

Assessment of Two Tests in
IEC 62788-5-2
Edge Seal Durability Tests
by IEC TC82 WG2 TG5
PVAQT5

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Purpose:

Use two commercially available edge sealants to evaluate tests in the Edge Seal Durability standard IEC 62788-5-2.

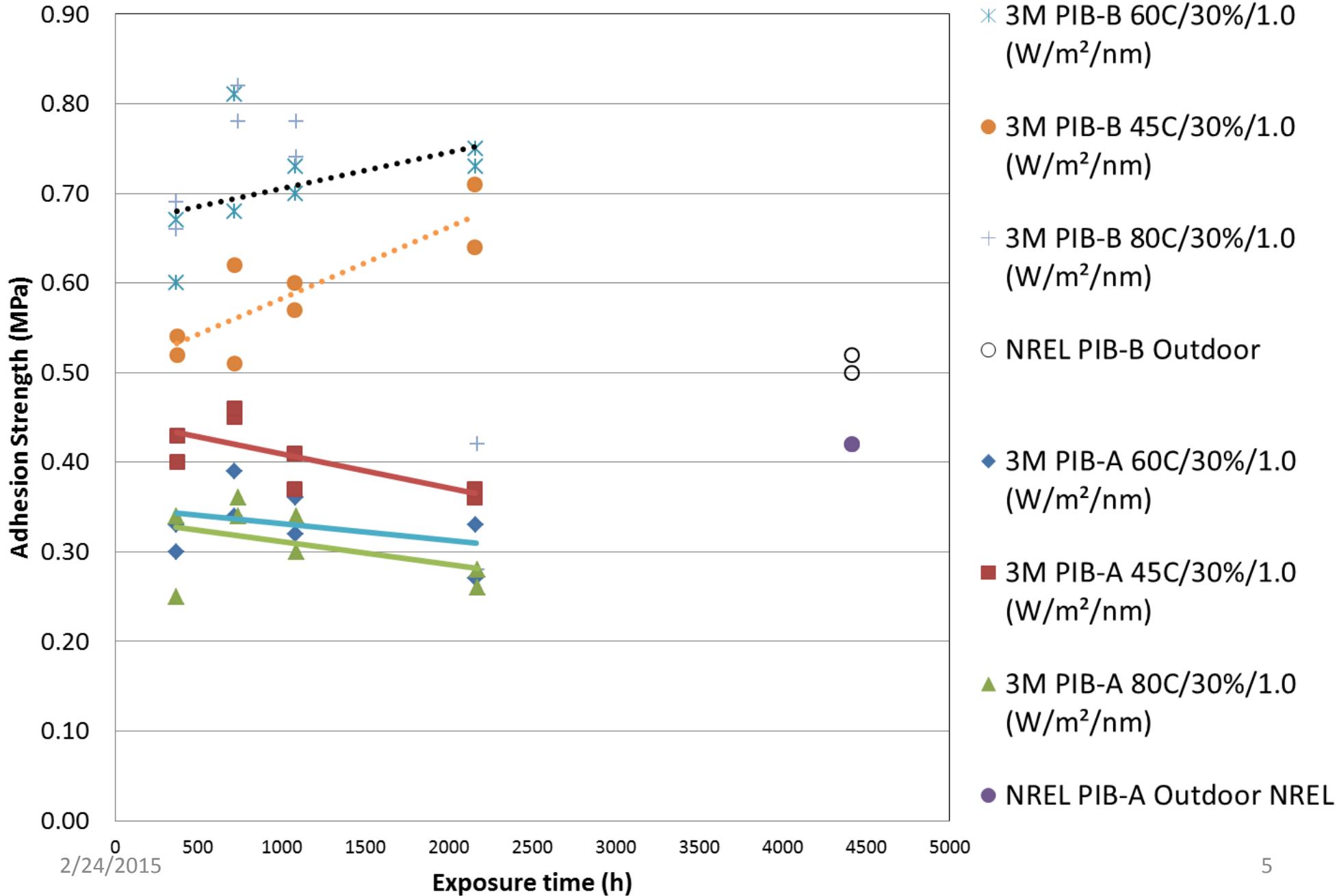
- Overlap Shear
- Wedge Test

Overlap Shear Tests

- Low iron Glass/Glass 25.4mm wide x 75 mm long
- Adhesive thickness ~0.6 mm
- Adhesive area 25.4 mm x 25.4 mm
- Strain rate 10 mm/min
- Two replicates per time period
- Chamber Exposure - Xenon @ 45°C 60°C 80°C
- Outdoor Exposures - NREL Golden, CO

