



Sistemi poliuretanici con migliorata reazione al fuoco

2^a Conferenza Nazionale Poliuretano Espanso Rigido

26 maggio 2015, Bologna

Market overview in Europe
EU revision. What about B3 foam?
Huntsman fire rated portfolio
Overview of fire testing

Alessandro Gallipoli,
Huntsman Polyurethanes Italy



The sandwich panel EAME market

Europe – Africa – Middle East

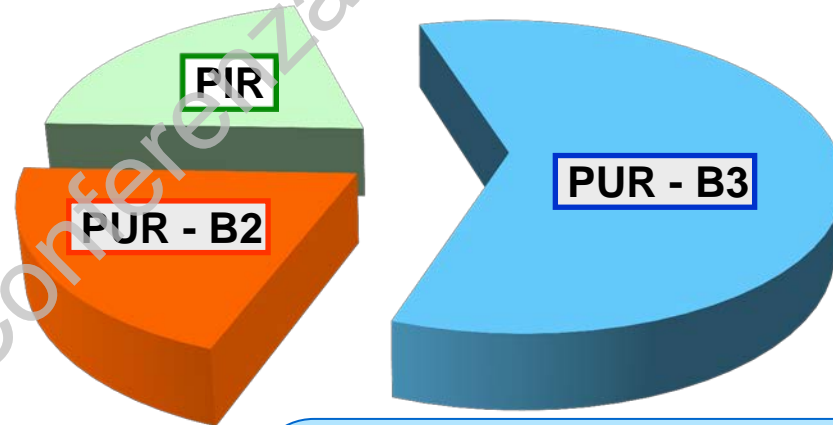
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PIR

- Current market penetration limited, especially in South Europe
- More demanding processing requirement vs PUR
- Future growth expected as new laminators are designed to process PIR

2013 EAME market
Lamination of steel faced panels



PUR B2

- High market penetration in specific areas to meet local fire legislation
- Processing requirements similar to PUR B3
- Can compete with PIR only for SBI Euroclass


PUR B3

- Majority of current sandwich panels produced
- Expected lower share in the foreseeable future due to revision of EN 14509

EN 14509 revision, Reaction to Fire Test (SBI)

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<div><p>01234</p><p>AnyCo Ltd, PO Box 21, B-1050 XYZ Co</p><p>05</p><p>01234-CPD-00234</p></div>	<p>Wrinkling stress (external face)</p> <ul style="list-style-type: none">- in span 100 MPa- in span, elevated temperature 95 MPa- at central support 80 MPa- at central support elevated temperature 75 MPa <p>Wrinkling stress (internal face)</p> <ul style="list-style-type: none">- in span 100 MPa- at central support 90 MPa <p>Reaction to fire: B-s2,d0 (with steel flashing details)</p> <p>Fire resistance: E240: EI 15 (load 1,5 kN)</p> <p>External fire performance: BROOF or BROOF(X)</p> <p>Water permeability: Class C</p> <p>Air permeability: 10 m³/h/m²</p> <p>Water vapour permeability: Impermeable</p> <p>Airborne sound insulation: R_w (C;C_{tr})</p> <p>Durability: Pass – light colours: reflectivity 40-90</p>
<p>EN 14509</p> <p>Metal faced insulating panel for use in buildings.</p> <p>Reference: KS1000. Insulation: PUR Density: 35 kg/m³ Thickness: 80mm. Facings: Steel 0,5 mm external; 0,4 mm internal (EN 10326). Coating: PVC. Mass: 12 kg/m².</p> <p>Use: Roofs</p> <p>Thermal transmittance: 0,25 W/m²K</p> <p>Mechanical resistance:</p> <p>Tensile strength 0,12 MPa</p> <p>Shear strength 0,10 MPa</p> <p>Reduced long term shear strength 0,08 MPa</p> <p>Shear modulus (core) 3,0 MPa</p> <p>Compressive strength (core) 0,14 MPa</p> <p>Creep coefficient t = 2000 h 2,0</p> <p>t = 100000 h 7,0</p> <p>Bending resistance in the span</p> <ul style="list-style-type: none">- +ve bending 3,70 kNm/m- +ve bending, elevated temperature 3,50 kNm/m- -ve bending 2,90 kNm/m- -ve bending, elevated temperature 2,75 kNm/m <p>Bending resistance at an internal support</p> <ul style="list-style-type: none">- +ve bending 2,60 kNm/m- +ve bending, elevated temperature 2,50 kNm/m- -ve bending 3,00 kNm/m- -ve bending, elevated temperature 2,80 kNm/m	<p>Compulsory & External</p>

