

Flammability Testing of Adhesive and Applications

28. October 2010



Part I: Overview FST Adhesives

3M - Dr. Elgimiabi & Dr. Spiekermann

Part II: Adhesive and Applications - Fire
Property Testing

Sell - K. Bösner & D. Langer



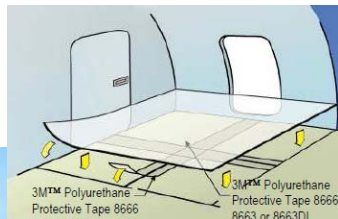
3M Aerospace Solutions for Structures and Interiors



Preformed boots



Primers



Polyurethane protection tapes



Temporary Protection



Low density void fillers

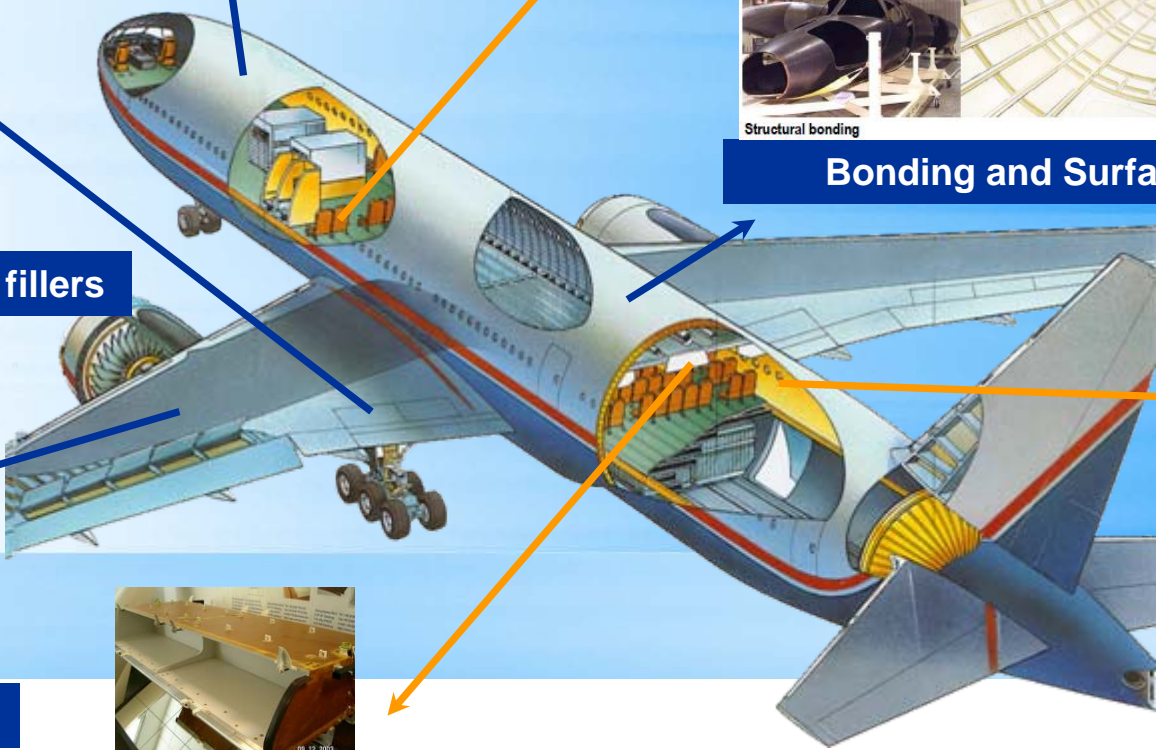


Structural bonding

Bonding and Surfacing Films



Paste Adhesives

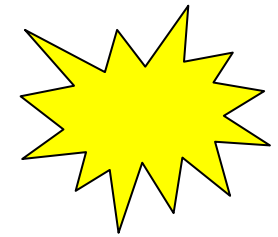


Core Splice films



Low density void fillers





Recently launched **3M** Aerospace Products

Void fillers and adhesives

Product	Application
SW 3450 FST	One-part low density void filler, designed for interior applications (-55 °C to 80 °C)
SW 3550 B/A FST	Two-part void filler for interior panels; low viscosity, suitable for cartridge and dispensing system
SW 3460 HT FST	One-part high temperature resistant core filler, exterior and interior applications (-55 °C to 135 °C)
SW 9300 B/A FST	Two-part adhesive, combining excellent FST and bonding properties

**3M™ Scotch-Weld™
9300 B/A FST**

Scope

Development of flame retardant (FR) adhesive paste that will meet new interpretations of FAA Fire Testing Standards and replace SW 9323-2 B/A used at Sell GmbH

Product main Features:

- Very high mechanical strength
- Low viscosity to enable various application techniques (e.g. injection, brushing)
- Customized curing cycle (long pot life at RT)
- Free of halogen and antimony trioxide as flame retardants

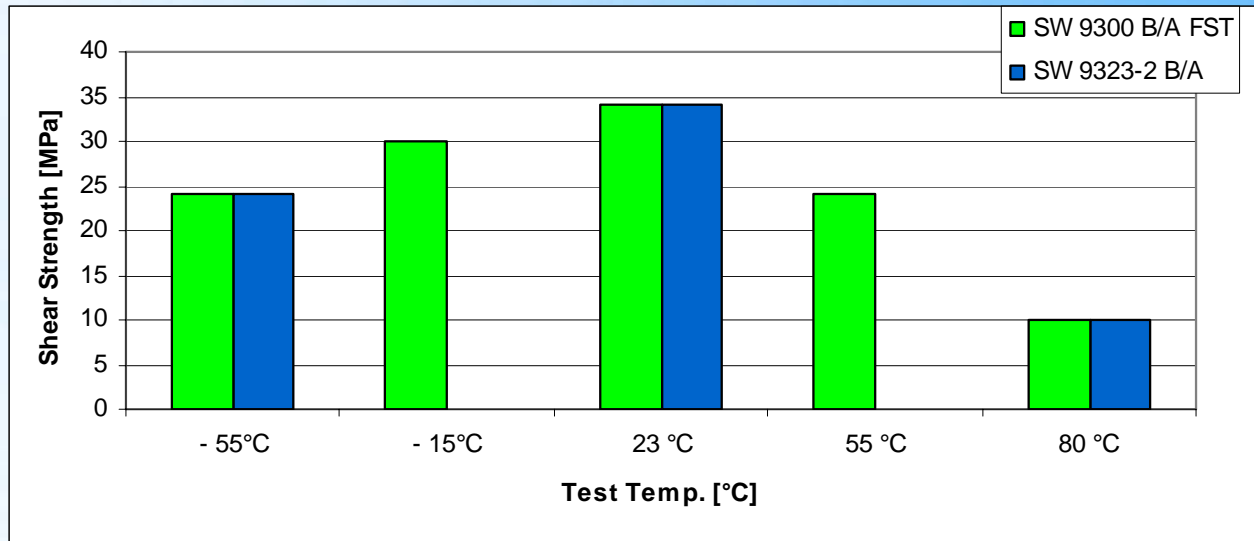
Applications

- *Panel bonding (e. g. mortise and tenon joints)*
- *Ditch and pot (bent panel applications)*
- *Bonding of edge protectors*
- *Insert bonding*