Lap Shear PIB A and B

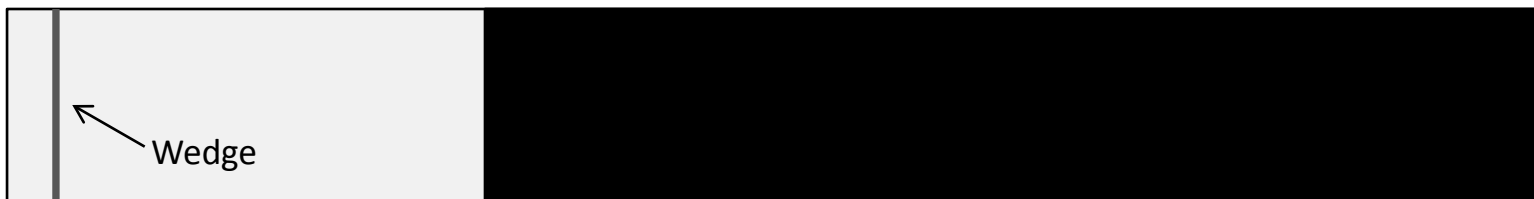
Various UV exposures & temperatures



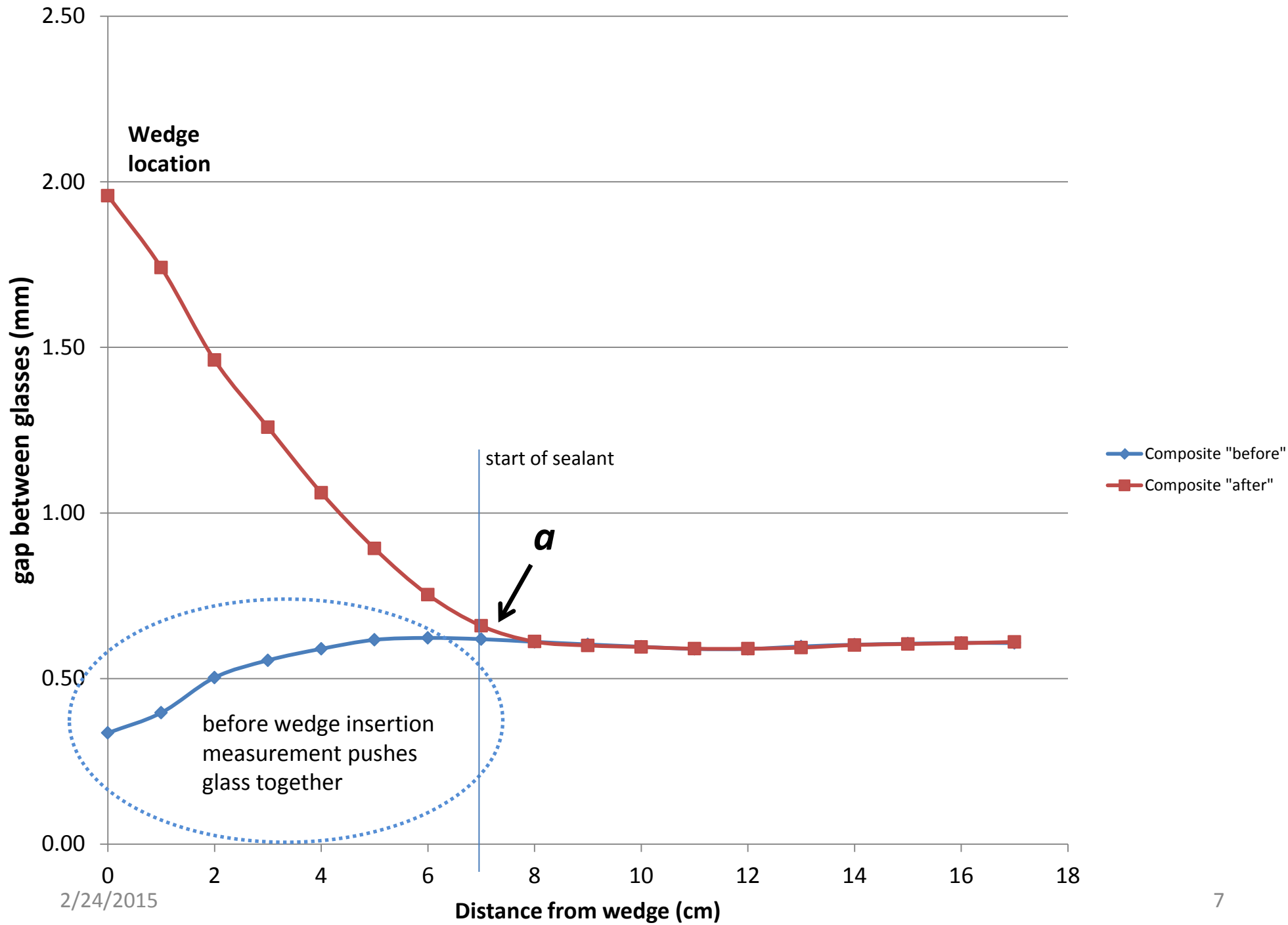
Wedge Test Calculating Griffith's Criterion G_{th} “Fracture Toughness Threshold”

