



Adhesives in the fast lane

Polyurea for use in adhesive applications

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Wood Products: Focal Points

- Appearance
- Bond strength
- Heat resistance
- Health & safety
- Sustainability
- Carbon footprint
- Etc.



Cost Drivers during Manufacturing



Press time



Inventory



Requirements for an ultra-fast adhesive

Applicable wood species: Soft and hard wood

Wood surface: Planed

Bond strength: destacking after 30 seconds → high green strength; full bond strength after 1-2 d

Temperature resistance: 80°C (Watt 91)
110°C

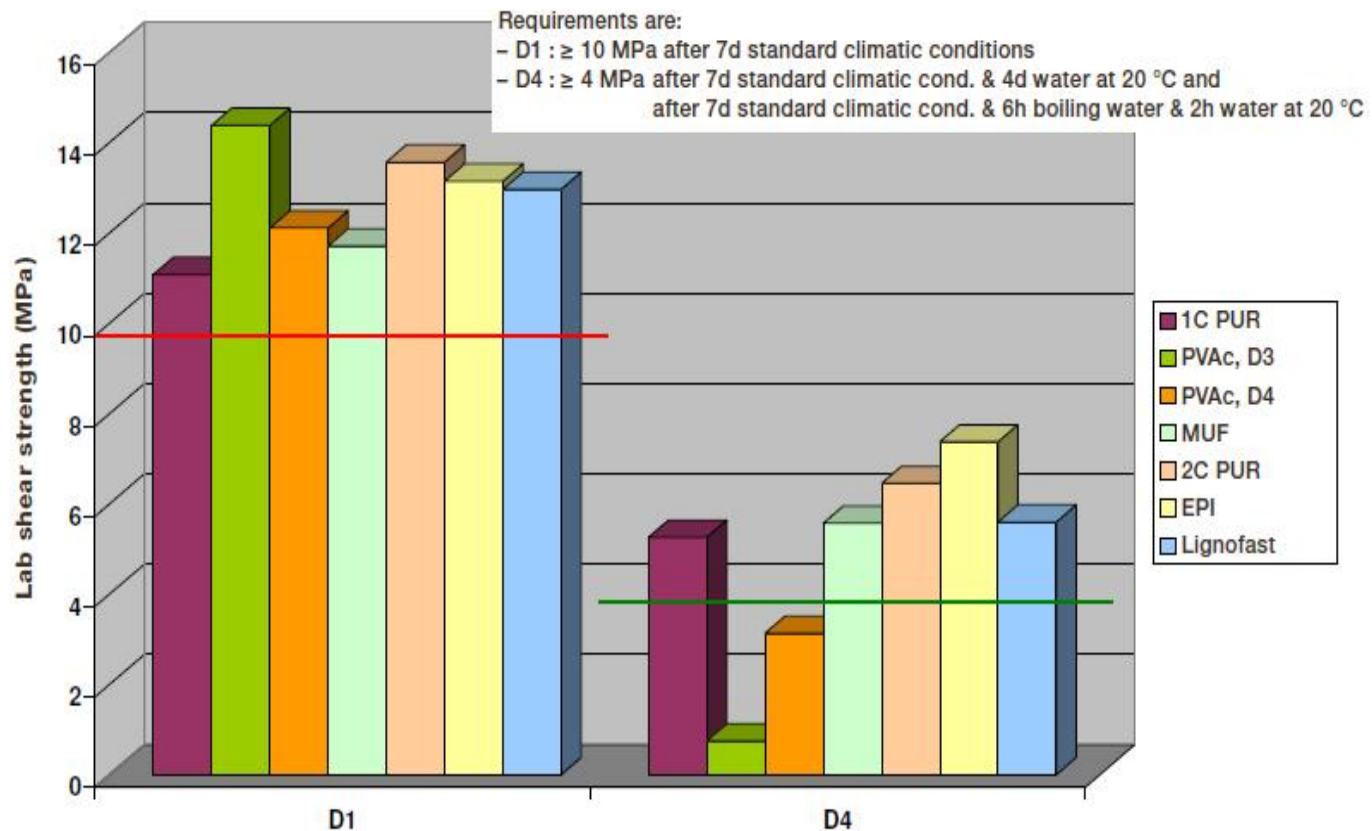
Water resistance: D4 acc. EN 204/205

Additionally:

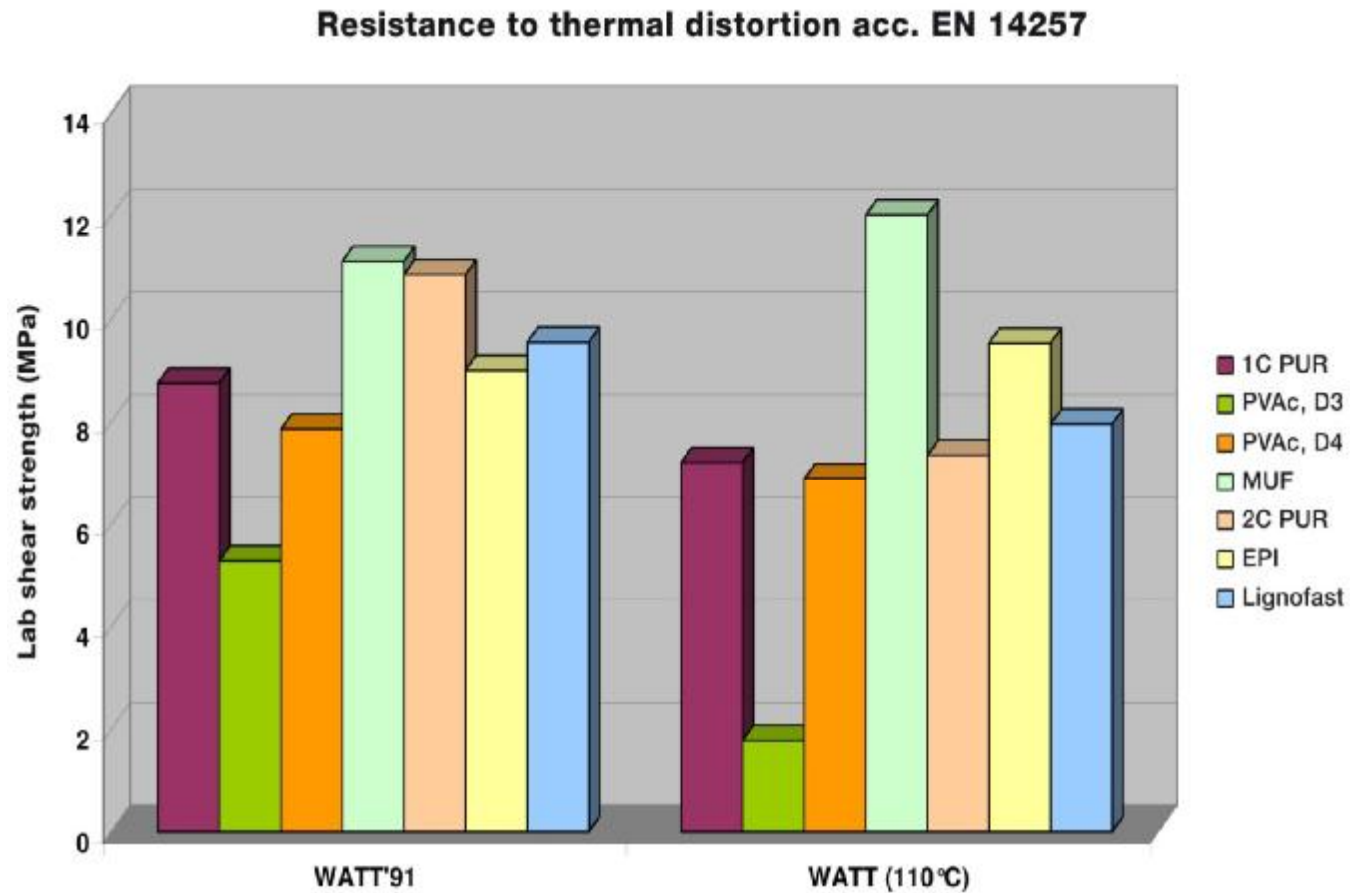
- No residues on sanding band during sanding process
- paintability

Comparison of first prototype to other adhesive technologies

Shear strength comparison D1, D4 acc. DIN EN 204/205



Comparison of first prototype to other adhesive technologies



Hurdles to be jumped

Need for R&D on

- Mixing and Application Technology (need for low output)
- Green strength
- High-speed press systems
- Wood transport to the press
- Destacking of the glued parts