Mechanical Properties

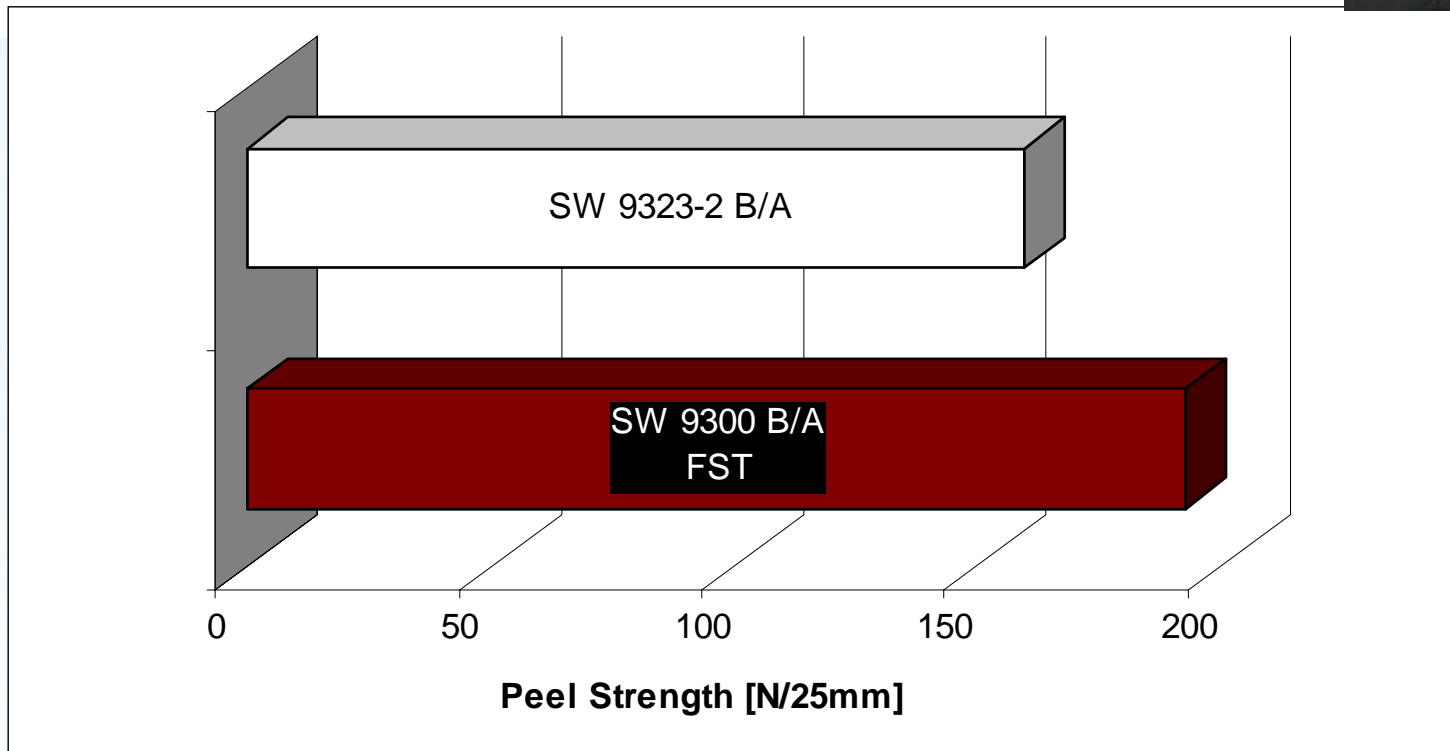
Overlap shear strength



- Test method: EN 2243 - 1
- Test substrates: clad aluminum 2024 T3
- Surface preparation: Optimized FPL

Mechanical Properties

Floating roller peel strength



- Test method: EN 2243 - 2
- Test substrates: clad aluminum 2024 T3
- Surface preparation: Optimized FPL

Mechanical Properties


Ageing and fluid resistance

Condition	Duration	Overlap shear strength [MPa]
Initial	N/A	34
demin. water	168 h	28
5% NaCl solution	24 h	32
95% r.h. , 55 °C	168 h	25
Dry heat, 80 °C	24 h	30
Cold Soak, -55 °C	24 h	30
Coca Cola	24 h	28
Disinfectant (Lysol)	24 h	29
Methy ethyl ketone	1 h	30

General Properties

General Properties	Part B	Part A	Test method
Colour	Brown	Off-white	
Base	Epoxy	Modified amine	
Consistency	Thixotropic paste	Thixotropic paste	
Density	1.2 g/cm ³	1.2 g/cm ³	EN 542
Viscosity	100 Pas	30 Pas	ISO 2555
Mix ratio by volume	100	50	
Cure cycle	2 hours at 65°C or 7 days at 23°C		
Work life ^(a) at 23 ± 2°C	> 3 hours		ISO 10364
Shelf life	6 months from date of shipment		
Available packaging sizes	Cartridges: Pails:	400 ml duo-pack 54 L kit, 280 L kit	

^(a) 45 g of mixed adhesive



Thank you for your attention!

Adhesive and Applications Fire Properties Testing

28. October 2010 - Klaus Bösner & Dirk Langer



One main objective for the development of the adhesive Scotch-Weld™ 9300 B/A FST was to prove, that

1) international Aerospace Certification and Industry Standards for Flammability, Heat Release, Smoke and Toxic Gases are met (e.g. CS/FAR 25.853, ABD0031, D6-51377)

2) latest requirements from Regulators are met in respective HC Panel applications (e.g. FAA Issue Paper on Flammability Compliance Methods, e.g. Ditch & Pot (DAP))

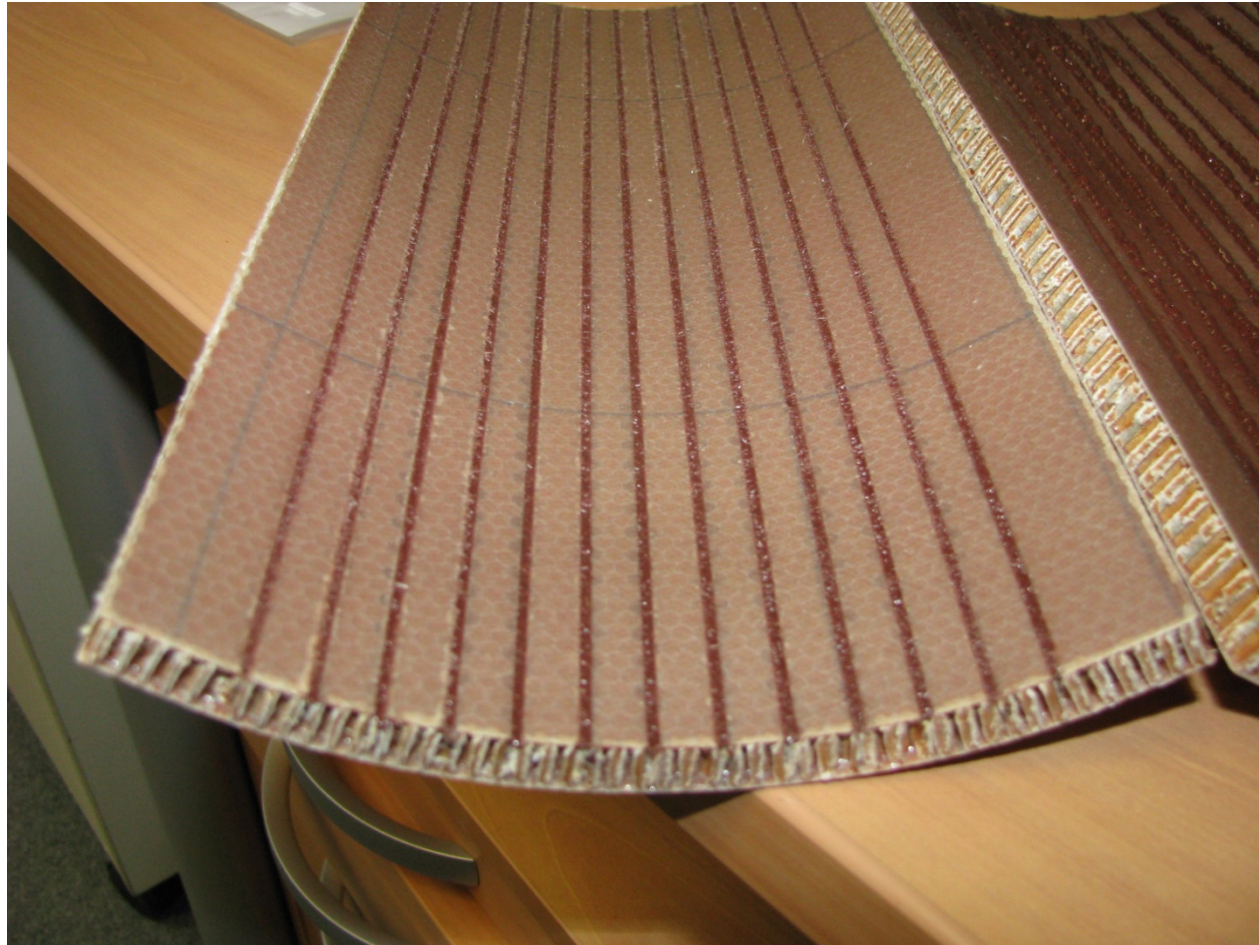
for the adhesive and its applications in composite structures for cabin interiors.