$$G_{th} = \frac{3Et^3h^2}{16a^4}$$

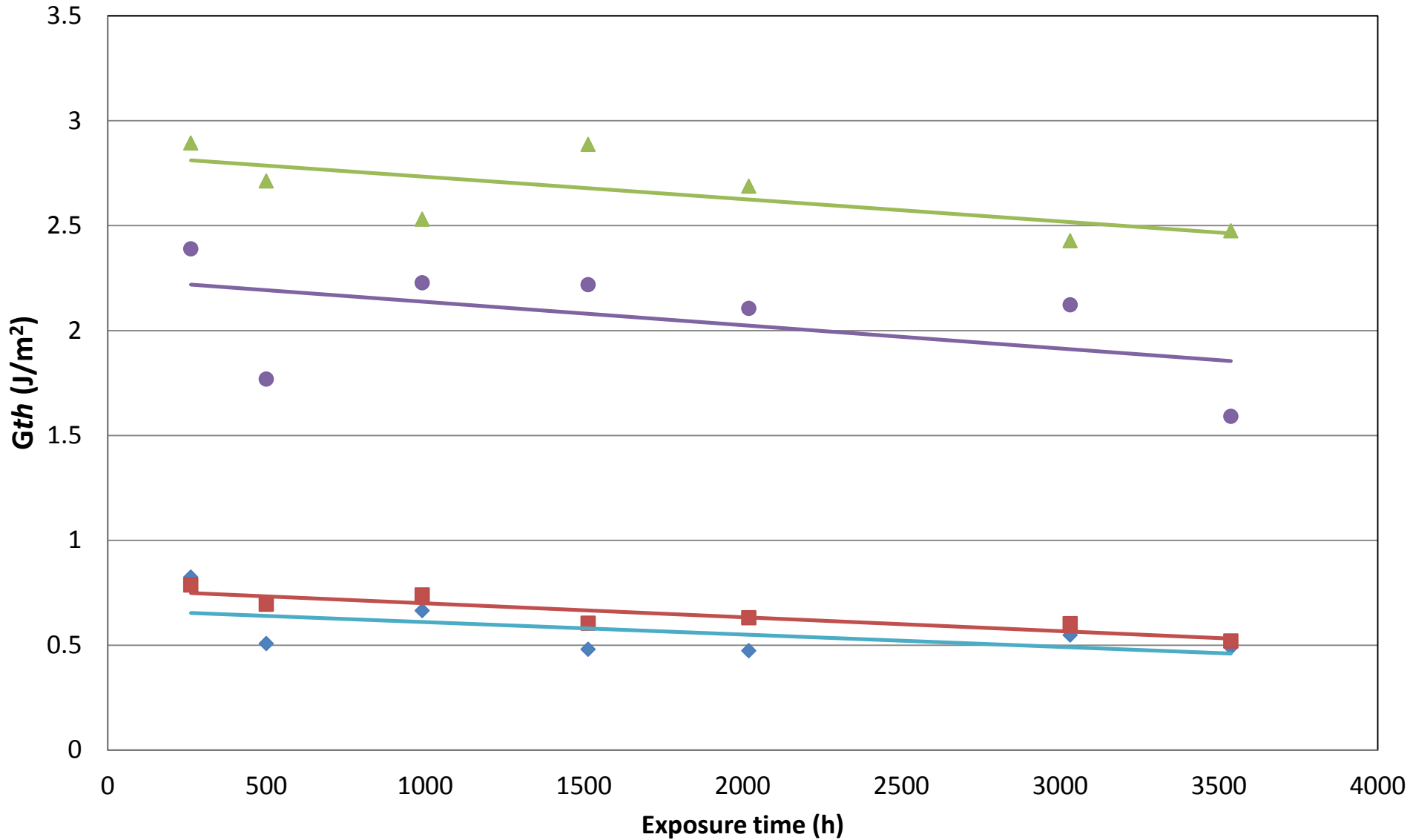
- E= 72 GPa low-iron glass
- t= 3.18 mm beam thickness
- h= wedge size - initial adhesive thickness
wedge 2 and 2.38 mm, adhesive thickness ~0.60 mm
- a= distance from wedge to the 5% change in thickness
–Used change in thickness since no delamination occurred



