Burn-Through Fire Testing of AlphaGen Panels Conducted on April 08-12, 2010 at UAB

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Background

UAB was provided with 10 panels for burn-through fire testing. The panels were fabricated at AlphaGen.

Experimental Conditions

Table 1 summarizes the details of the panels. The experimental conditions were set based on the David Taylor Research Center [DTRC] Burn-Through Test, MIL-STD-2031(Navy adopted standard). These conditions are as follows:

- Torch Fuel = Propane
- Torch Diameter = 38.1 mm
- Distance from panel around which ambient temperature was taken = 6 inches
- Torch distance from the panel = 10.5 inches or 266.7mm
- Flame spread at the surface = 100mm diameter
- Heat Flux at the Surface of the Panel = 45 kW/m²
- Duration of the Test = 60 min
- Temperature Measurement = 5 K-type thermocouples (TC), spaced as shown

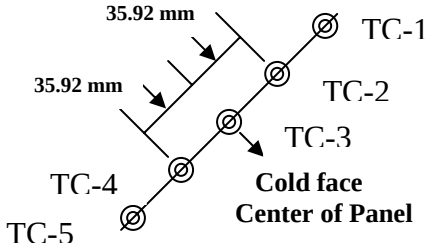


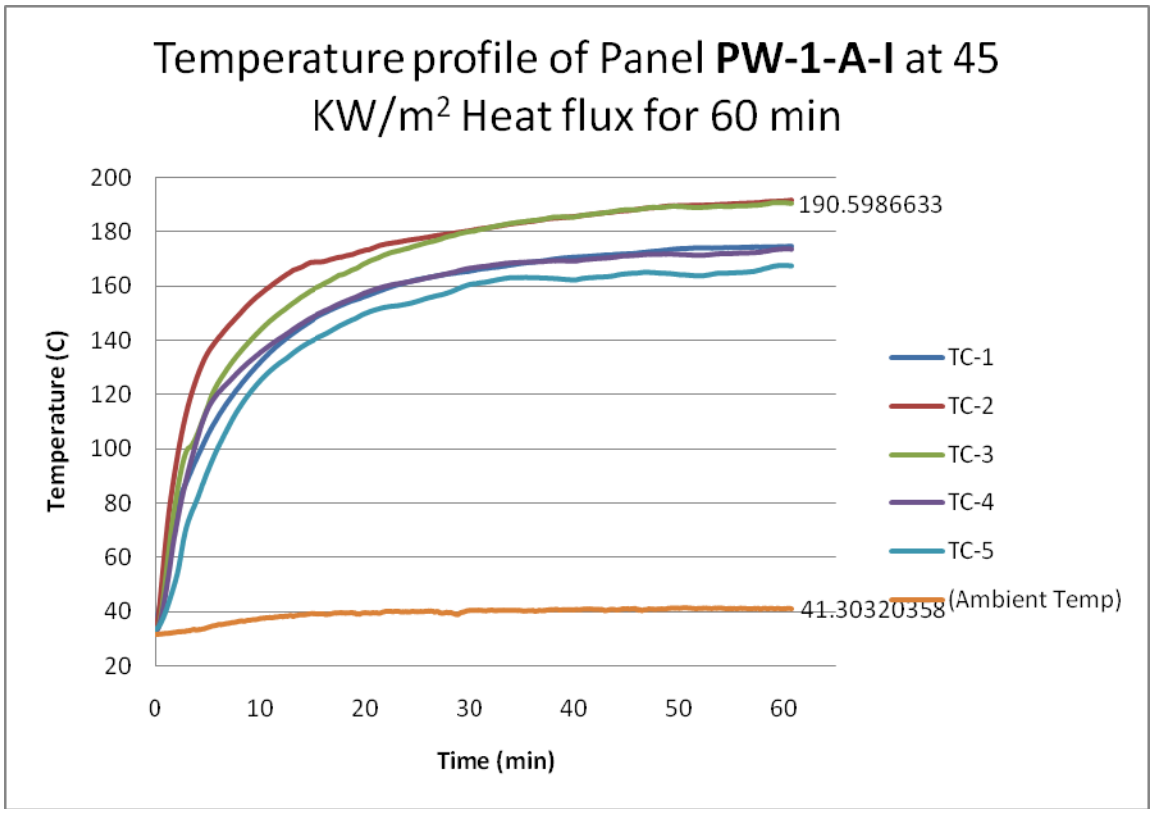
Table 1. Panels received from for burn-through testing.

Panel ID	Weight before burn-through (lbs)	Weight after burn-through (lbs)	Heat Flux (kW/m2)	Time Tested (min)	Thickness (mm)			
PW-1A#1	1.54	1.5	44-45	60	4.5	4.4	5.2	5.2
PW-1A#2	1.54	1.52	44-45	60	5.25	4.76	5	5
PW-1B#1	1.22	1.18	44-45	60	4.2	3.76	4	4.1
PW-1B#2	1.42	1.36	44-45	60	5	4.7	4.13	4.6
PW-1C#1	2.16	2.1	44-45	60	5.88	5.4	6.63	6.68
PW-1C#2	1.74	1.68	44-45	60	4.8	5.38	5.16	5.6
PW-1D#1	1.2	1.18	44-45	45	3.4	3.6	3.6	4
PW-1D#2	1.34	1.3	44-45	60	3.97	3.5	4.95	3.43
PW-1C-A	1.62	1.48	44-45	60	5.53	4.42	4.9	5
PW-1D-A	1.22	1.14	44-45	60	4.5	3.75	4.1	3.7

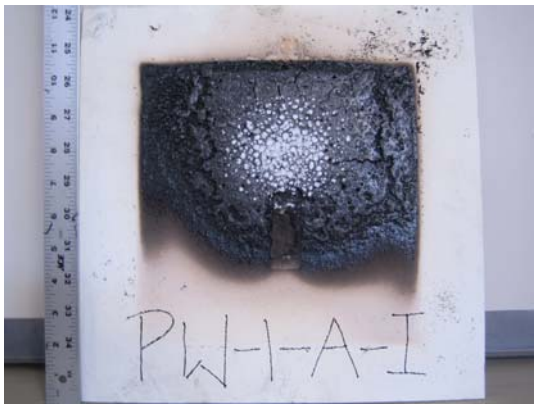
Results and Discussion - 1
The following panels were tested with "**Burn this face**" as fire front.