Compulsory & External



**EN ISO 11925-2
with flashing
(protection)**

**Revision of EN 14509
published in August
2014**

**EN ISO 11925-2 not
allowed anymore with
flashing protection**

EN 14509 revision:

Ignitability test & SBI of no fire rated foams (B3)

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Ignitability Test - EN ISO 11925-2

SBI – EN 13823

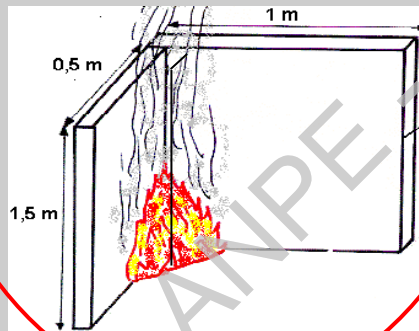
...until August 2014



naked foam



with flashing
(protection)
accedes to SBI



today: no flashings allowed

naked
foam



flashing
(protection)
not allowed



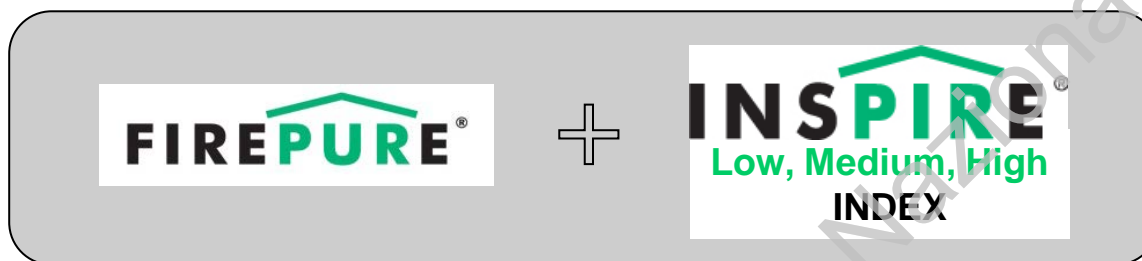
Classification:
CLASS F
No SBI allowed

Classification:

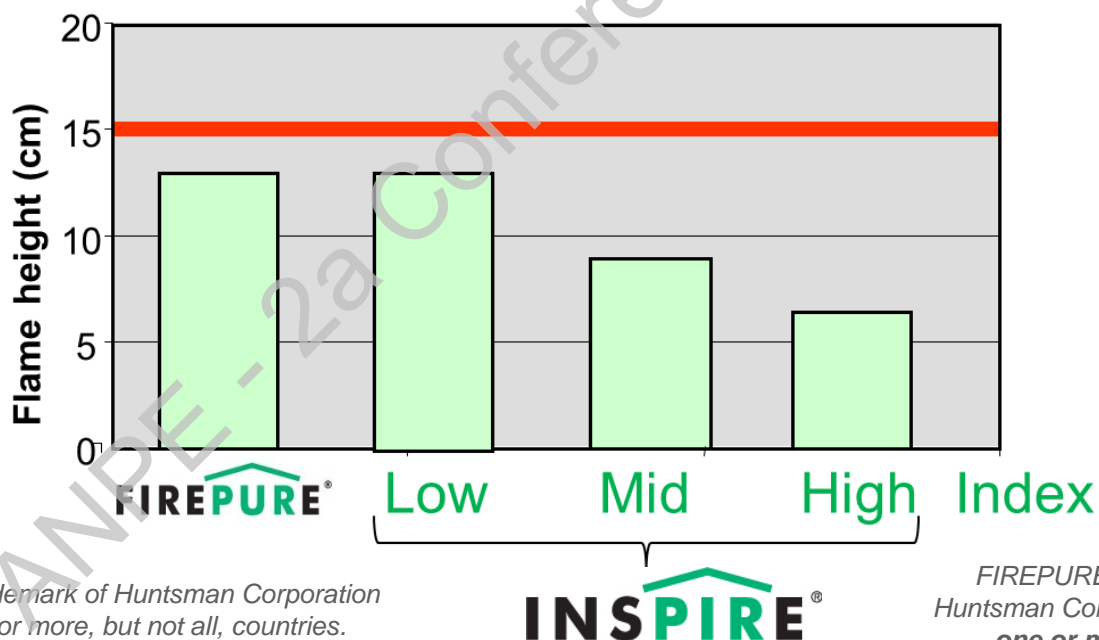
Cs₃d0
Ds₃d0...
With ... flashings

**ONLY foams which
pass ignitability
test with naked
foam accede to
SBI test**

Fire rated product portfolio



ALL TECHNOLOGIES PASS IGNITABILITY TEST ON NAKED FOAM



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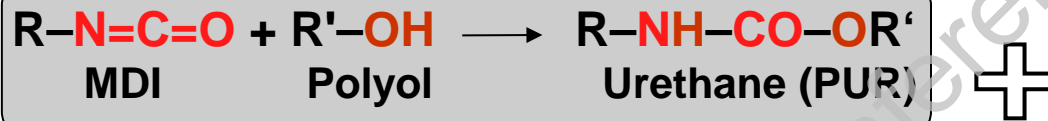
Technical background

What is Polyurethane (PUR)

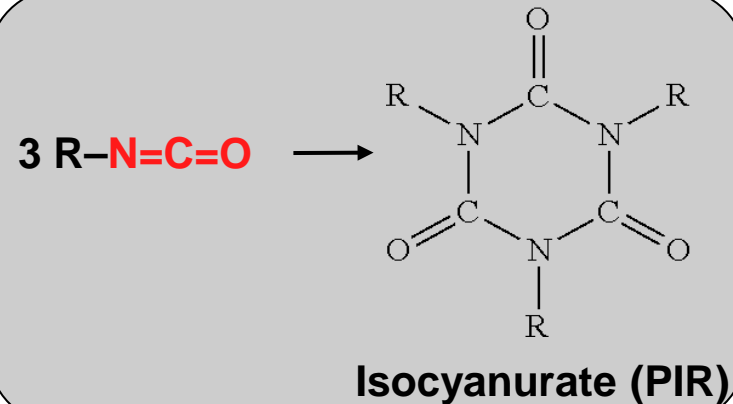


Degradation T
150-200°C

What is Polyisocyanurate (PIR)