Impact of Wedge Insertion on Thickness



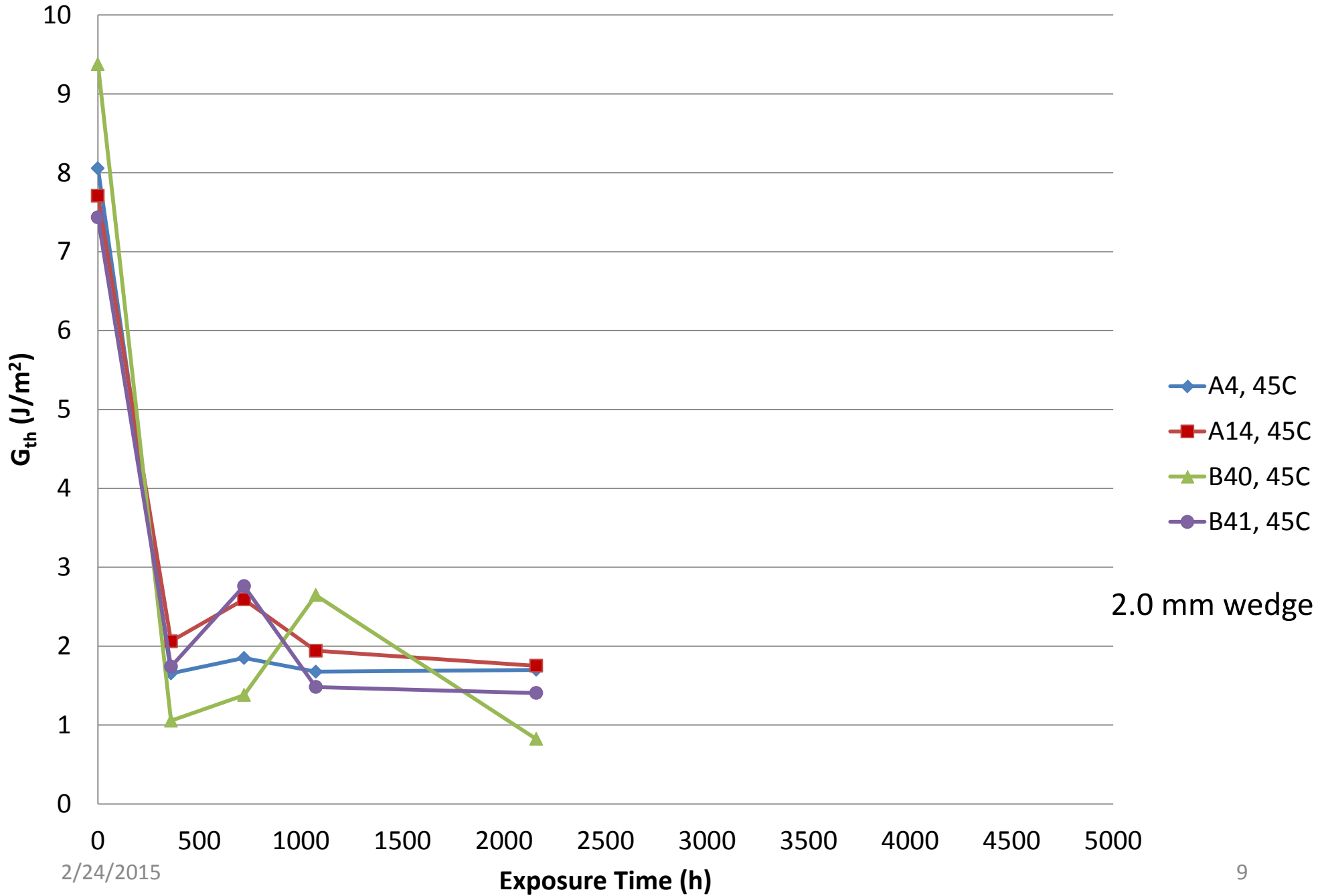
Wedge Test Fracture Toughness PIB A and PIB B NREL Xenon UV exposure 60°C Chamber