Total Quantity of Fire Property Tests performed with the new adhesive to prove the fireworthiness characteristics:

162 for material and respective applications

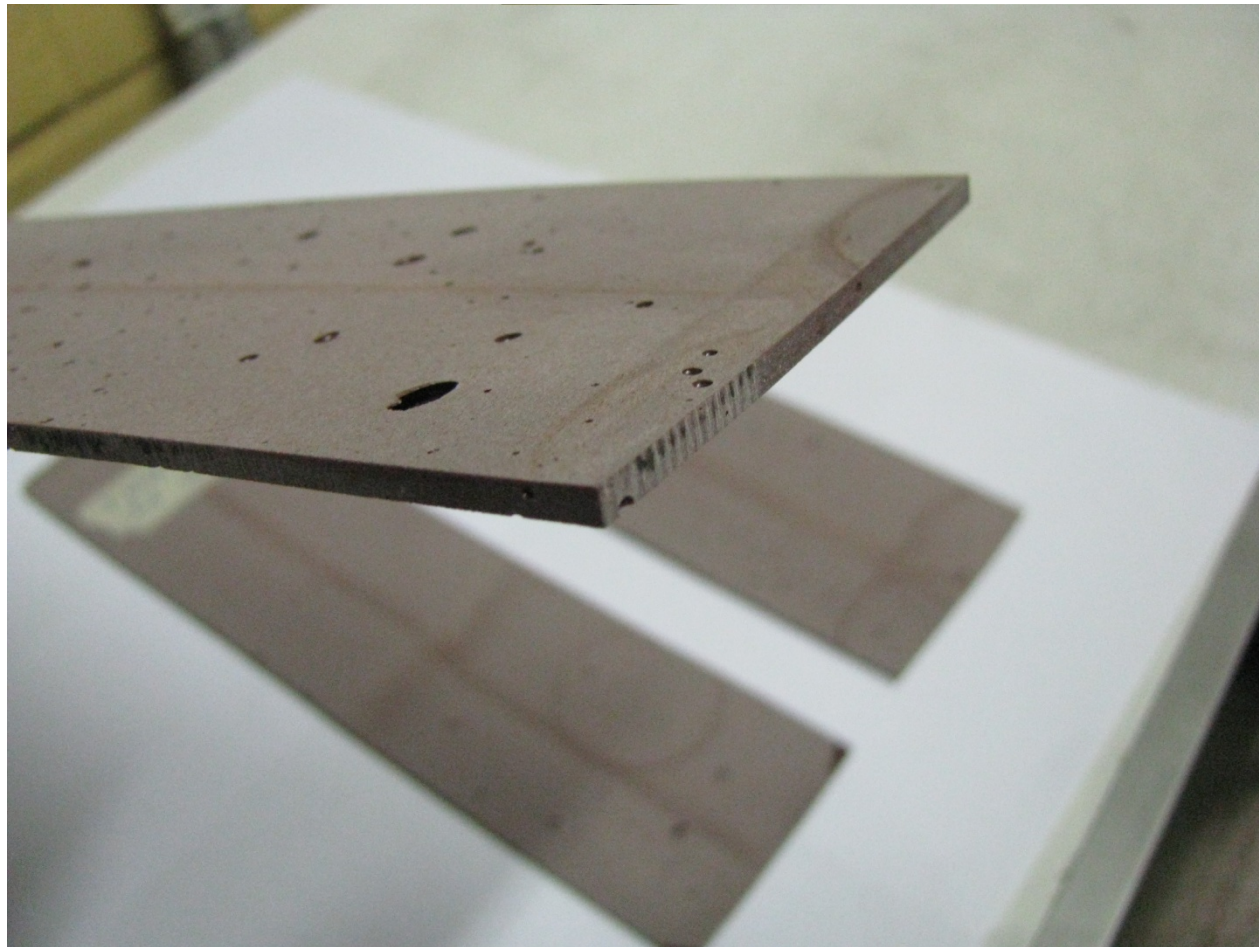
Numbers	Test
54	Flammability (F1 and F2): Stand Alone & Adhesive applications in bended HC Panels
54	Heat Release: Adhesive applied in HC Panel
54	Smoke Density and Toxic Gas Emissions: Adhesive applied in HC Panel