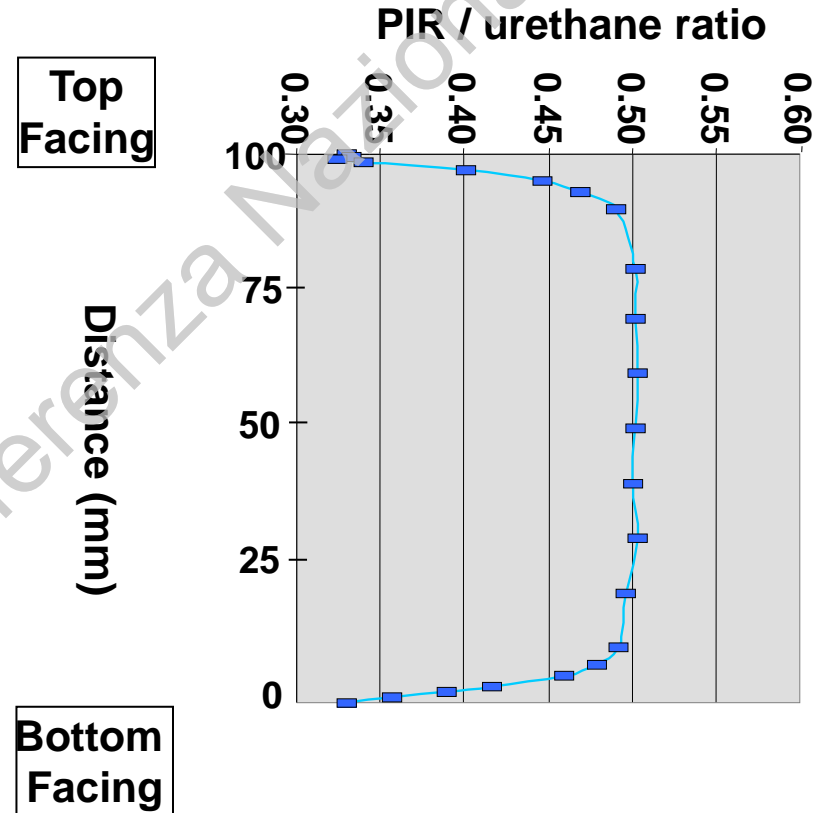
Degradation T > 270°C



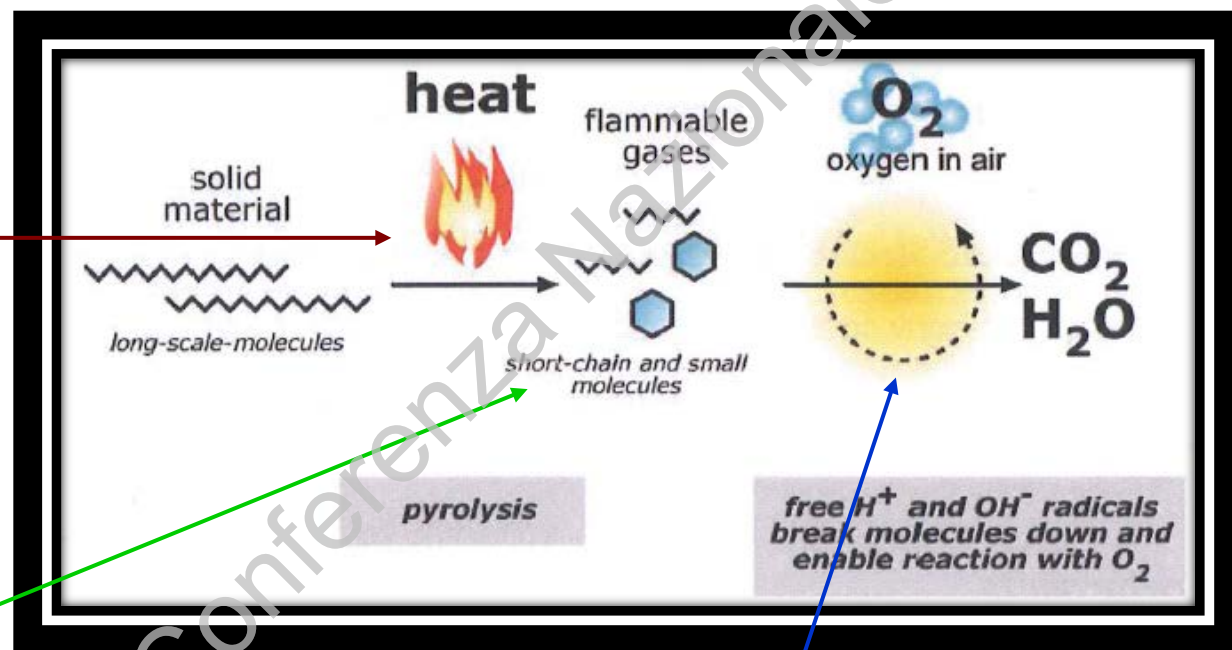
Trimerisation

- Isocyanurates are very stable, both thermally and chemically (thanks to the exagonal structure), have improved fire rating and are more rigid than PUR.
- PIR reaction is more exothermic than PUR, but needs an higher activation energy.

Conversion distribution



Mechanism of combustion



**Direct
attack**



**Protection through
physical barrier**

**Decomposition of
Matrix**



**Less aggressive with
chemically stable
groups**

**Radical
propagation**



Quenched by Halogens

Huntsman technology is designed taking into consideration this mechanism and maximizing the possibility to pass the most severe fire tests

From small scale to large scale

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EN ISO 11925-2



foam

FIREPURE[®]
INSPIRE[®]

OK!



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EN 13823 (SBI)



foam

panel

FIREPURE[®]
INSPIRE[®]

Bs1d0
Bs2d0
Bs3d0



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EN 1364 (Fire Resistance)



foam

panel

constr.
system

INSPIRE[®]