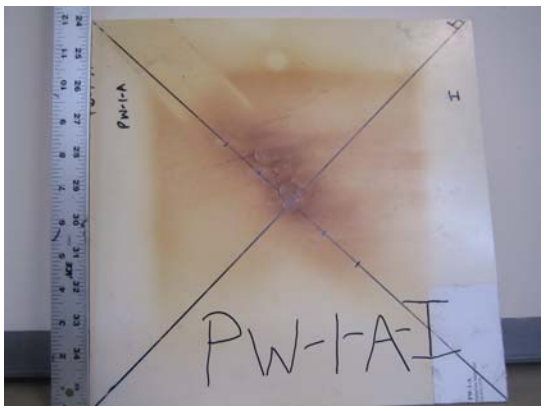
Panel PW-1A#1--- Tested for 60 min

Avg. Thickness on 4 sides – 4.5 mm, 4.4 mm, 5.2 mm, and 5.2 mm
Weight before testing – 1.54 lbs
Weight after testing – 1.5 lbs
Weight loss % – 2.597 %



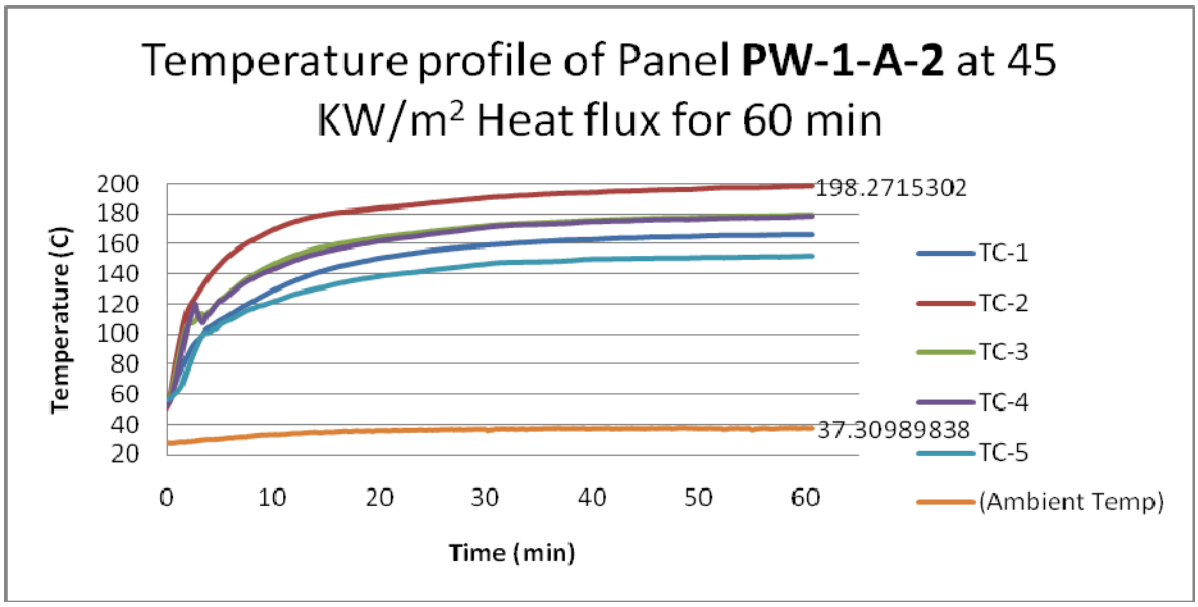
Front & Back face Damage



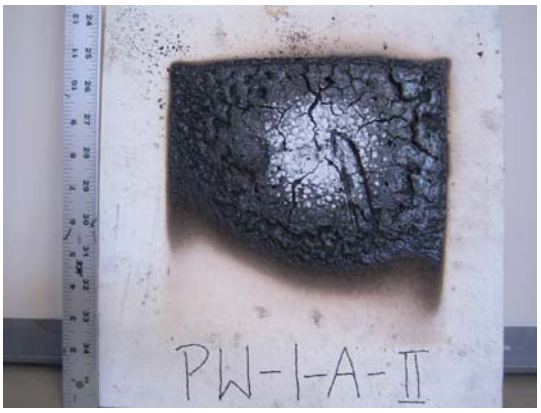


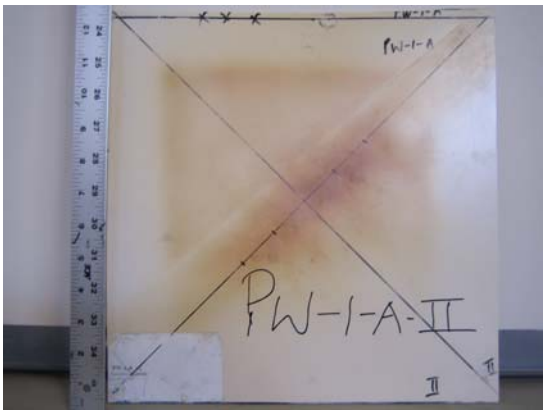
Panel PW-1A#2--- Tested for 60 min

Avg. Thickness on 4 sides – 5.25mm, 4.76 mm, 5 mm, and 5 mm
Weight before testing – 1.54 lbs
Weight after testing – 1.52 lbs
Weight loss % – 1.29 %