Flammability Test Sample Adhesive Applications



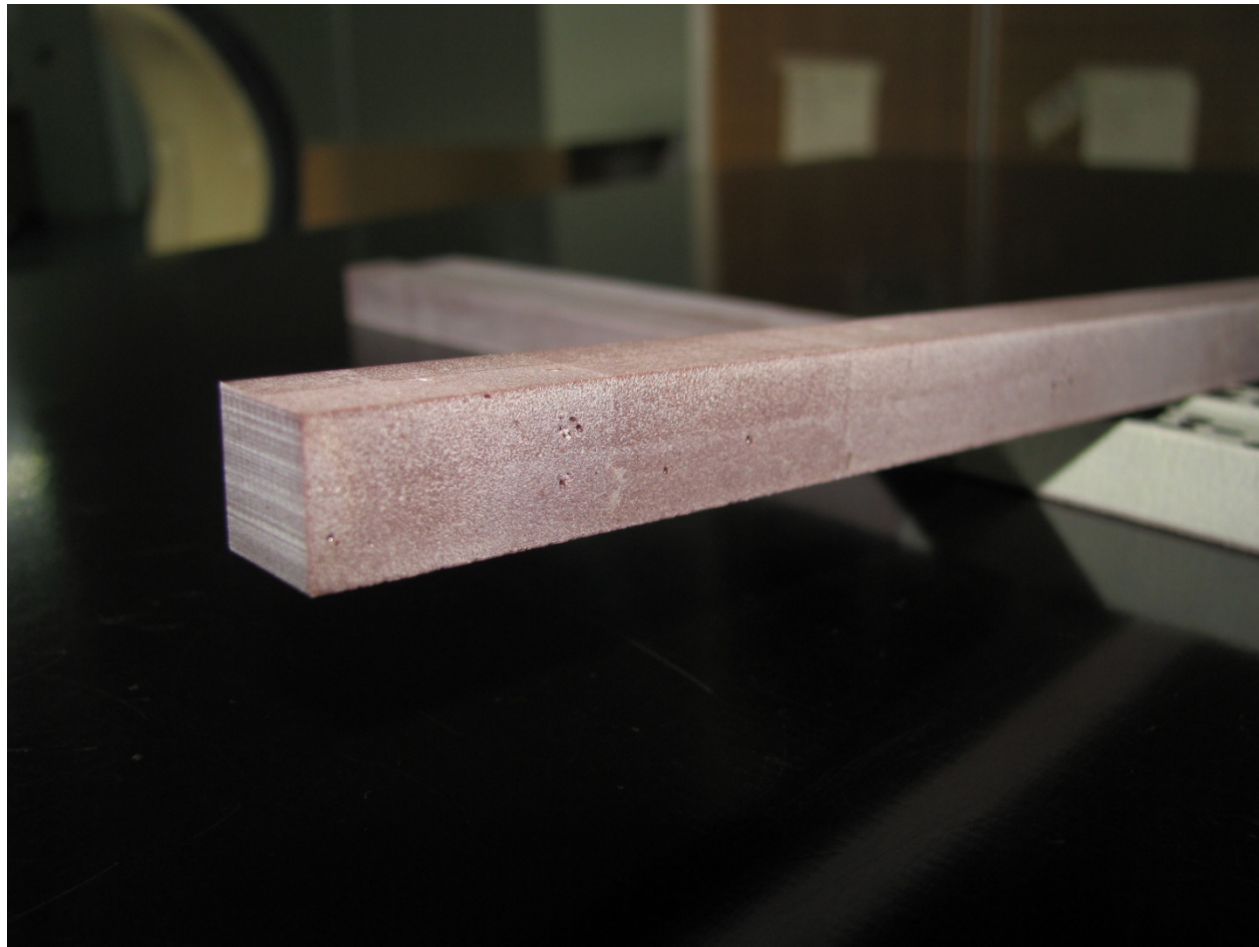
Bended Panel 5" Radius (1" & 3" Radius not shown)

Flammability Test Sample Adhesive Stand Alone - Brick



Stand Alone Sample 12" x 3" x 0.125"

Flammability Test Sample Adhesive Stand Alone - Bar



Stand Alone Sample 0,5" x 0,5" x 12"

Flammability Test Video (F1) Adhesive Stand Alone - Bar



Video starts 50s after Test start

Flammability Test Video (F1) Adhesive Stand Alone - Bar



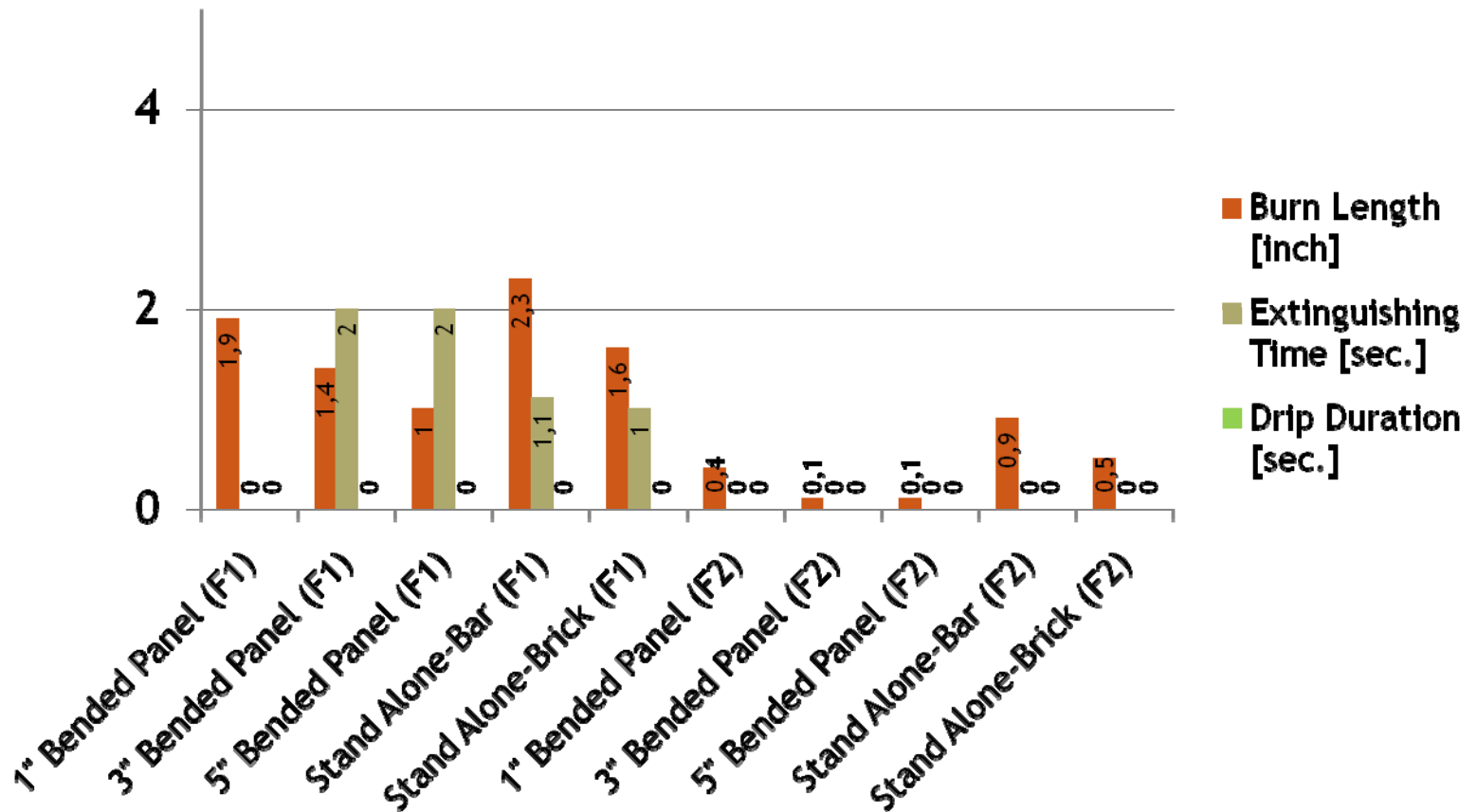
Extinguishing time: 4s - No Drips - Burn Length: 0,5"