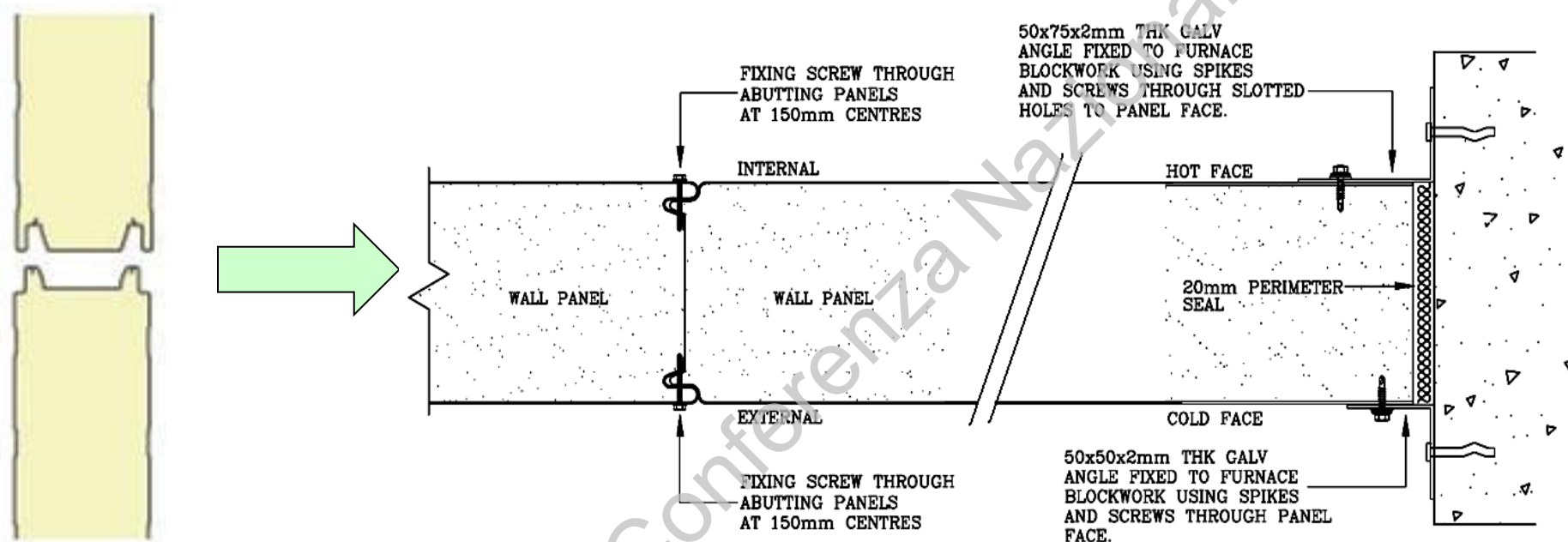
80-100 mm: REI-EI30
200 mm: EI60



From panel to construction system

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FIRE RESISTANCE CRITERIA

Load Bearing Capacity (R) – only for roof

Integrity (E)

Insulation (I)

Resistance to Fire

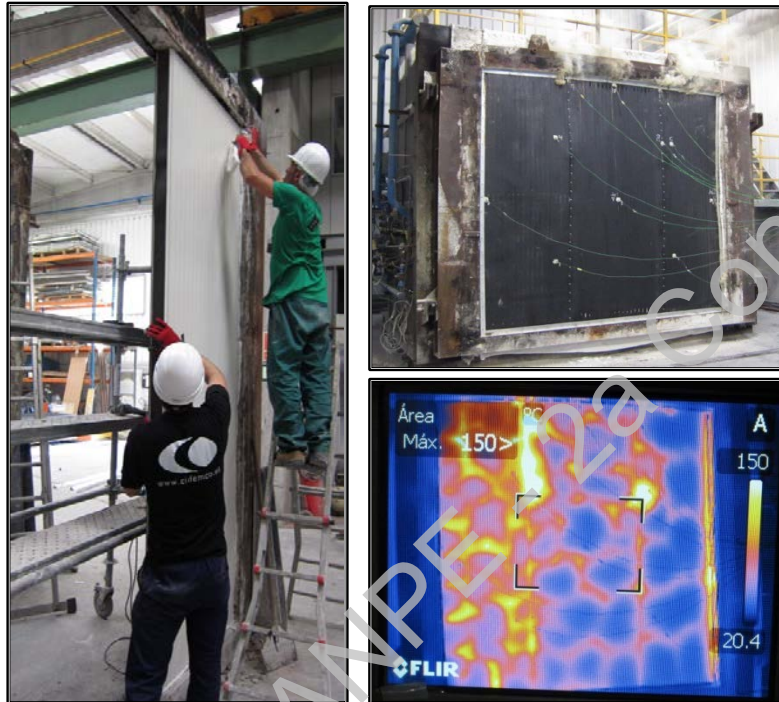
official results

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INSPIRE[®]
High Index

EI 30 with 100 mm wall panel
(insulation failed @ 41 min)



REI 30 with 100 mm roof panel
(integrity failed @ 35 min)



tecnalia

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Summary fire properties

FOAM	REACTION TO FIRE	RESISTANCE TO FIRE
FIREPURE®	Bs3d0 Bs2d0	Not tested yet
INSPIRE® Low Index	Bs2d0	Not tested yet
INSPIRE® Mid Index	Bs2d0	<u>100mm</u> E 30 EI 20 (26 min)
INSPIRE® High Index	Bs2d0 Bs1d0	<u>80-100mm</u> RE 60 / E 45 REI 30 / EI 30 (41 min)

what is next?
Huntsman development never stops!

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GRAZIE!

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