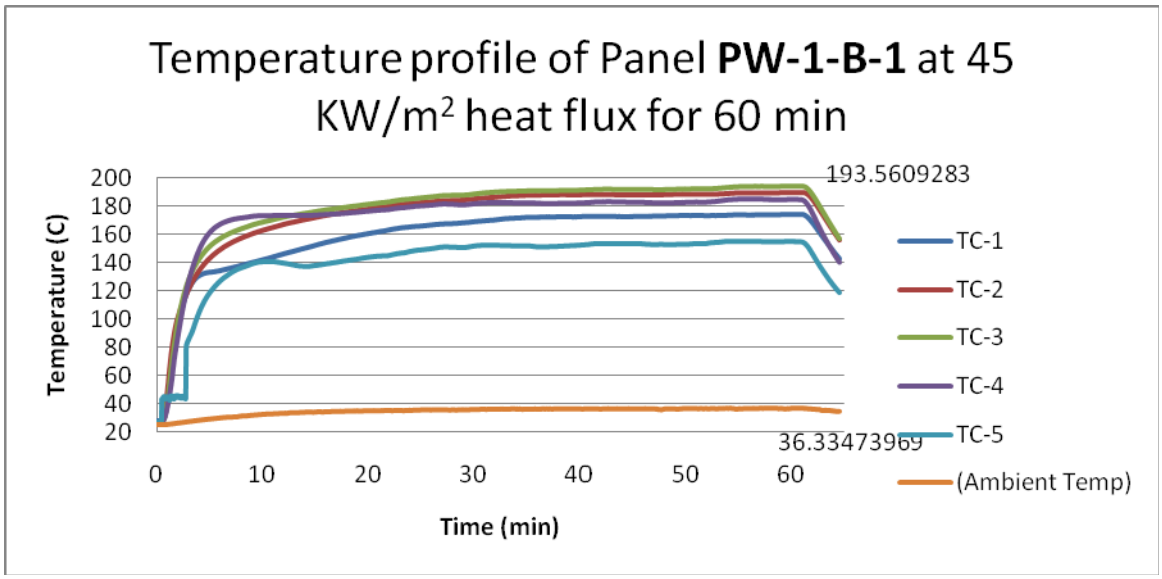
Front & Back face Damage



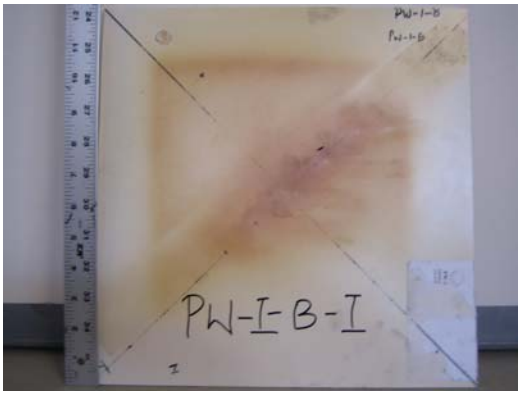


Panel PW-1B#1--- Tested for 60 min

Avg. Thickness on 4 sides – 4.2mm, 3.76 mm, 4 mm, and 4.1 mm
Weight before testing – 1.22 lbs
Weight after testing – 1.18 lbs
Weight loss % – 3.27 %

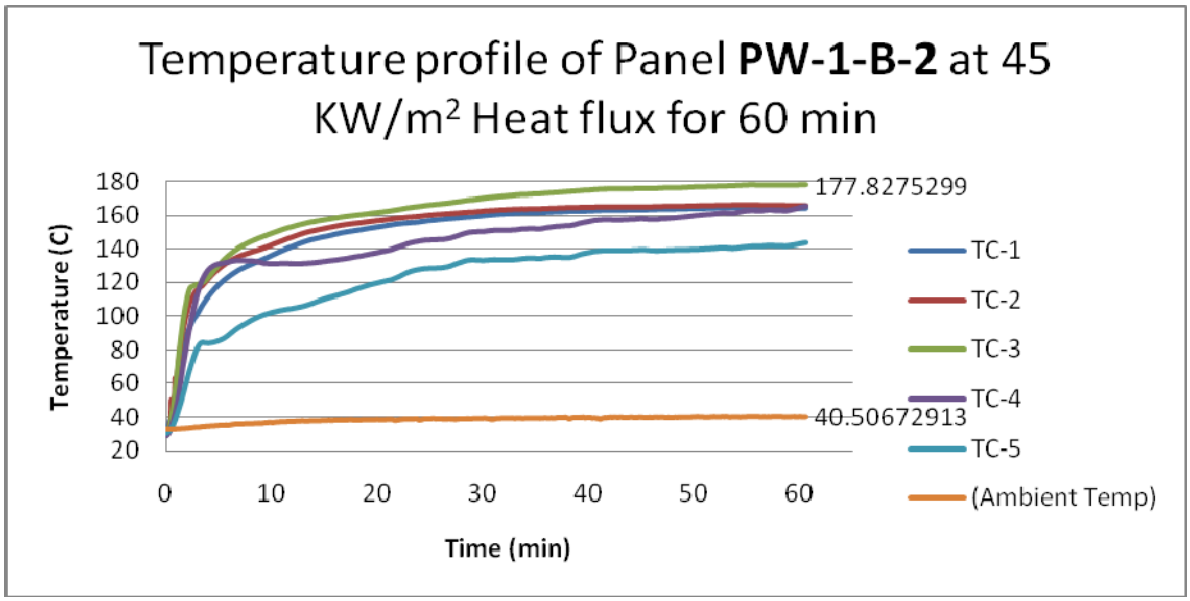


Front & Back face Damage



Panel PW-1B#2--- Tested for 60 min

Avg. Thickness on 4 sides – 5 mm, 4.7 mm, 4.13 mm, and 4.6 mm
Weight before testing – 1.42 lbs
Weight after testing – 1.36 lbs
Weight loss % – 4.225 %



