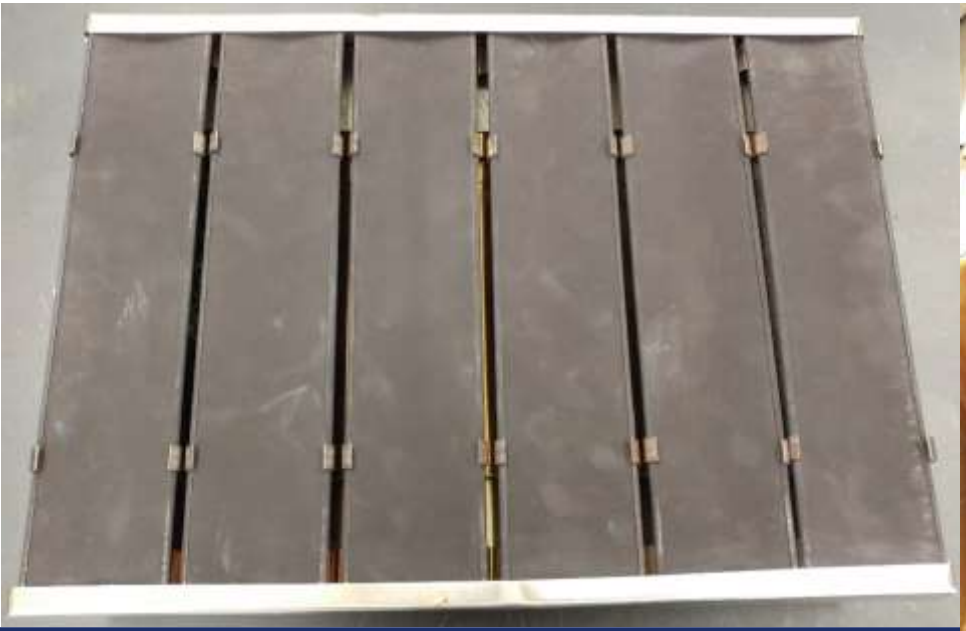
Handbook changes

- **Reduction of heat flux tolerance from ±5% to ±1% ~~has been made permanent~~ remains red.**
- **Replaced Superwool 607/Plus with generic "refractory board"**
  - Refractory board added to "Definitions" section in beginning
  - "A high-temperature, non-combustible, rigid insulation board with a maximum thermal conductivity of 0.694 Btu·in/hr·ft^2·°F (0.10 W/m·K) at 500°F (260°C)."
- **Removed "Bernzomatic" name brand from Pilot Burner section**
- **Added that foam samples that rise during testing may be held down with safety wire as long as the the wire is positioned away from the propane igniter and does not affect the flame propagation.**

Radiant Panel Aging

- **Temperature set point steadily increases to obtain same heat flux as panel ages – eventually leads to more material failures**
- **Biggest difference seems to be black paint on surface**
- **Need to find out what changes in the panel to make it run hotter**
- **Need to add guidance about when to replace electric panel**

New Panel



Old Panel

Radiant Panel Aging

- Condition likely depends on amount of use and types of materials tested

Radiant Panel Aging – Proposed Study

- **Test 7 electric panels**
  - 2 brand new, 1 in use, 4 old out of use
- **Panel set point**
- **3-position calibration check**
- **Measure emissivity of panel surface**
- **Measure internal resistance**
- **Measure power**
- **Measure temperature at sample surface**
- **Material testing**

Possible Borderline Material

- Tested 5 PEEK samples each at 1.50 Btu/ft^{2}s, 1.60 Btu/ft^{2}s, and with the air gaps around the drawer open and closed
- No after flame and very little flame propagation (~0.5 inch) for all tests
- Not very borderline

Backing Board Study

- **Reported problems with certain foam materials that melt and stick to the backing board affecting subsequent tests**
- **Backing board should not interfere with test**
- **Zotefoam organized a study with the FAA and Wulfmeyer**
- **PVDF Foam material samples in 25 mm and 3 mm thicknesses**
- **Three different backing boards**
- **30 samples for each combination**
- **2 out of 3 labs reported data so far**