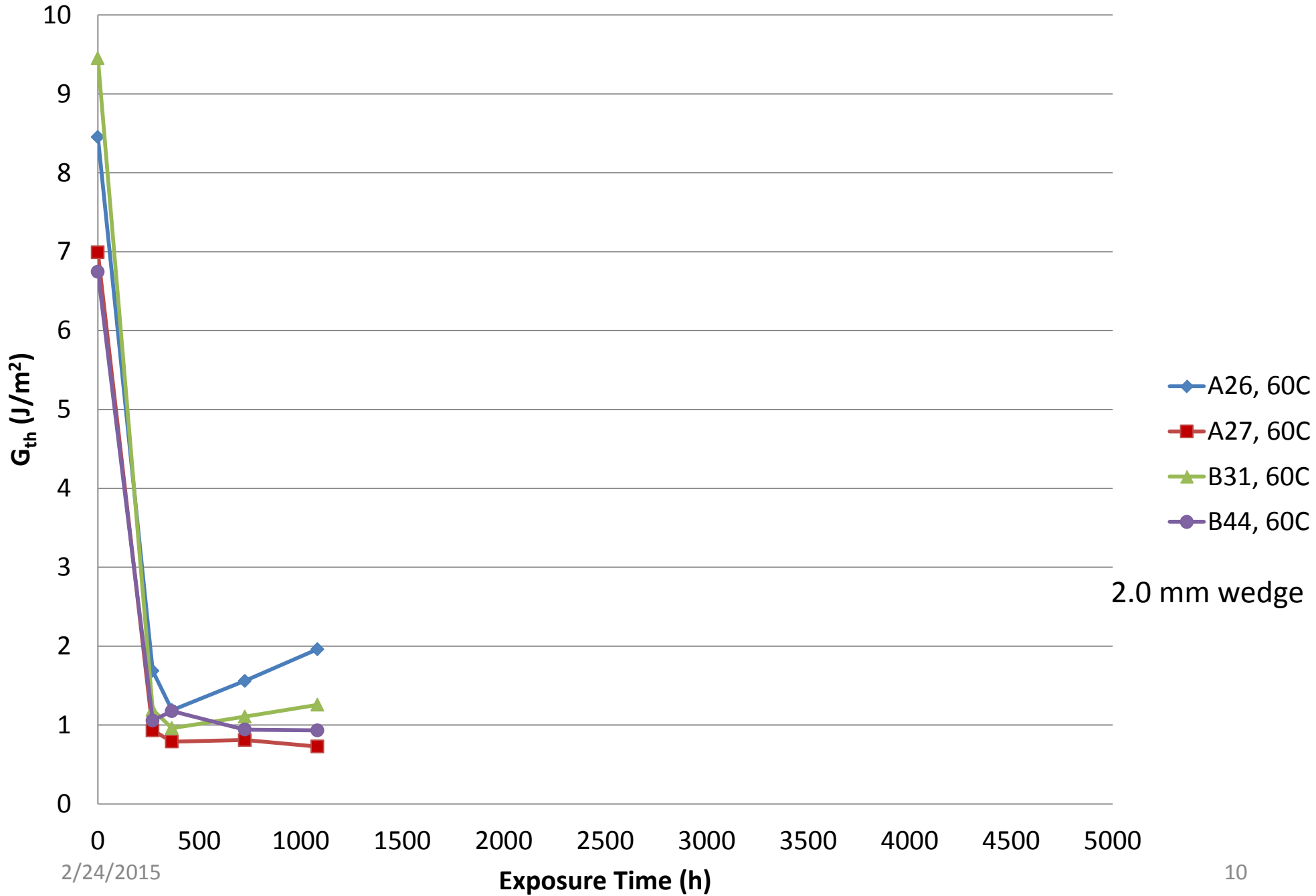
2.38 mm wedge

- ▲ B45 NREL, SERF Ci4000, 114 W/m² (300-400 nm), CHT=60C, BPT=85
- B46 NREL, SERF Ci4000, 114 W/m² (300-400 nm), CHT=60C, BPT=85
- ◆ A39 NREL, SERF Ci4000, 114 W/m² (300-400 nm), CHT=60C, BPT=85