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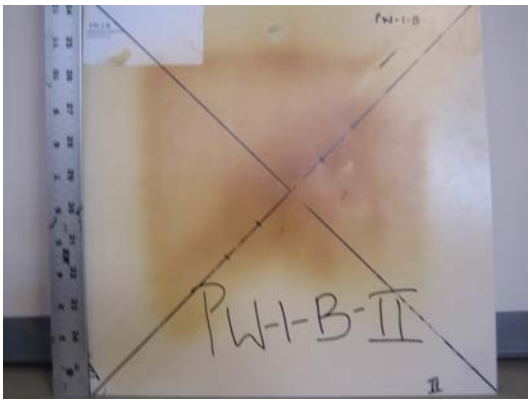
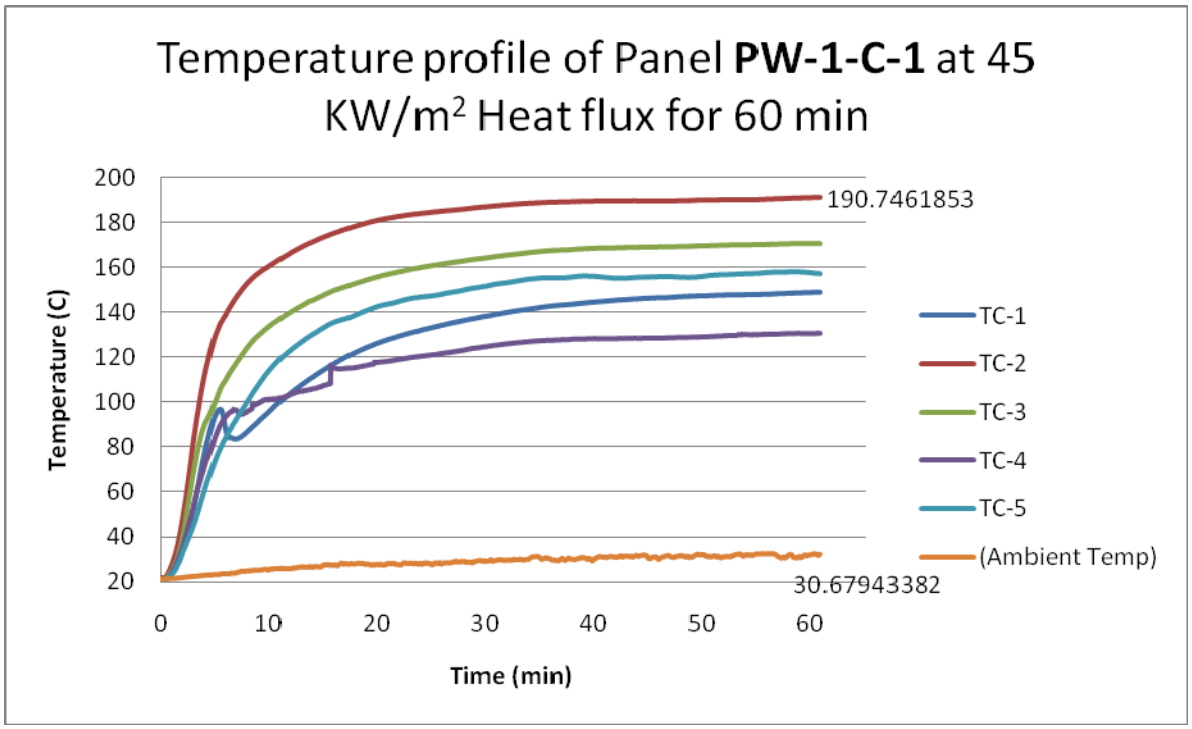
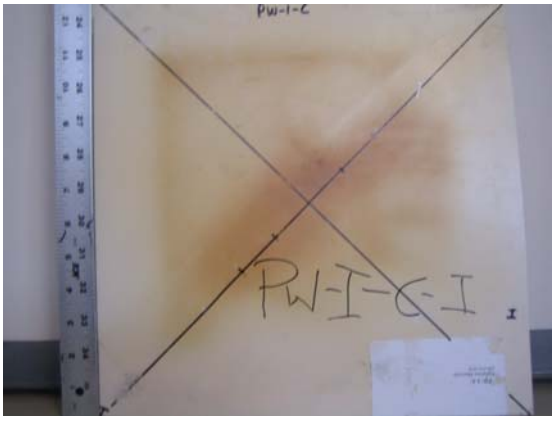


Panel PW-1C#1--- Tested for 60 min

Avg. Thickness on 4 sides – 5.88 mm, 5.4 mm, 6.63 mm, and 6.68 mm
Weight before testing – 2.16 lbs
Weight after testing – 2.1 lbs
Weight loss % – 2.77 %