Backing Board Study

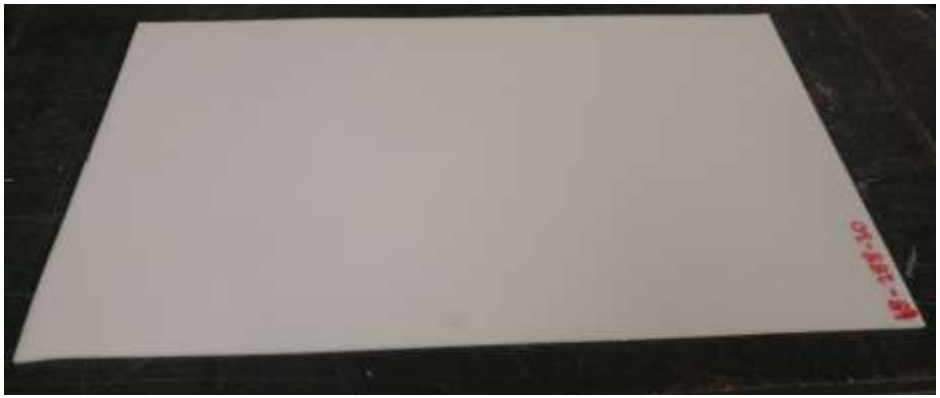
	Superwool 607 (67% Silica (SiO_2), 27% Calcium Oxide + Magnesium Oxide)	**Fermacell Gypsum Fibreboard Greenline** (Gypsum and Recycled Paper Fibers)	**JM Super Firetemp M** (Lime, Silica, and Reinforcing Fibers)
Density (kg/m^3)	320 – 350	1150 ± 50	449
Thermal Conductivity (W/m·K)	0.06 @ 260°C (500°F) (increases with temperature)	0.32 @ 10°C (50°F)	0.10 @ 260°C (500°F)

Backing Board Study

- PVDF Foam material samples being tested
- Same material, 25 mm and 3 mm thicknesses
- (30) 25 mm samples for each backing board at each lab
- (27) 3 mm samples for each backing board at each lab