Low Pressure Applicator

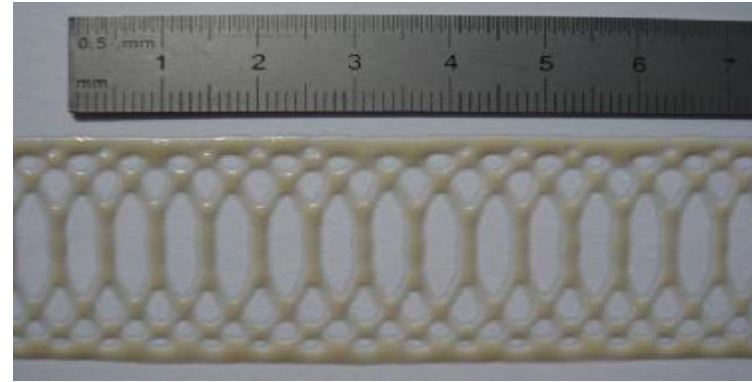
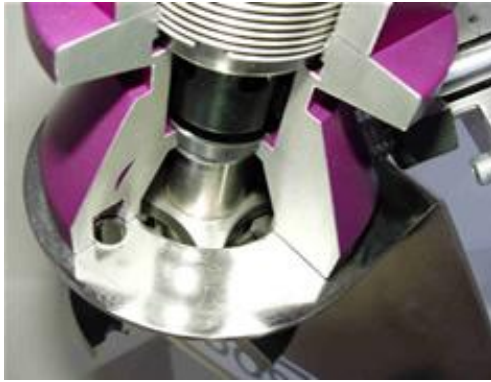


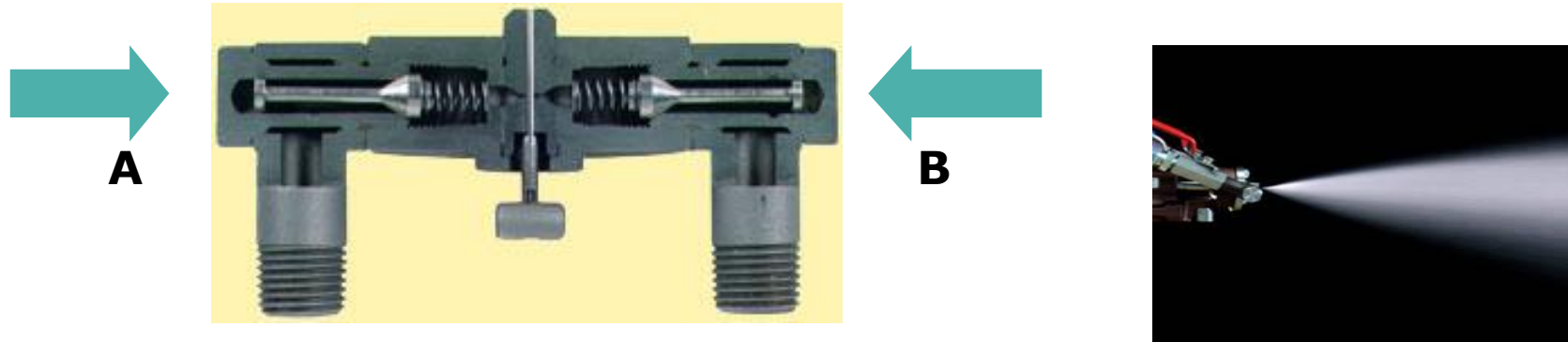
Photo Dosiplast

Advantage: Low application weight,
1 - 10 g/sec
no overspray

Negative: Cleaning shots required for
stop-and-go

Not suitable for very fast systems

High pressure injection



Spraying or casting

Advantage: Easy cleaning by mechanical device
stop-and-go in < 1 second

Negative: High output quantity (> 4g/sec)
smallest application width > 1cm



Investigations on Wood Penetration by Polyurea Adhesives

Diploma Thesis of FH-Rosenheim, Sebastian Meyer
(Prof. Dr. Larbig, Prof. Dr. Michanickl)