Flammability Test Results

Adhesive Stand Alone & Applications



Flammability Test Results

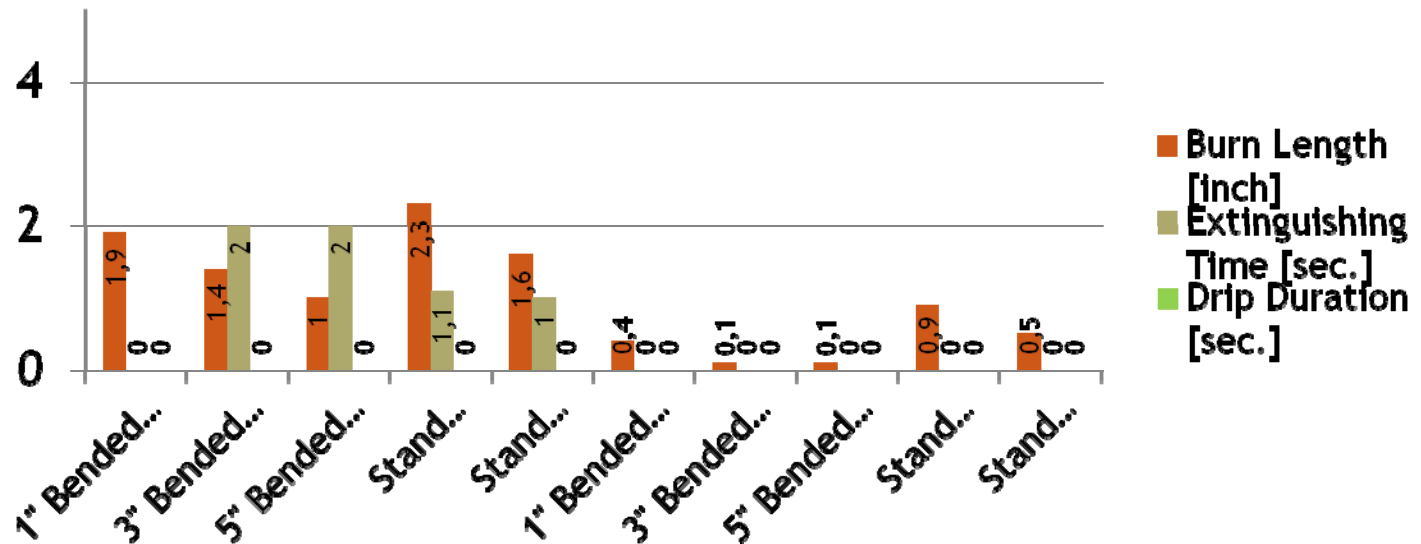


Flammability Test Results

Adhesive Stand Alone & Applications



Flammability Test Results

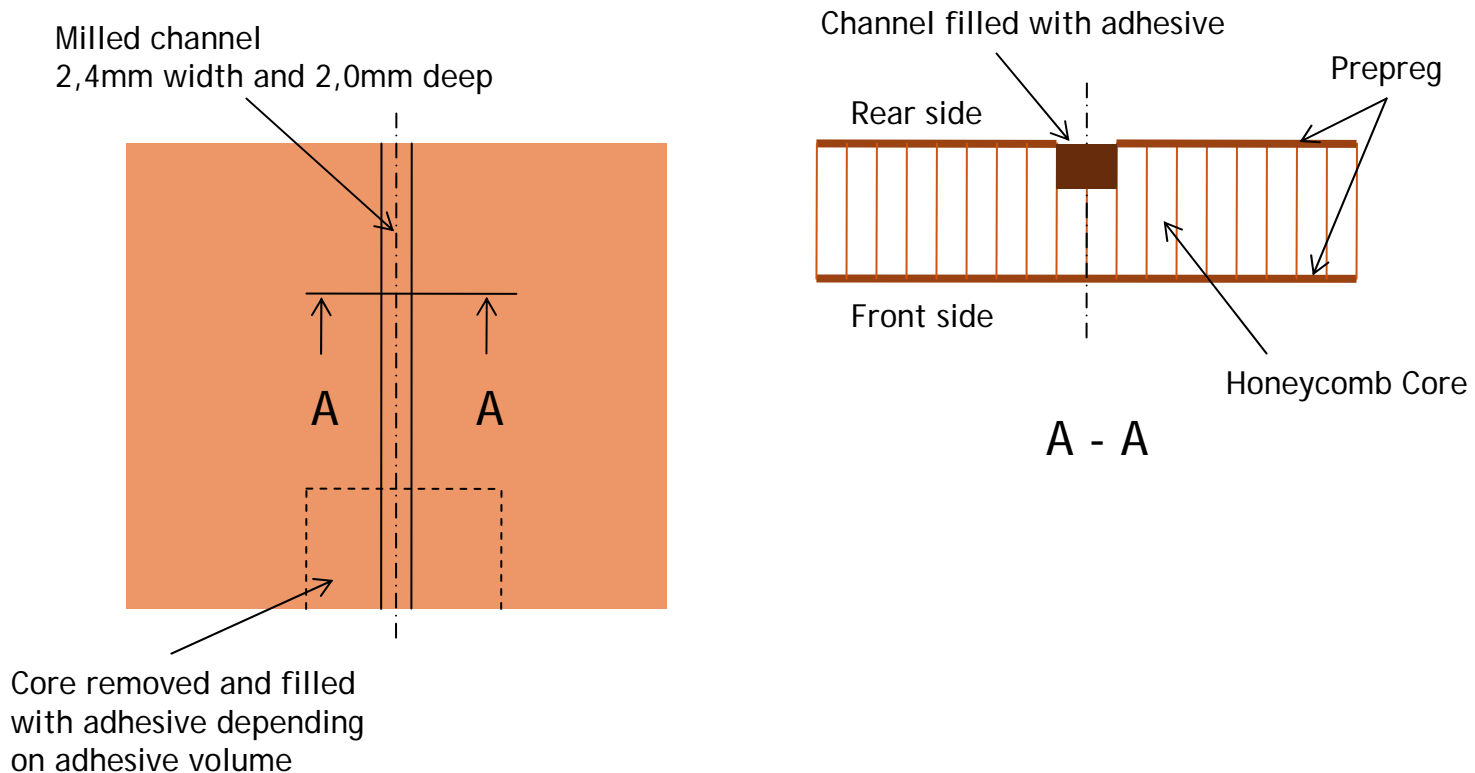


Test results demonstrate:

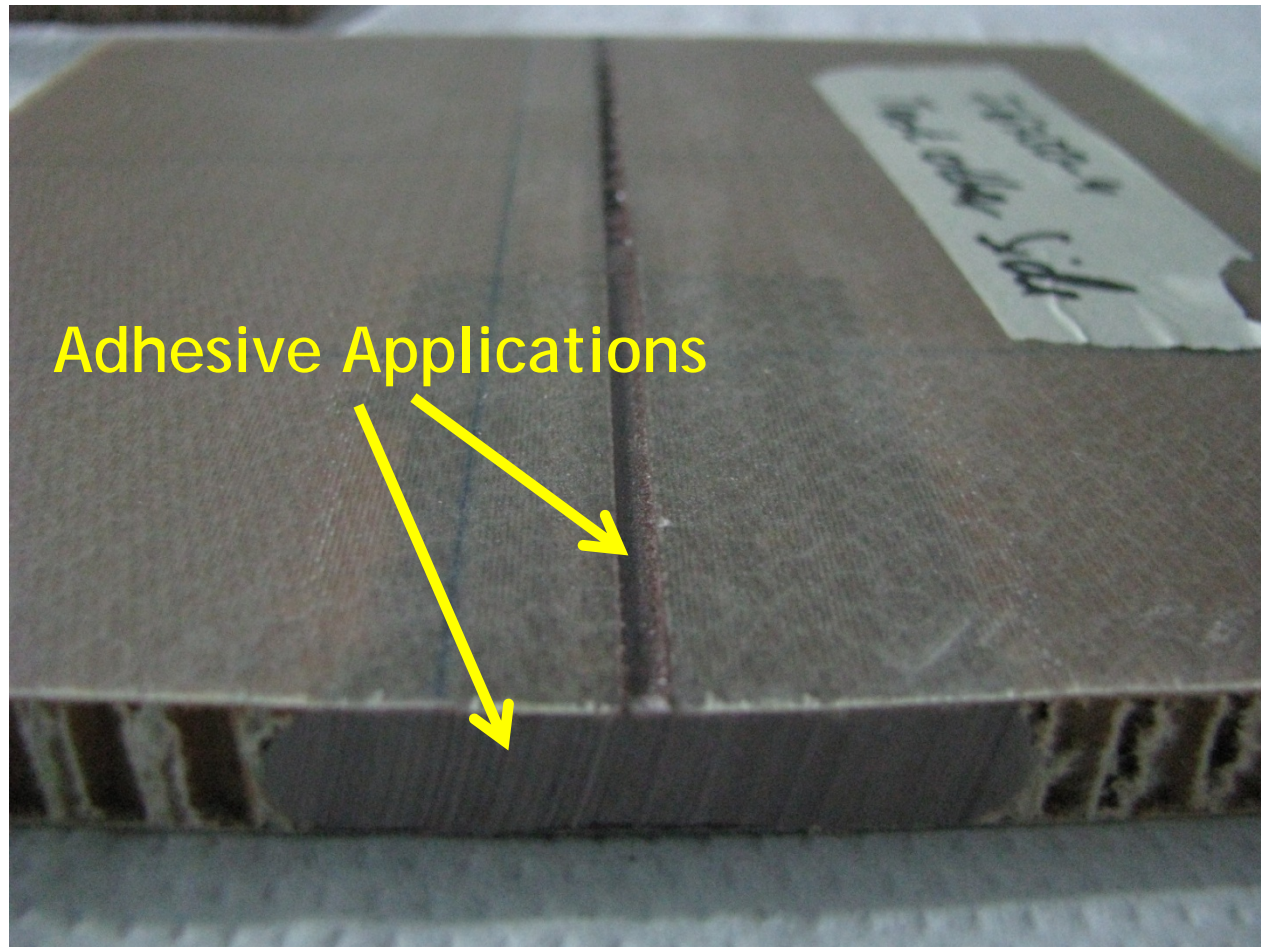
- ✓ Adhesive Applications and Stand Alone with comparable values
- ✓ Banded Panel Applications well below airworthiness limits

Heat Release/Smoke Density/Toxic Gas Emission Test Sample Configuration

HC panels with different adhesive volume applied: 0,2 % / 1 % / 10 % to cover the complete range of constructions and Ditch and Pot-Applications.