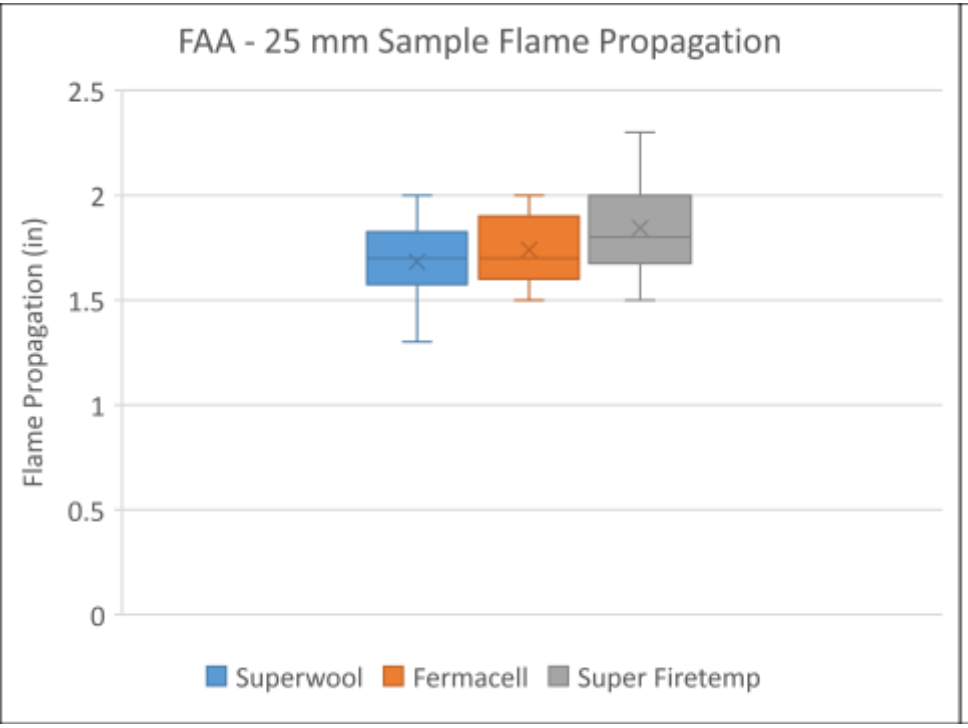
25 mm Sample

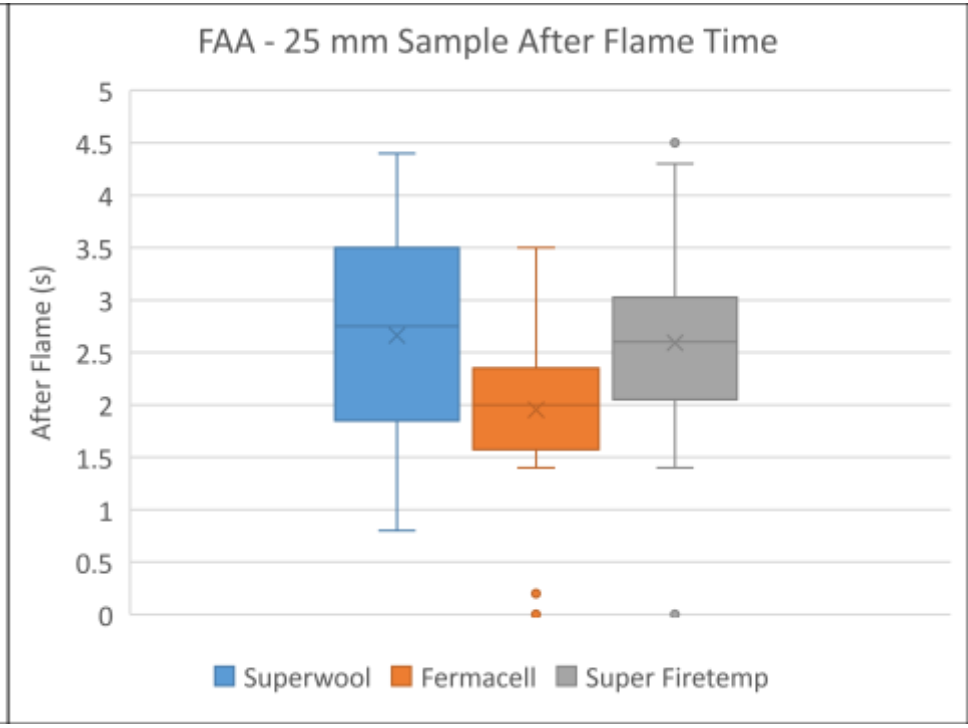
3 mm Sample



FAA Results – 25 mm samples

30 foam samples each