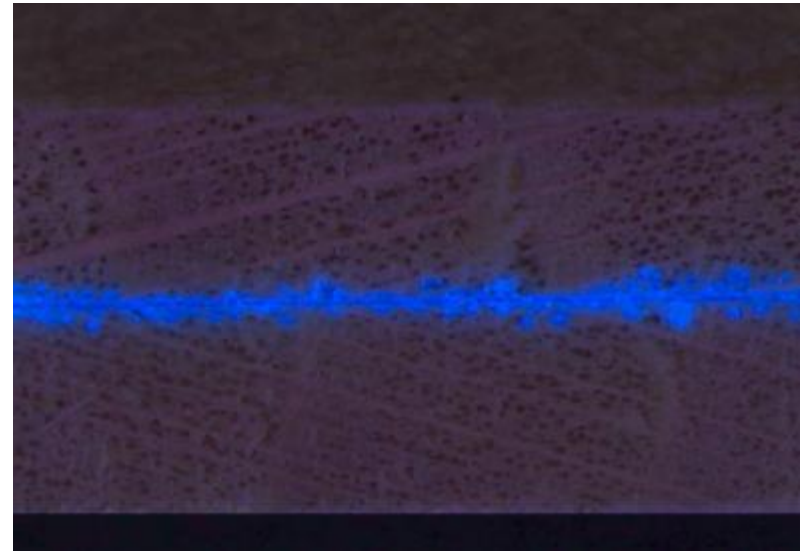
Parameters

- Wood moisture content from 4 - 20%
- Press pressure from 0.05 - 1 N/mm²
- Coating weight of 130 - 200 gsm

Measurements

- Depth of penetration
- Bond strength according to
DIN EN 14257 (Watt91)
DIN EN 12765 (C1-C4)

Experimental Set-up



Experimental Results (1)