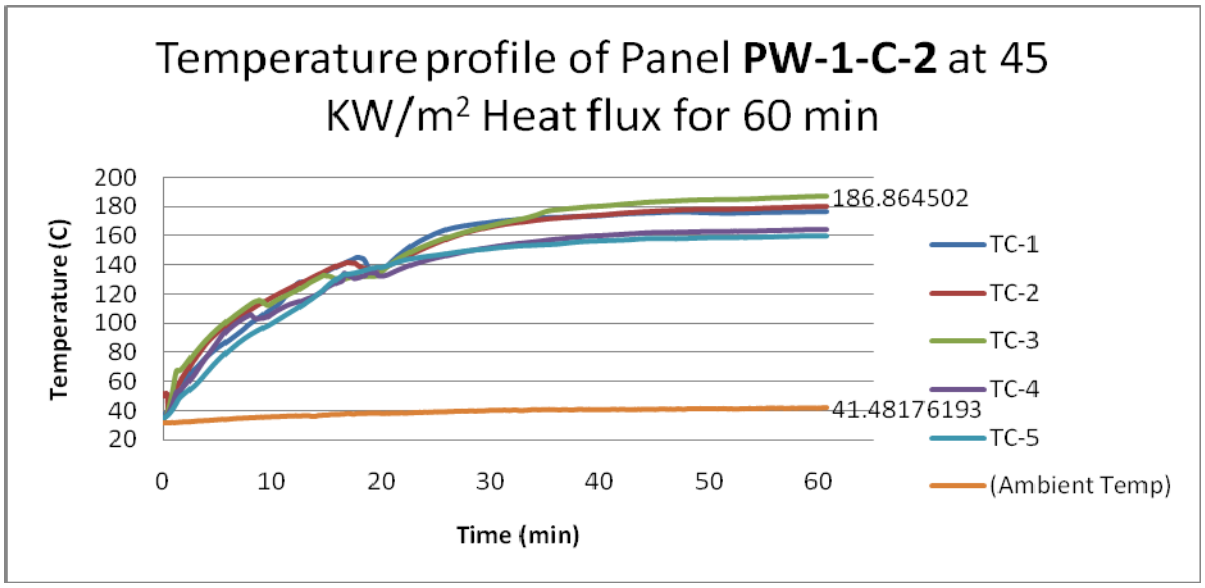


Front & Back face Damage

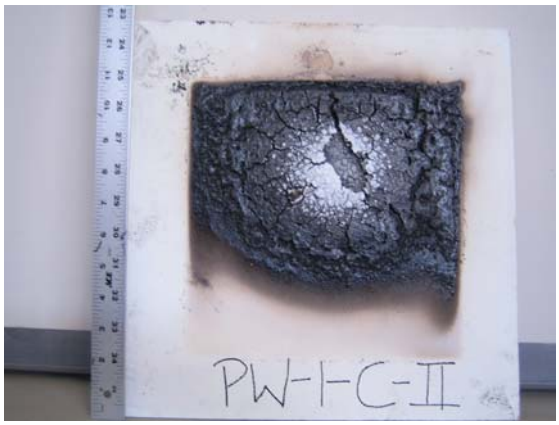


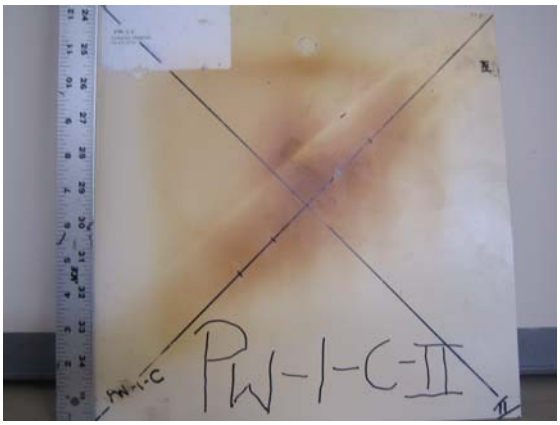
Panel PW-1C#II--- Tested for 60 min

Avg. Thickness on 4 sides – 4.8 mm, 5.38 mm, 5.16 mm, and 5.6 mm
Weight before testing – 1.74 lbs
Weight after testing – 1.68 lbs
Weight loss % – 3.44 %



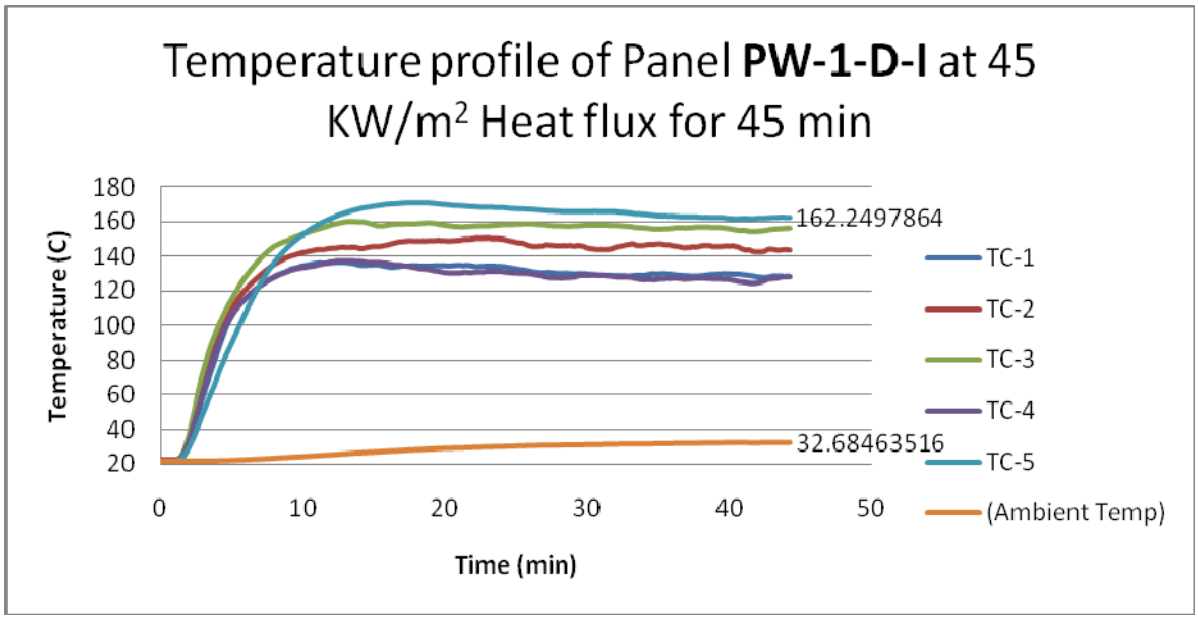
Front & Back face Damage



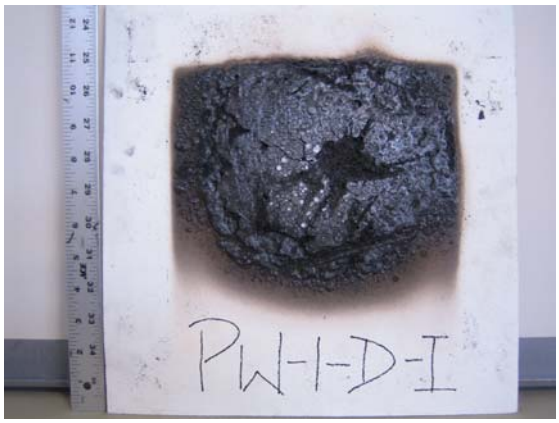


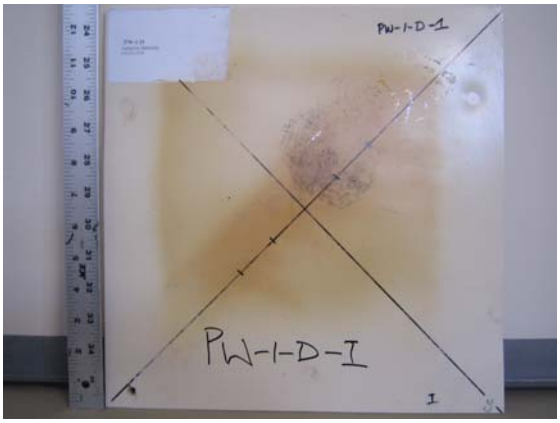
Panel PW-1D#I--- Tested for 45 min

Avg. Thickness on 4 sides – 3.4 mm, 3.6 mm, 3.6 mm, and 4 mm
Weight before testing – 1.2 lbs
Weight after testing – 1.18 lbs
Weight loss % – 1.66 %