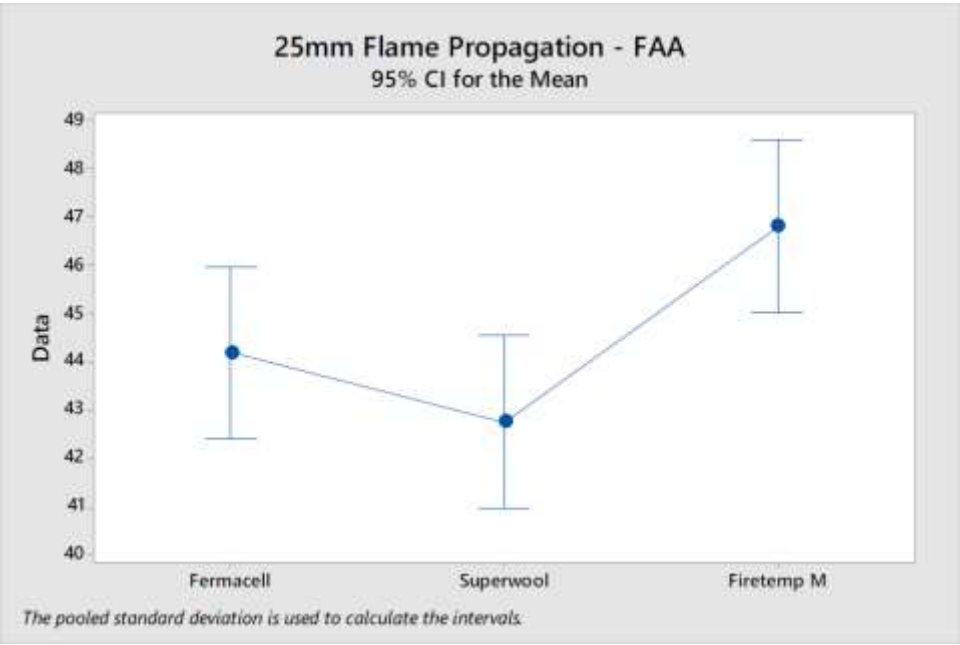


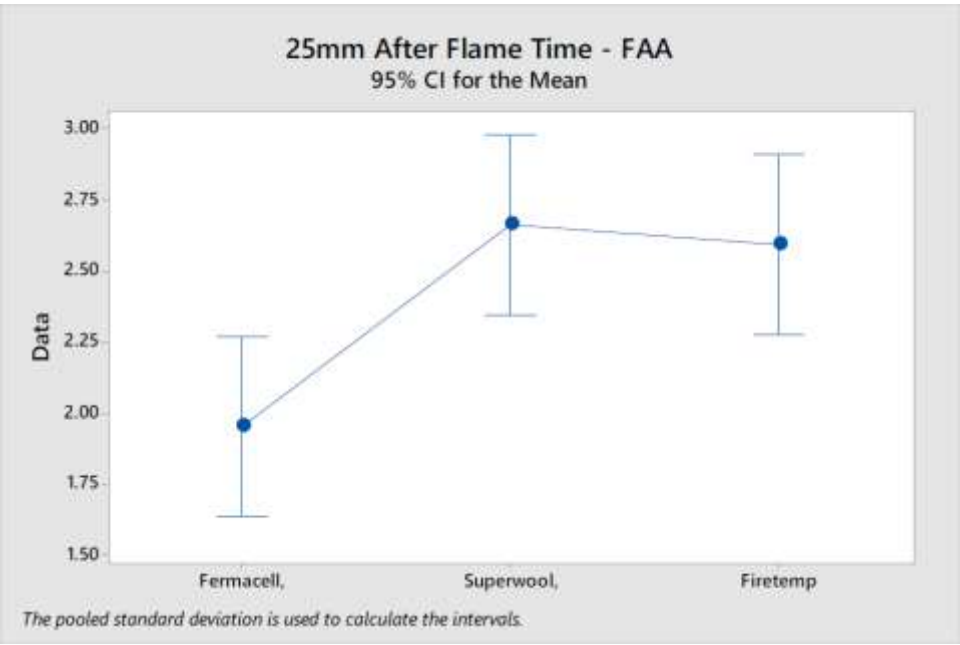


	Superwool	Fermacell	Super Firetemp
Avg. Flame Prop.	1.68	1.74	1.84
Avg. After Flame	2.66	1.95	2.59
Failures	13	2	9