Heat Release/Smoke Density/Toxic Gas Emission Test Sample Configuration

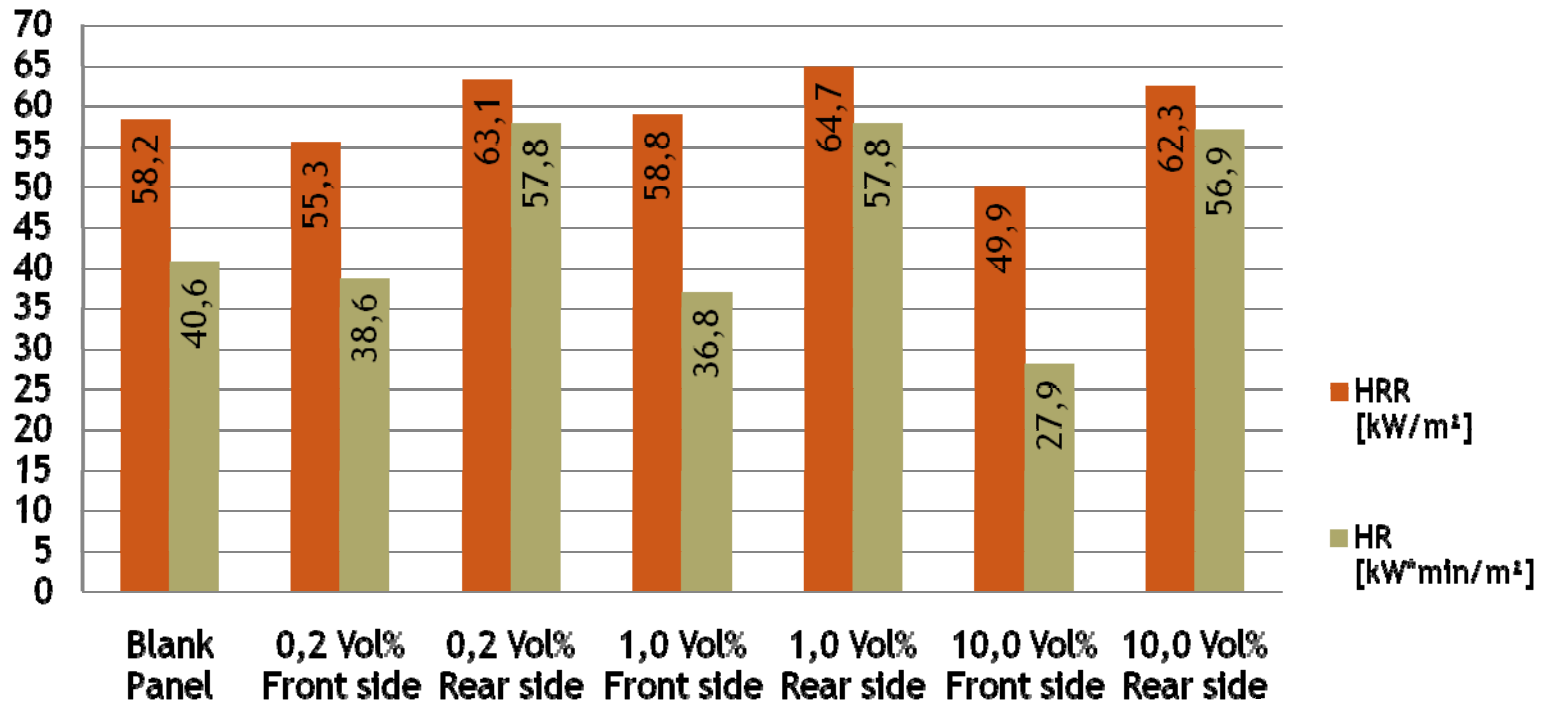


Adhesive Application 10 % Volume - Rear Side shown

Heat Release Test Results Adhesive Applications

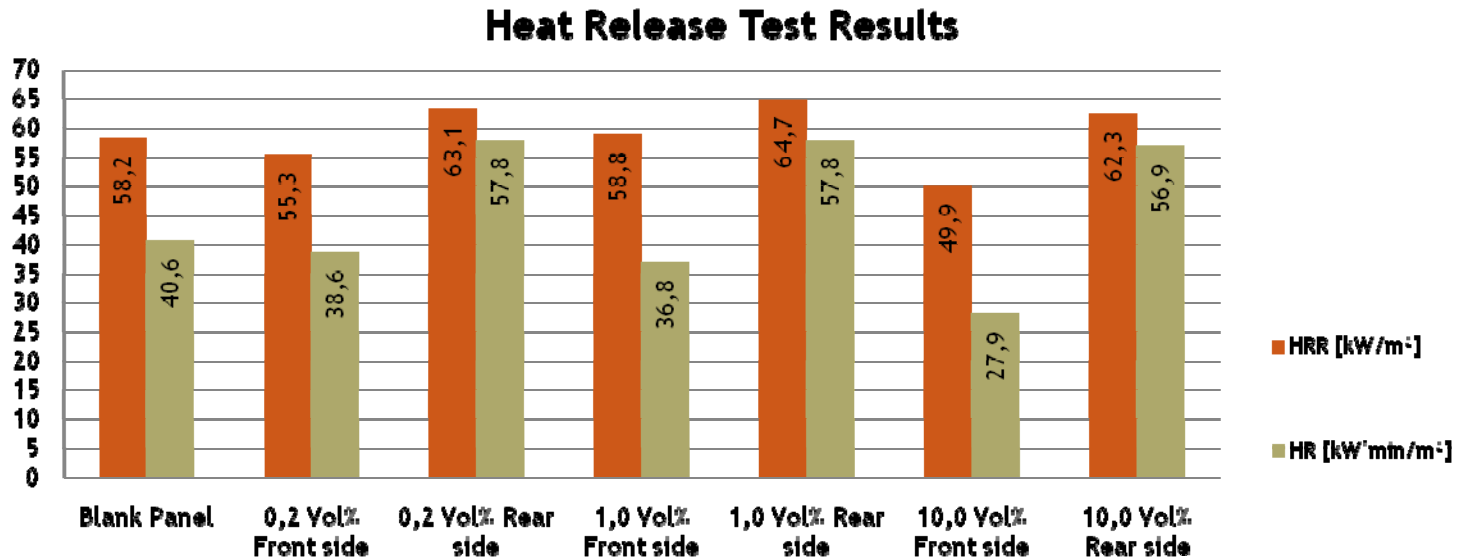


Heat Release Test Results



Heat Release Test Results

Adhesive Applications



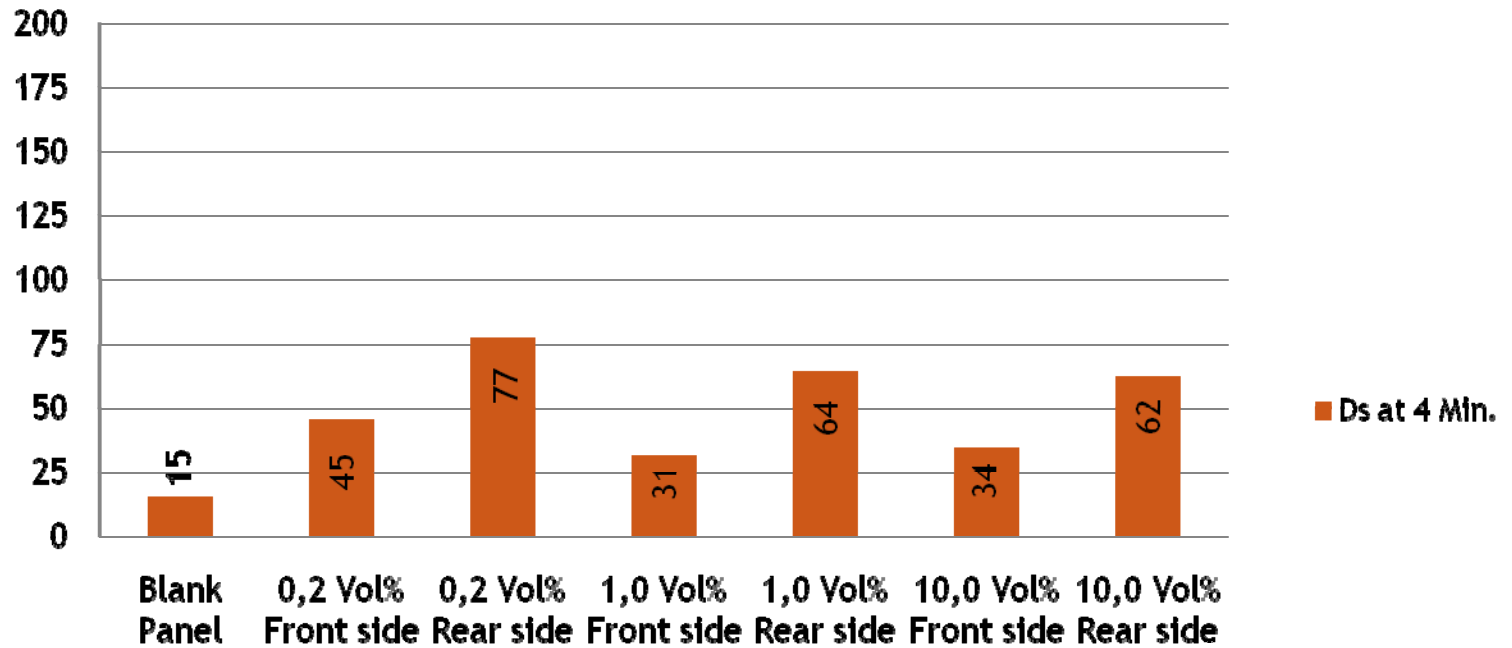
Test results demonstrate:

- ✓ No major affect through adhesive amount
- ✓ Front side (adhesive fully covered) reveals lower HR/HRR-values than rear side (open surface with adhesive)

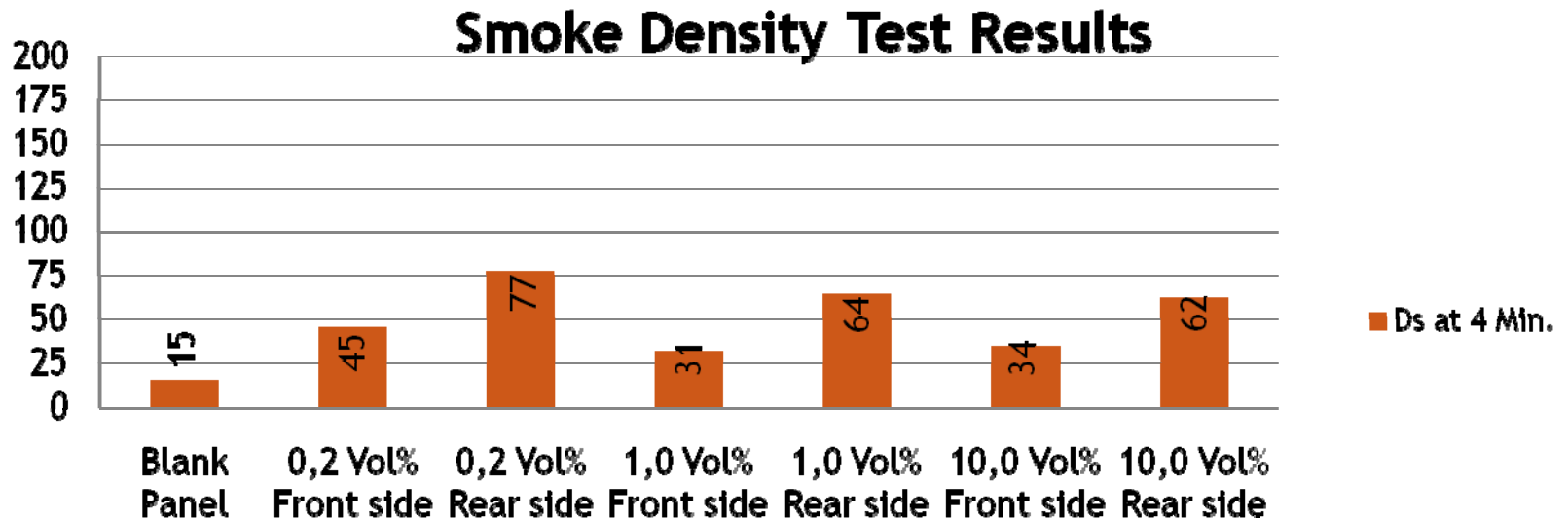
Smoke Density Test Results Adhesive Applications