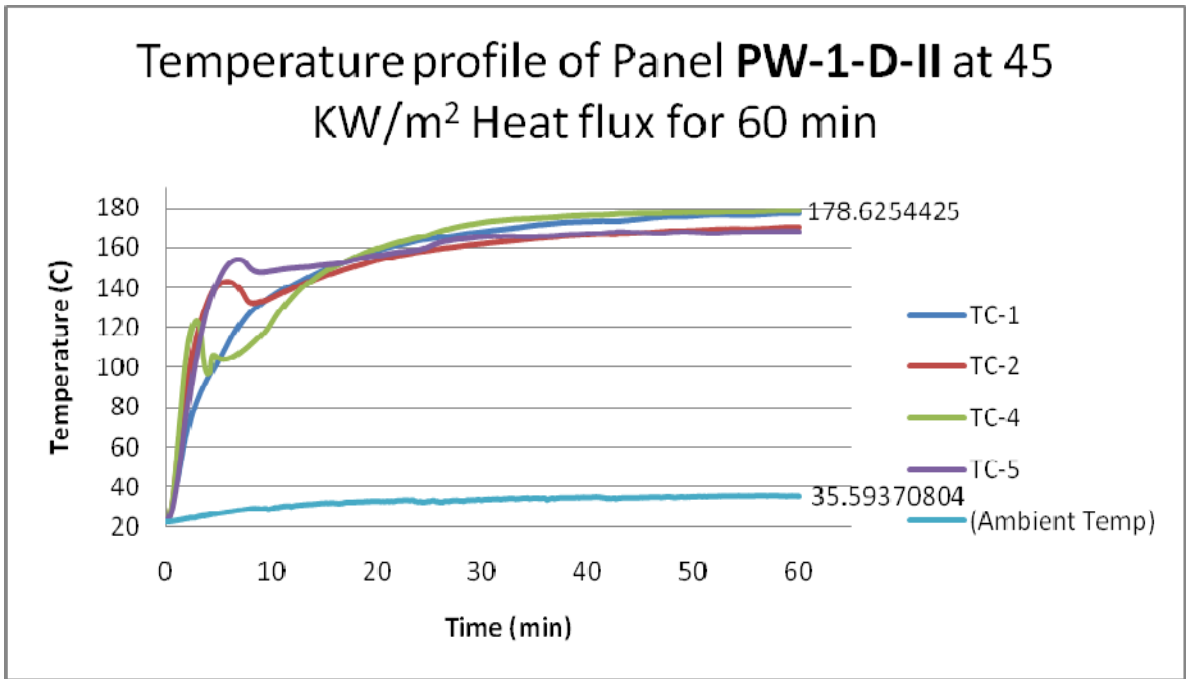
Front & Back face Damage



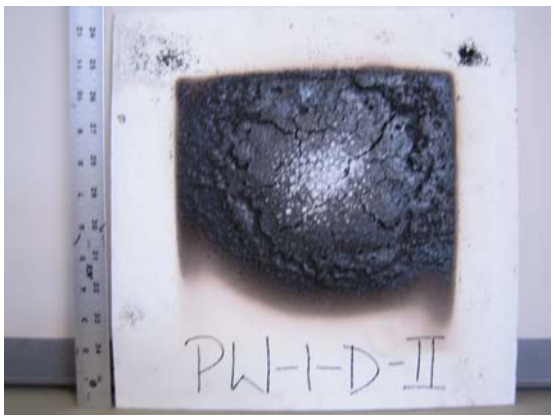


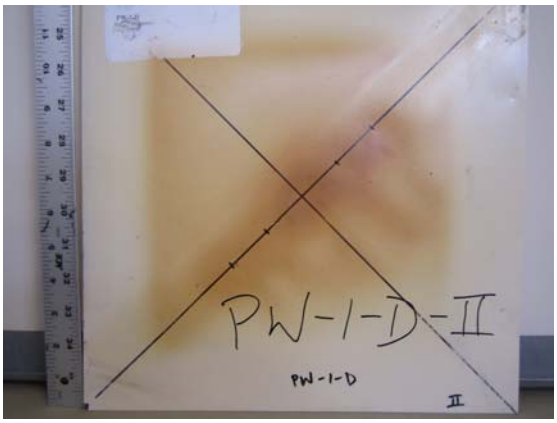
Panel PW-1D#II--- Tested for 60 min

Avg. Thickness on 4 sides – 3.97 mm, 3.5 mm, 4.95mm, and 3.43 mm
Weight before testing – 1.34 lbs
Weight after testing – 1.3 lbs
Weight loss % – 2.98 %