FAA Results – 25 mm Samples

ANOVA analysis done by Zotefoams

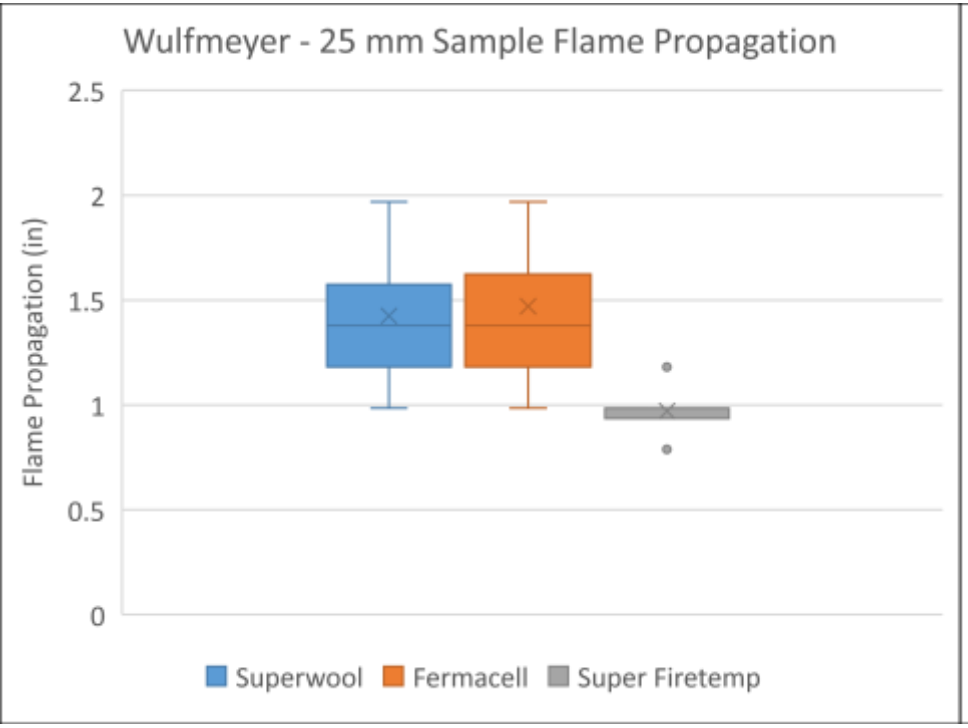


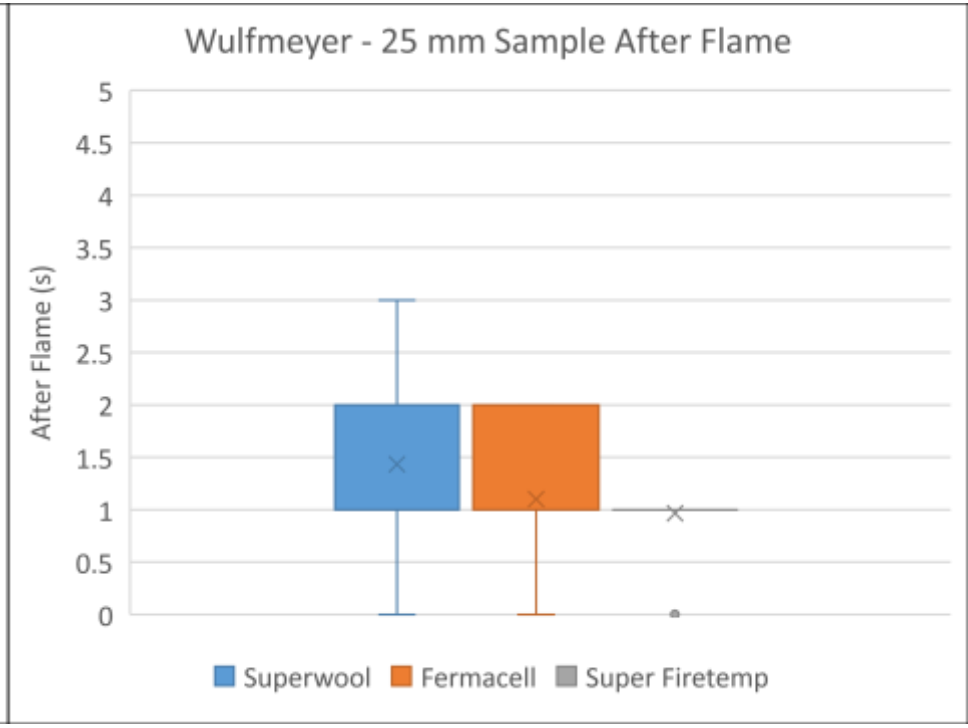


- No statistically significant difference in flame propagation lengths
- After flame times with Fermacell backing boards were significantly less than Superwool and Firetemp boards