- A40 NREL, SERF Ci4000, 114 W/m² (300-400 nm), CHT=60C, BPT=85

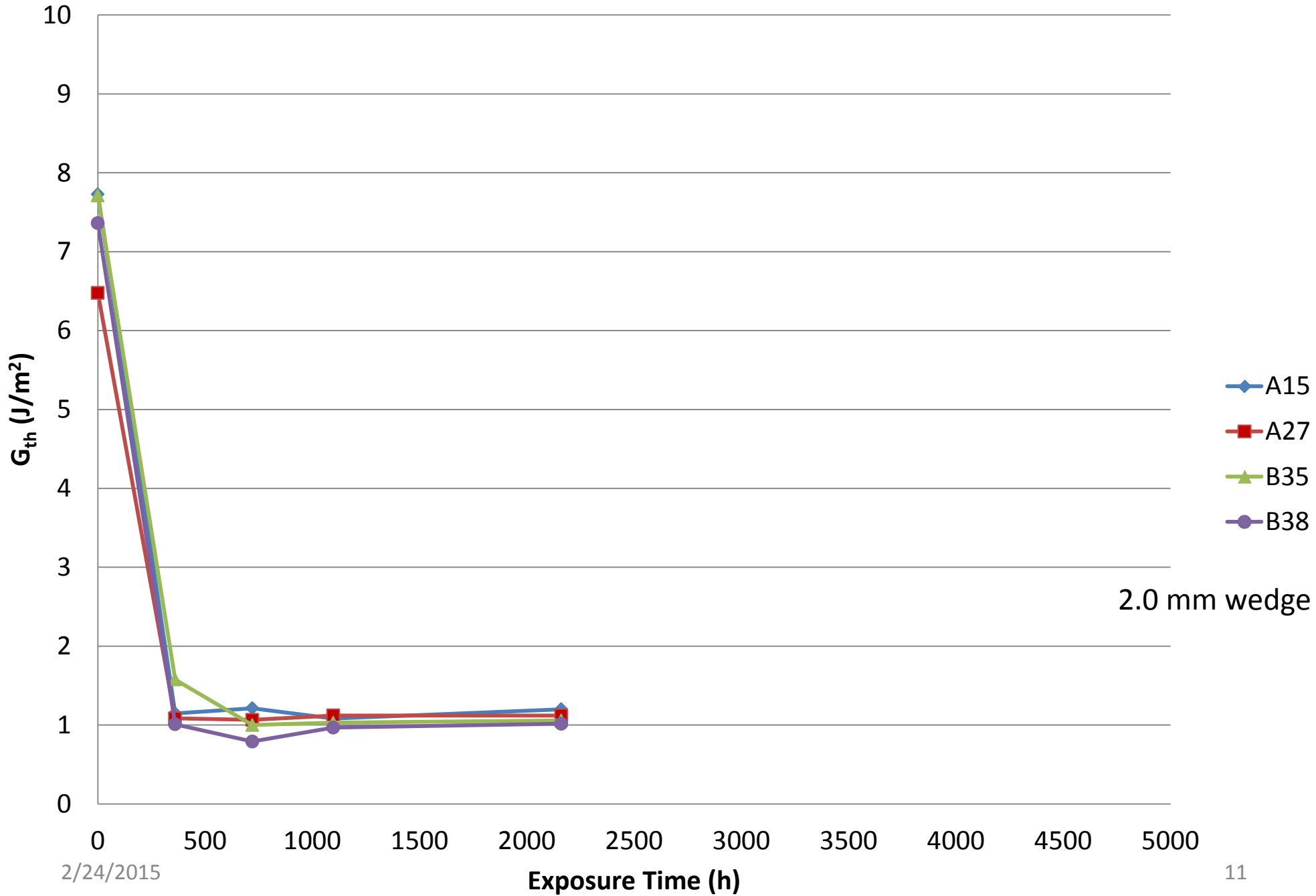
Wedge Test Fracture Toughness PIB A and PIB B
3M Xenon UV exposure 40°C, 1 W/m²/nm