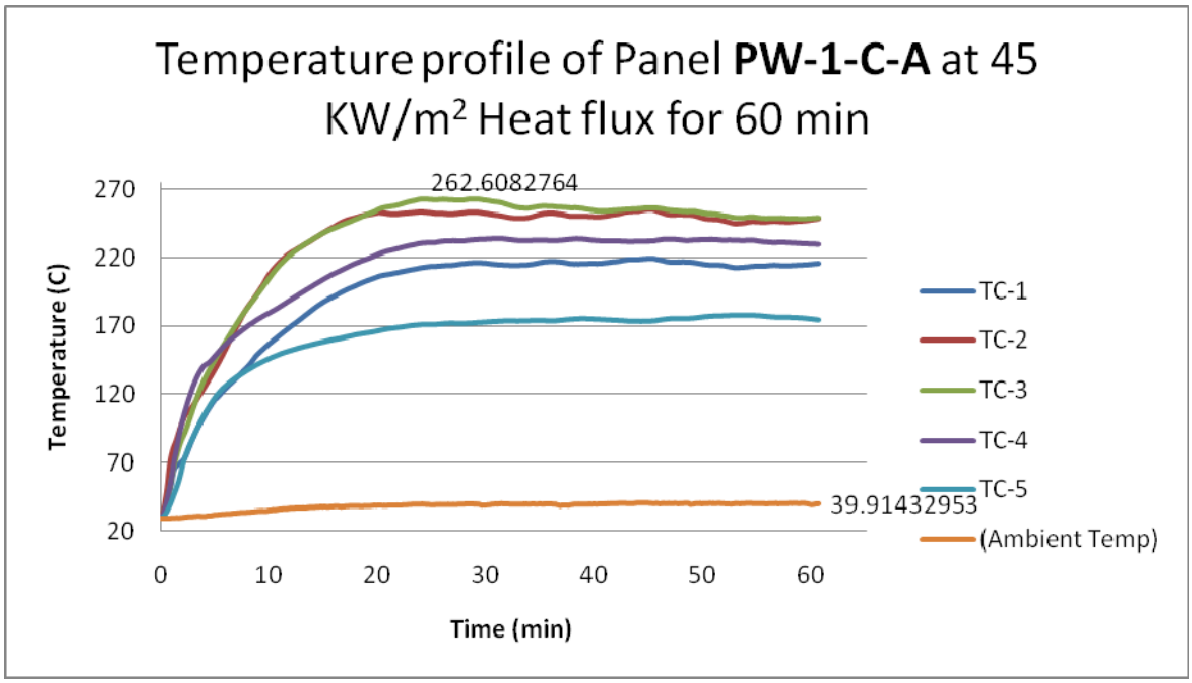
Front & Back face Damage



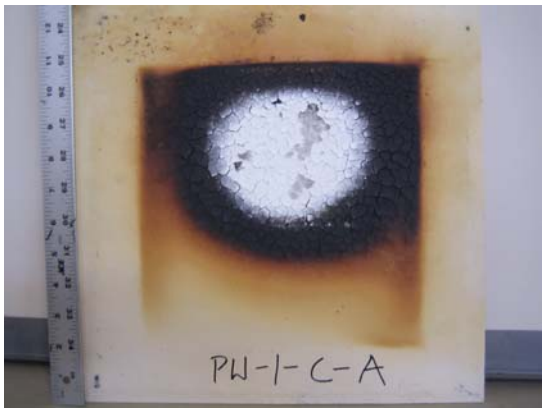


Panel PW-1C-A--- Tested for 60 min

Avg. Thickness on 4 sides – 5.53mm, 4.42 mm, 4.9 mm, and 5 mm
Weight before testing – 1.62 lbs
Weight after testing – 1.48 lbs
Weight loss % – 8.64 %

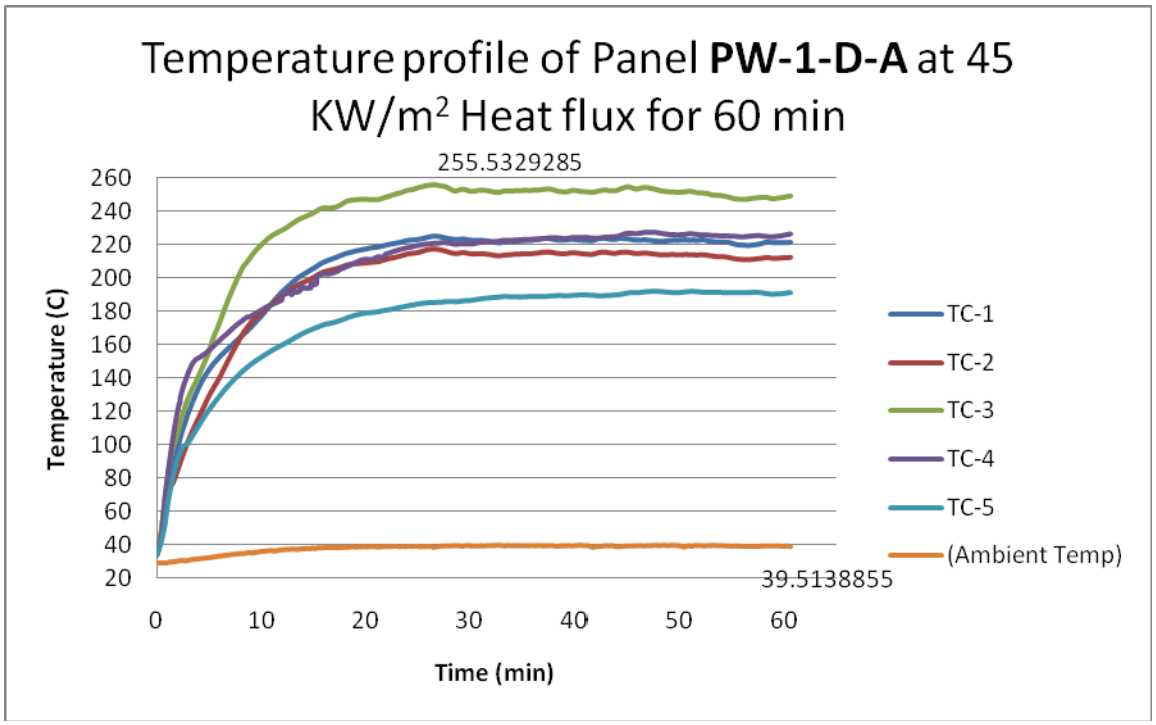


Front & Back face Damage

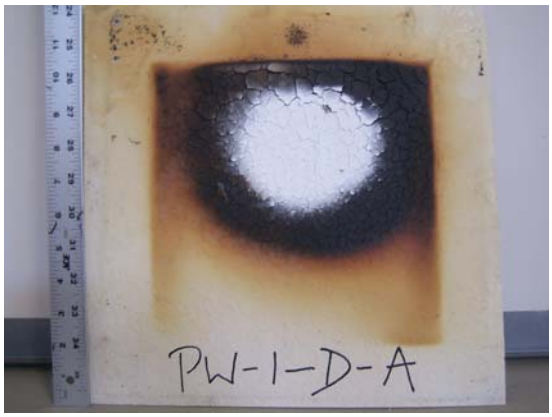


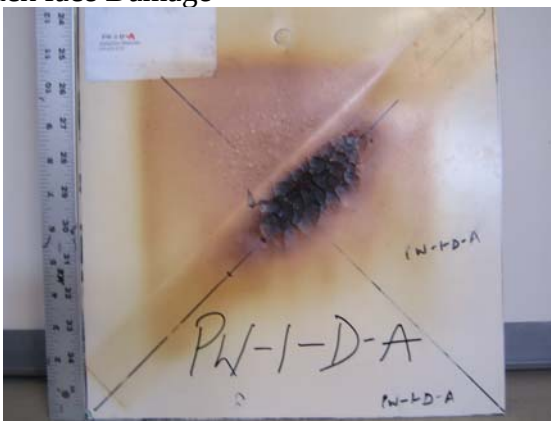
Panel PW-1D-A--- Tested for 60 min

Avg. Thickness on 4 sides – 4.5 mm, 3.75 mm, 4.1 mm, and 3.7 mm
Weight before testing – 1.22 lbs
Weight after testing – 1.14 lbs
Weight loss % – 6.55 %