Wulfmeyer Results - 25 mm Samples

30 foam samples each

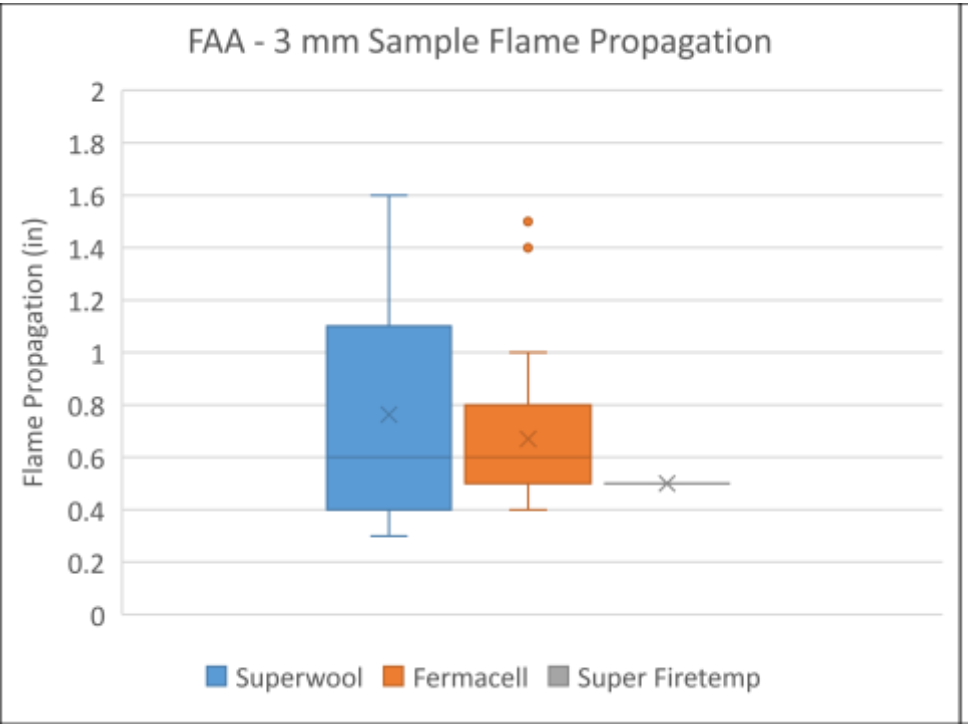


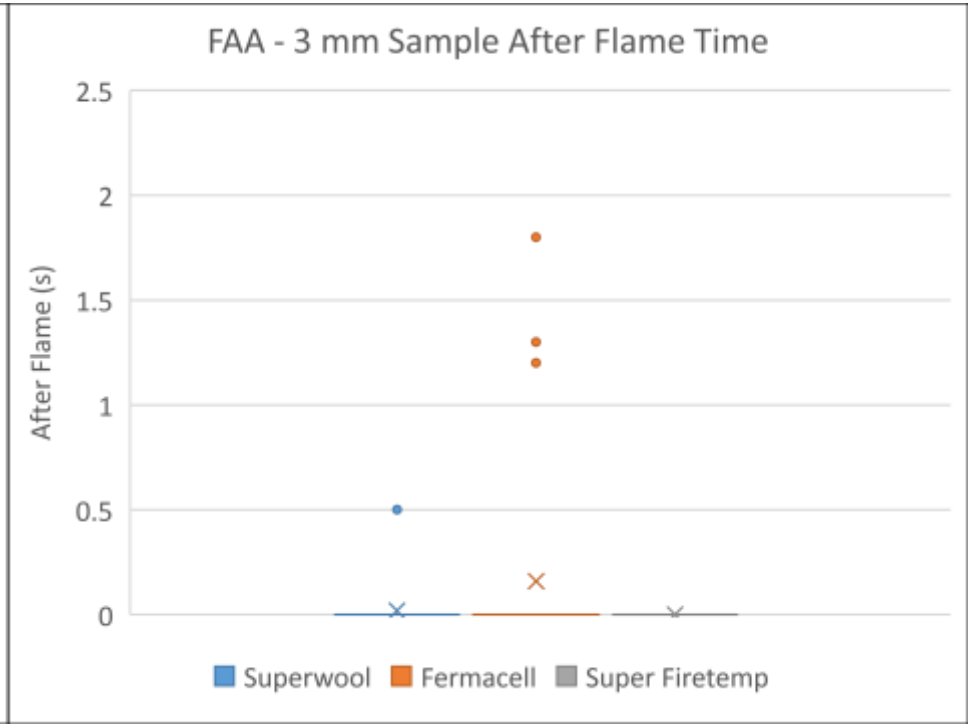


	Superwool	Fermacell	Super Firetemp
Avg. Flame Prop.	1.42	1.47	0.97
Avg. After Flame	1.43	1.10	0.97
Failures	0	0	0