Smoke Density Test Results



Smoke Density Test Results Adhesive Applications



Test results demonstrate:

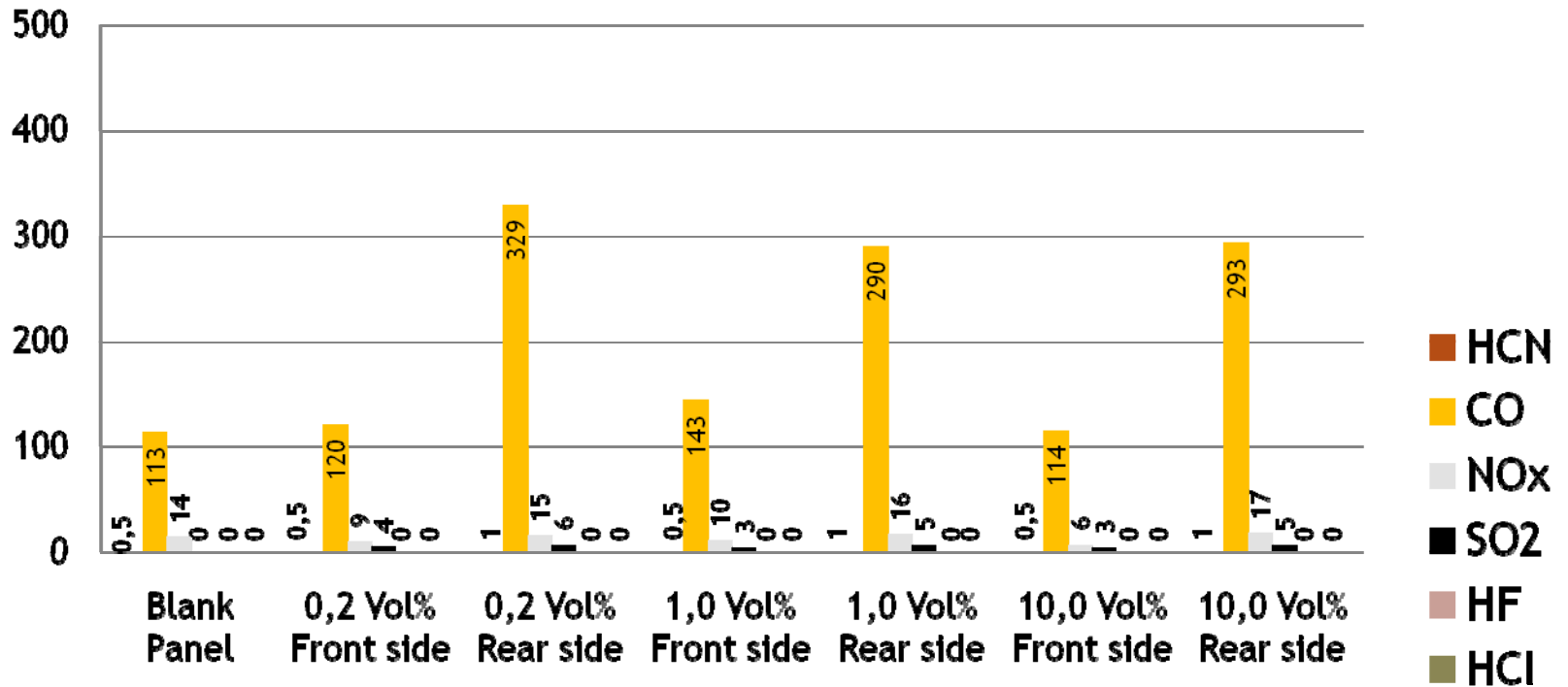
- ✓ Adhesive has major affect on Ds-values (but are still well below airworthiness limit)
- ✓ No increase of Ds-value by increase of adhesive amount
- ✓ Front side (adhesive fully covered) reveals lower Ds-values than rear side (open surface with adhesive)

Toxic Gas Emission Test Results

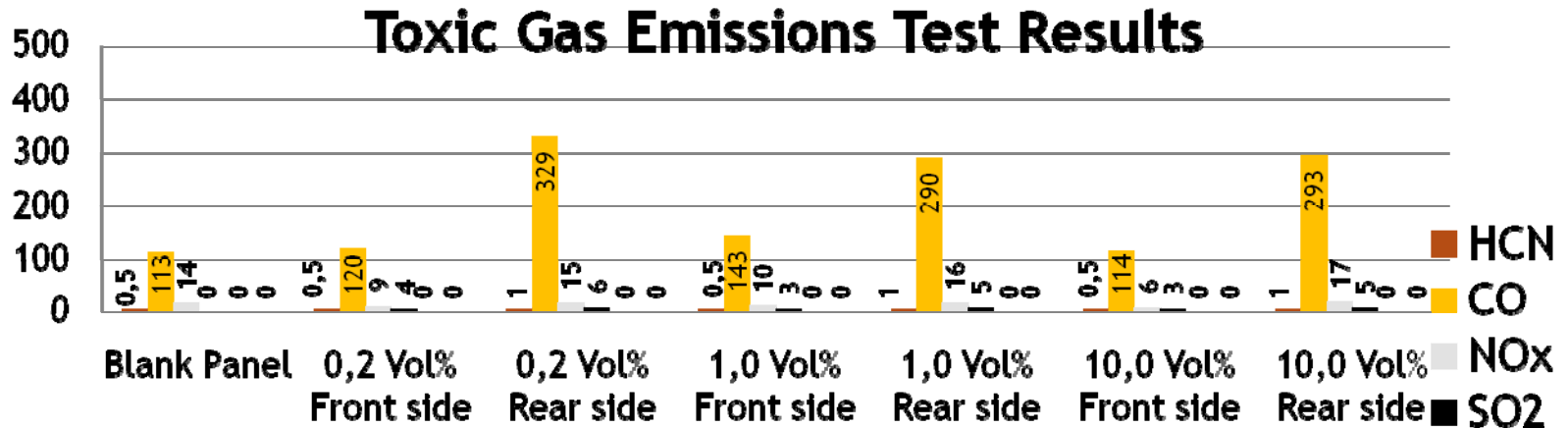
Adhesive Applications



Toxic Gas Emissions Test Results



Toxic Gas Emission Test Results Adhesive Applications



Test results demonstrate:

- ✓ Adhesive has major affect on Gas Emission values (but are still well below industry limits)
- ✓ No increase of Gas Emission values by increase of adhesive amount
- ✓ Front side (adhesive fully covered) reveals lower Gas Emission values than rear side (open surface with adhesive) similar as blank panel

An appropriate range of adhesive & applications should be tested during the initial qualification and certification process

- to evaluate adhesive fireworthiness characteristics
- to understand adhesive fireworthiness affects
- to reduce fireworthiness risks for test failures

The Fire Property Tests performed show that the Scotch-Weld™ 9300 B/A FST meets

1) international Aerospace Certification and Industry Standards for Flammability, Heat Release, Smoke and Toxic Gas Emissions (e.g. CS/FAR 25.853, ABD0031, D6-51377),

2) latest requirements from Regulators are met in respective HC Panel applications (e.g. FAA Exemption No. 9791 for Ditch & Pot (DAP) flammability compliance issues)

in composite structure applications of cabin interiors.

Thank you for your attention!