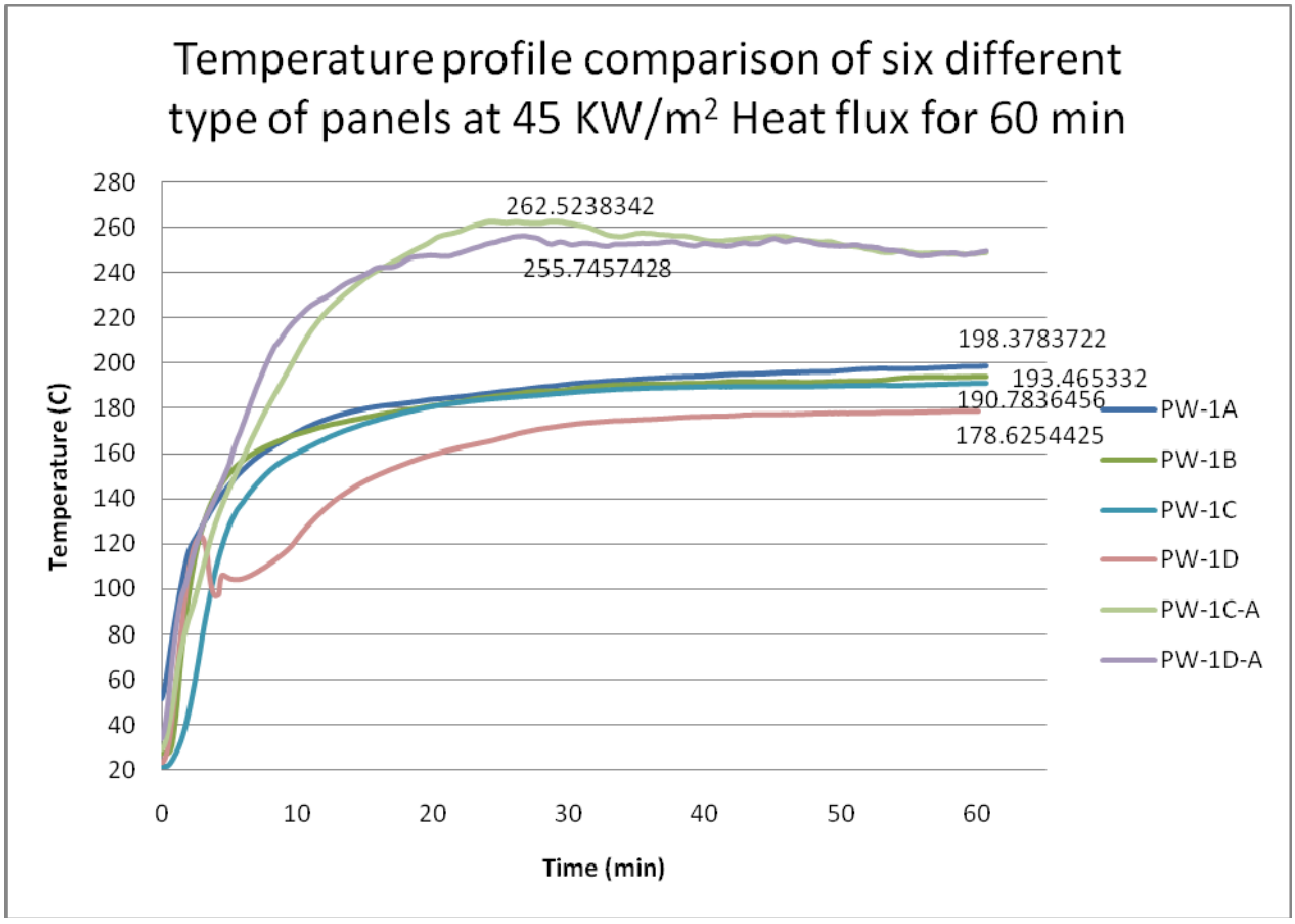


Front & Back face Damage





Comparison chart for all the 6 types of panels (PW-1A, PW-1B, PW-1C, PW-1D, PW-1C-A, PW-1D-A) tested for burn-through at a heat flux of 45 kW/m2 for 60 min.



Synopsis

Panel ID	Weight before burn-through (lbs)	Weight after burn-through (lbs)	Mass loss %	Max. Temp. on the Back face (° C)	Max. Ambient Temp. 6 inches further from panel (° C)	Avg. Thickness (mm)	Time Tested (min)
PW-1A#1	1.54	1.5	2.597	191.79	41.75	4.825	60
PW-1A#2	1.54	1.52	1.29	198.55	37.41	5.0025	60
PW-1B#1	1.22	1.18	3.278	193.75	37.11	4.015	60
PW-1B#2	1.42	1.36	4.225	178.12	40.68	4.6075	60
PW-1C#1	2.16	2.1	2.777	190.95	32.55	6.1475	60
PW-1C#2	1.74	1.68	3.448	187.9	41.78	5.235	60
PW-1D#1*	1.2	1.18	1.666	170.9	32.76	3.65	45
PW-1D#2	1.34	1.3	2.985	178.69	35.83	3.9625	60
PW-1C-A	1.62	1.48	8.642	262.63	41.07	4.9625	60
PW-1D-A	1.22	1.14	6.557	255.95	40.06	4.0125	60

* Tested for only 45 minutes (Thermocouple came off).

Observations:

-Panel PW-1D-A and PW-1C-A had maximum back face temperature of 255.95^{o}C & 262.63^{o}C respectively. It could be because of the maximum weight loss percentage of 6.557% & 8.642% respectively.

-Panel PW-1D recorded the lowest back face and ambient temperature. This may be due to low weight loss % and less testing time.

-Panel PW-1B & Panel PW-1C had almost similar back face temperature profile which was better than Panel PW-1A. (Panel PW-1A had higher back face temperature)

-Thickness and weight of the samples may have played a role in the fire performance of the panels.