Design-Expert® Software

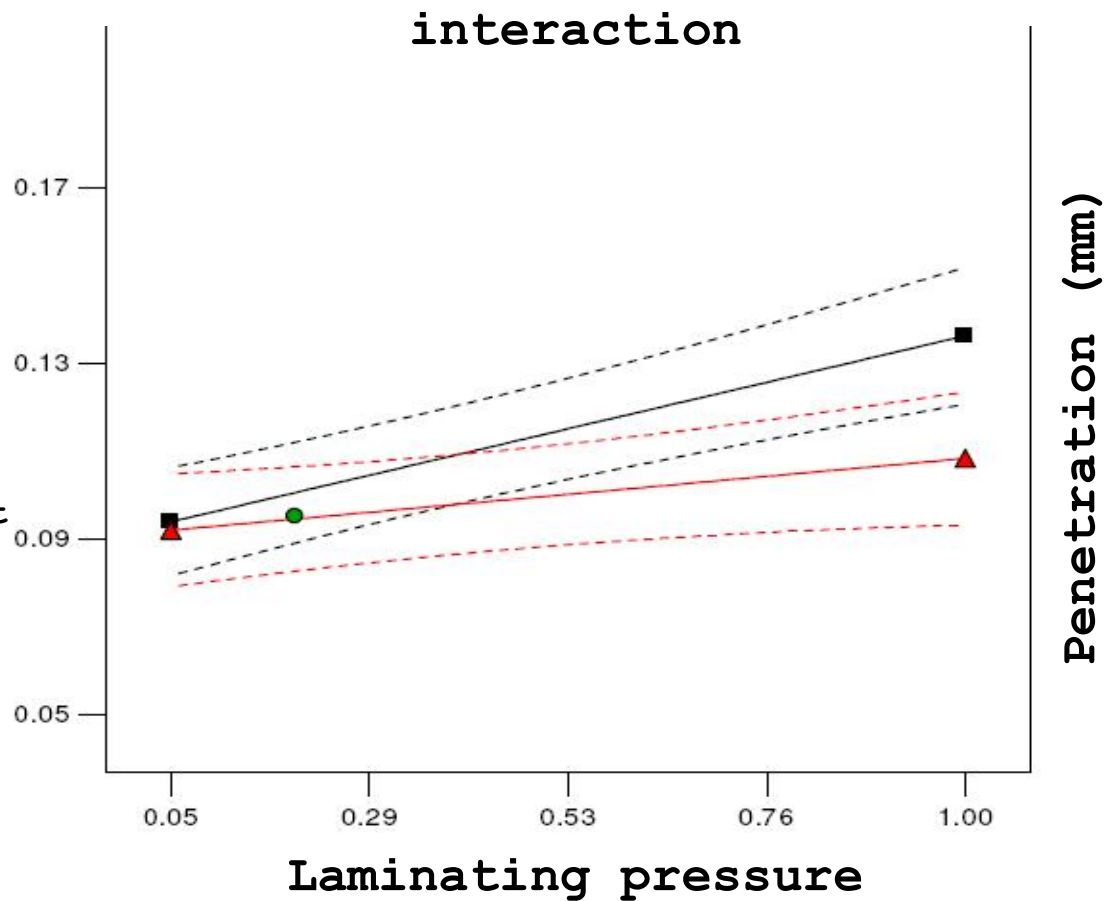
Penetration Studies

■ F 4.00%

▲ F20.00%

X1=C: laminating pressure

X2=F: moisture content

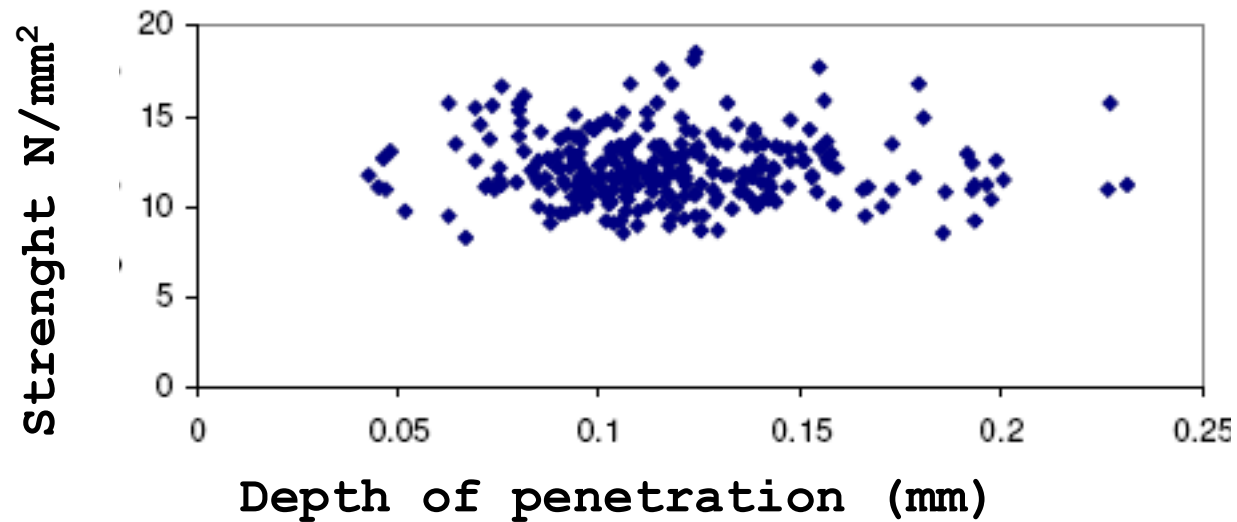


Experimental Results (2)

	Coating weight	Mixing ratio 100%-NCO: X%-NH ₂	Laminating pressure	Moisture content	Lap-shear strength (C4, DIN 12765) required >4N/mm ²
no of specimen	g/m ²	%	N/mm ²	%	N/mm ²
3	130	50	1,0	20	6.14
9	130	50	0,2	4	6.29
15	130	50	0,05	4	7.21
17	200	50	0,05	20	6.88
35	200	67	1,0	11	6.85
44	200	60	0,05	11	6.49
59	200	50	1,0	11	6.47

Correlation?

Direct comparison
(identical test specimens)



◆ Data points

Findings

- Sufficient penetration is observed over the entire experimental range
- Surprisingly small variations of the properties over the entire parameter range
- No correlation between depth of penetration and bond strength



System is non-critical despite of its speed
System allows for a high process reliability

Example: Solid Wood Panels

HF unit, not employed



photo Grecon-Dimter

Solid Wood Panels



Market: Can the SWP win back some market share (chipboard, MDF)?

- formaldehyde discussion
- more efficient production

- indoor, furniture, non structural use, adhesive needs no certification
- small, continuous adhesive application area
- Bern University of Applied Sciences, «development of system»

open:

- Industrial proof of concept

Efficiency calculation

1-layer SWP

Dimension of 1,2 x 5 m, 21 mm, 25 panels

old system, PVAc,
heat curing

1 press
1 man, 2 shifts/day

0,500 Mio. m²/year

Lignofast[®]-System

1 press
1 man, 1 shift/day

1,3 Mio. m²/year, V=60 m/min.

1/2 labour cost = 2-3 times production capacity

details available



Prototype Run



Conclusions

- Polyureas are excellent wood adhesives
- Polyurea glue lines are emission-free
- Polyurea adhesives are not highly critical with respect to temperature, moisture, laminating pressure, etc.
- Polyurea adhesives therefore provide a high process reliability

but

- Wood processing equipment has to be purpose-built
- Requires a major capital investment (application system, speed-press and processing equipment)
- Are yet to be certified for engineered wood applications



Thank you very much for your kind attention.

Questions?