Wedge Test Fracture Toughness PIB A and PIB B 3M Xenon UV exposure 60°C, 1 W/m²/nm



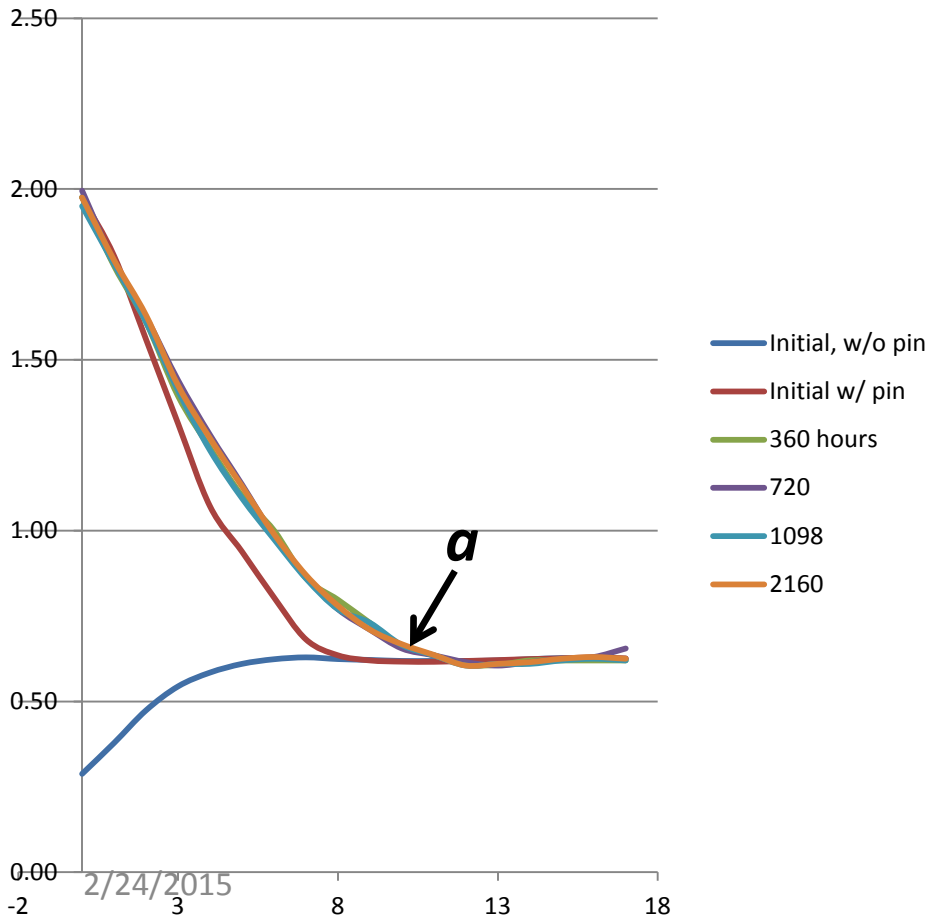
Wedge Test Fracture Toughness PIB A and PIB B
3M Xenon UV exposure 80°C, 1 W/m²/nm