FAA Results – 3 mm samples

27 foam samples each

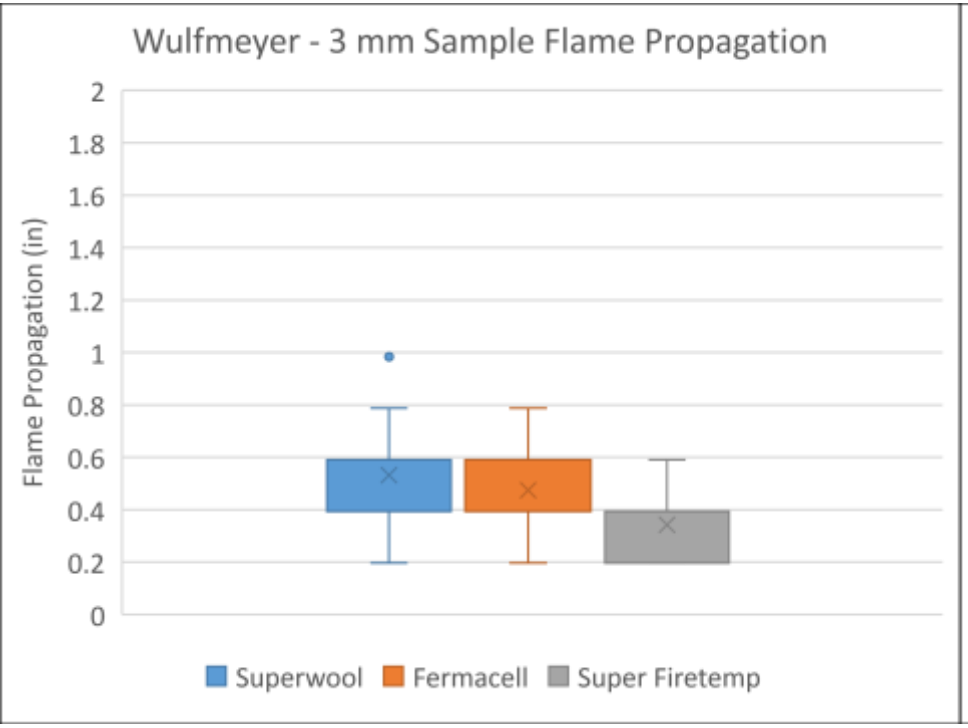


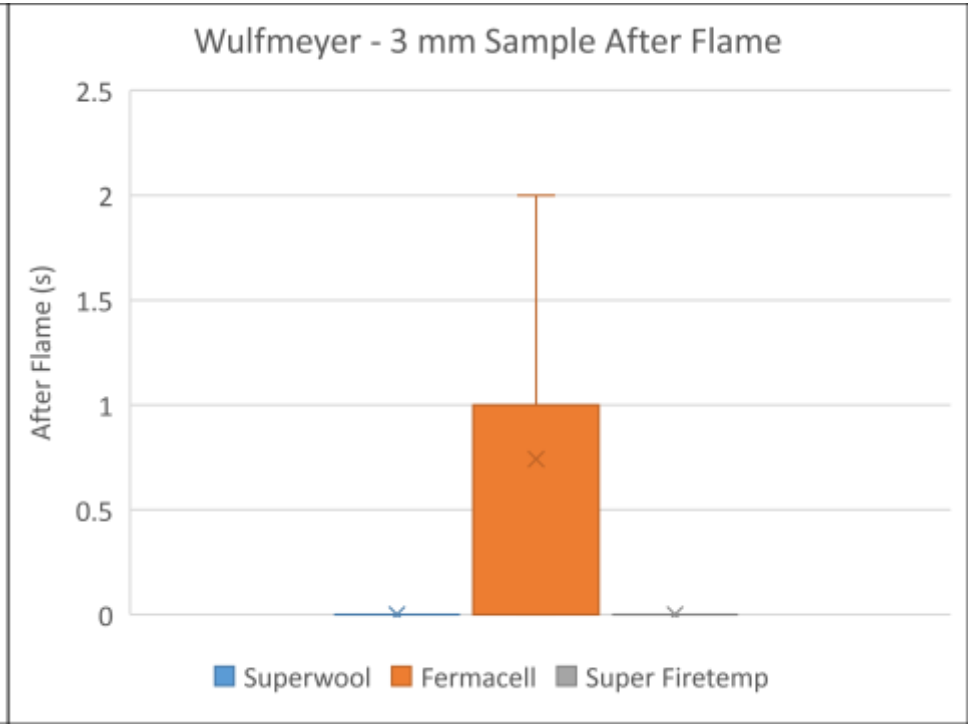


	Superwool	Fermacell	Super Firetemp
Avg. Flame Prop.	0.76	0.67	0.50
Avg. After Flame	0.02	0.16	0.00
Failures	0	0	0

Wulfmeyer Results – 3 mm samples

27 foam samples each





	Superwool	Fermacell	Super Firetemp
Avg. Flame Prop.	0.53	0.47	0.34
Avg. After Flame	0.00	0.74	0.00
Failures	0	0	0

Conclusion

- **25 mm foam samples with Superwool 607 and Super Firetemp M backing boards had higher after flame times and significantly more failures with than Fermacell backing board in FAA testing**
- **3 mm foam samples with Fermacell backing board had higher after flame times in Wulfmeyer testing, but not enough to cause failures**

- **Still need borderline material to test for panel aging study**

Questions?

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