Data driving the G_{th} Calculation

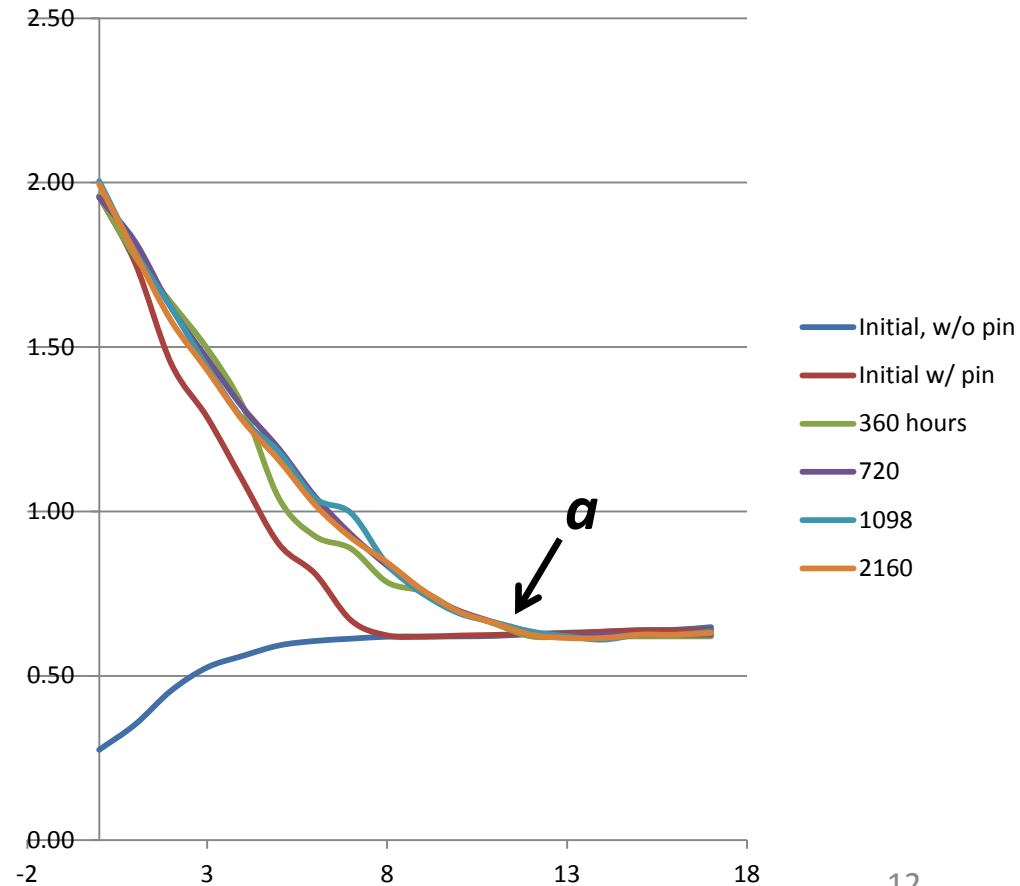
Thickness change @ 45C

Wedge Test, 45C A (ave)



Thickness change @ 80C

Wedge Test, 80C A (ave)



Special thanks to all of the Edge Seal Task Group members for their participation in meetings and especially to labs providing testing support. NREL, NIST, 3M, ATLAS, CWRU and Energy Research Institute (Saudi Arabia)