Just the two of us – new hybrid binder for wood-based panels

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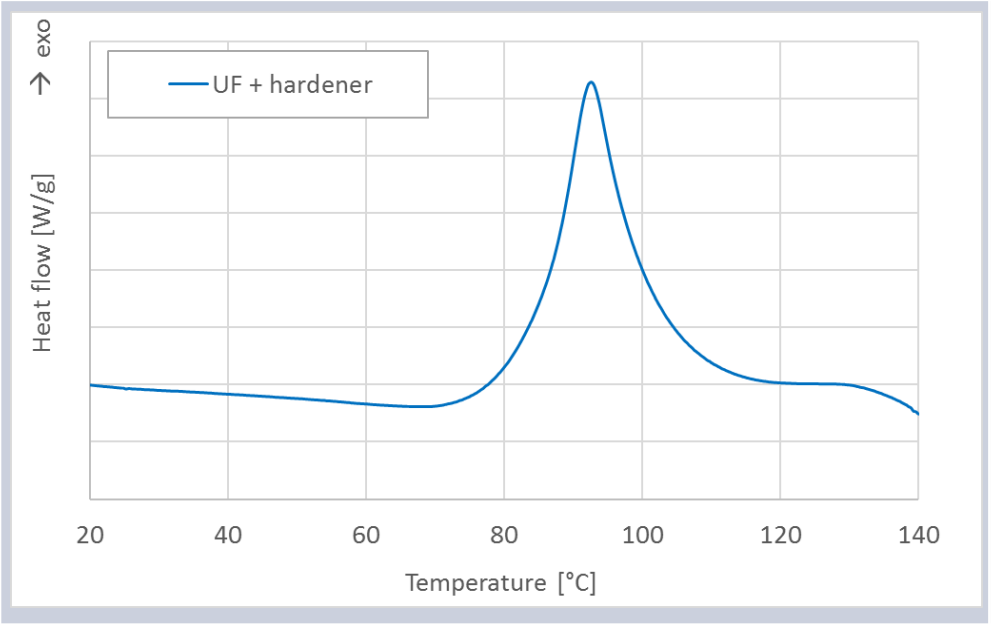
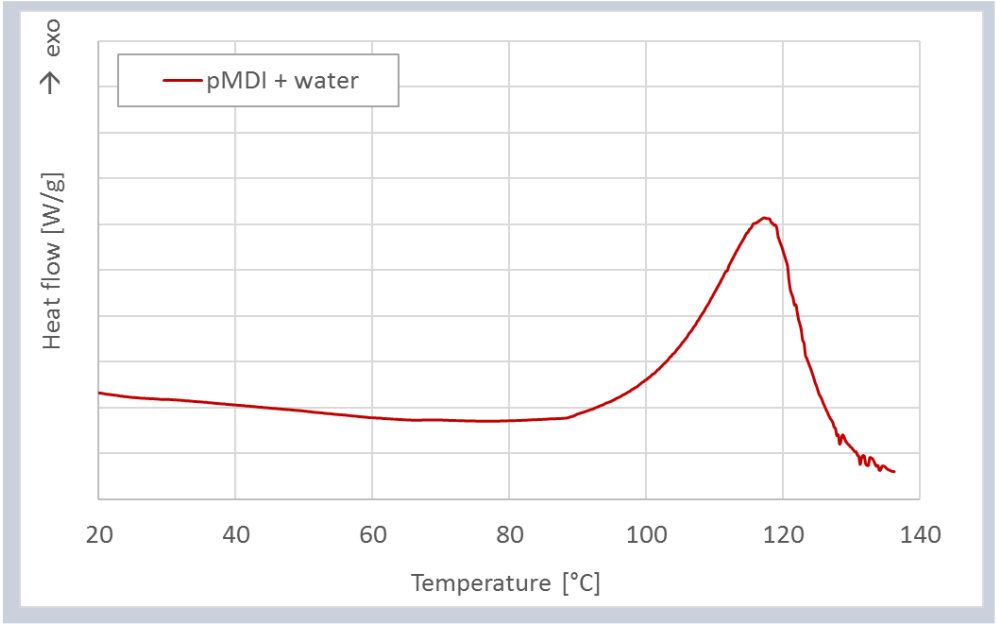
At a first glance, UF and pMDI are not really ideal components to combine

Urea formaldehyde resin UF		Isocyanate pMDI
polar	polarity	unpolar
good	miscibility with water	bad
polycondensation (elimination of water)	reaction mode	polyadditon (initiated by addition of water)

At a first glance, UF and pMDI are not really ideal components to combine

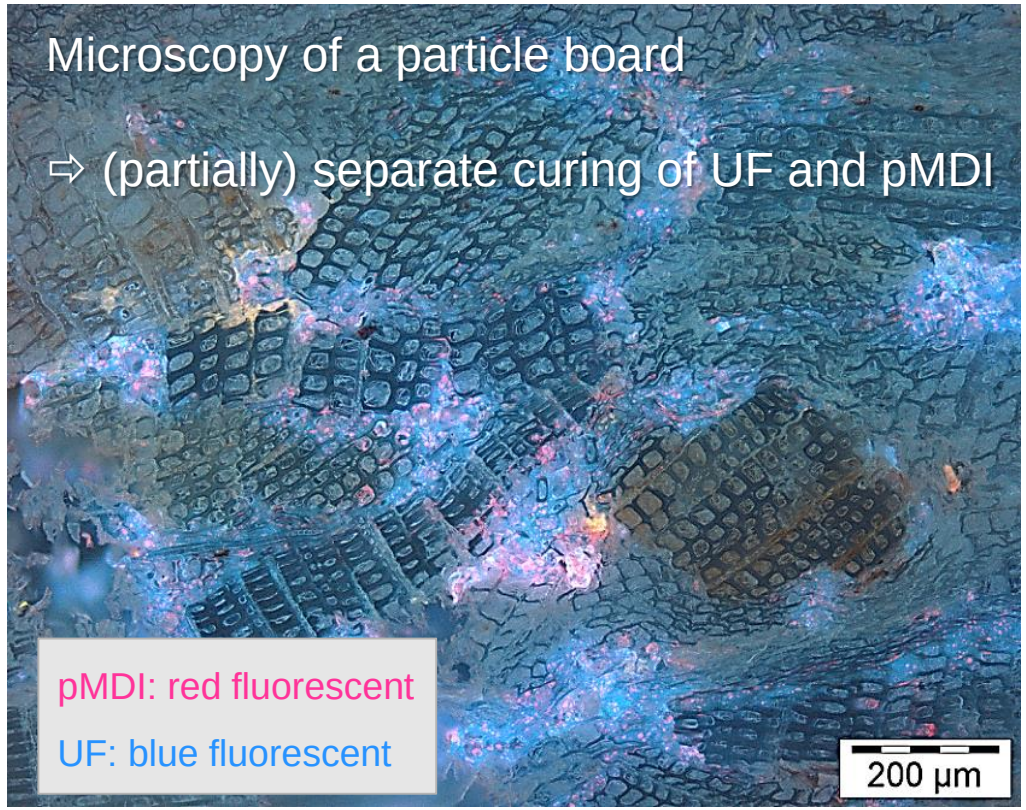
Urea formaldehyde resin UF		Isocyanate pMDI
	Reactivity (by Dynamic Scanning Calorimetry DSC)	

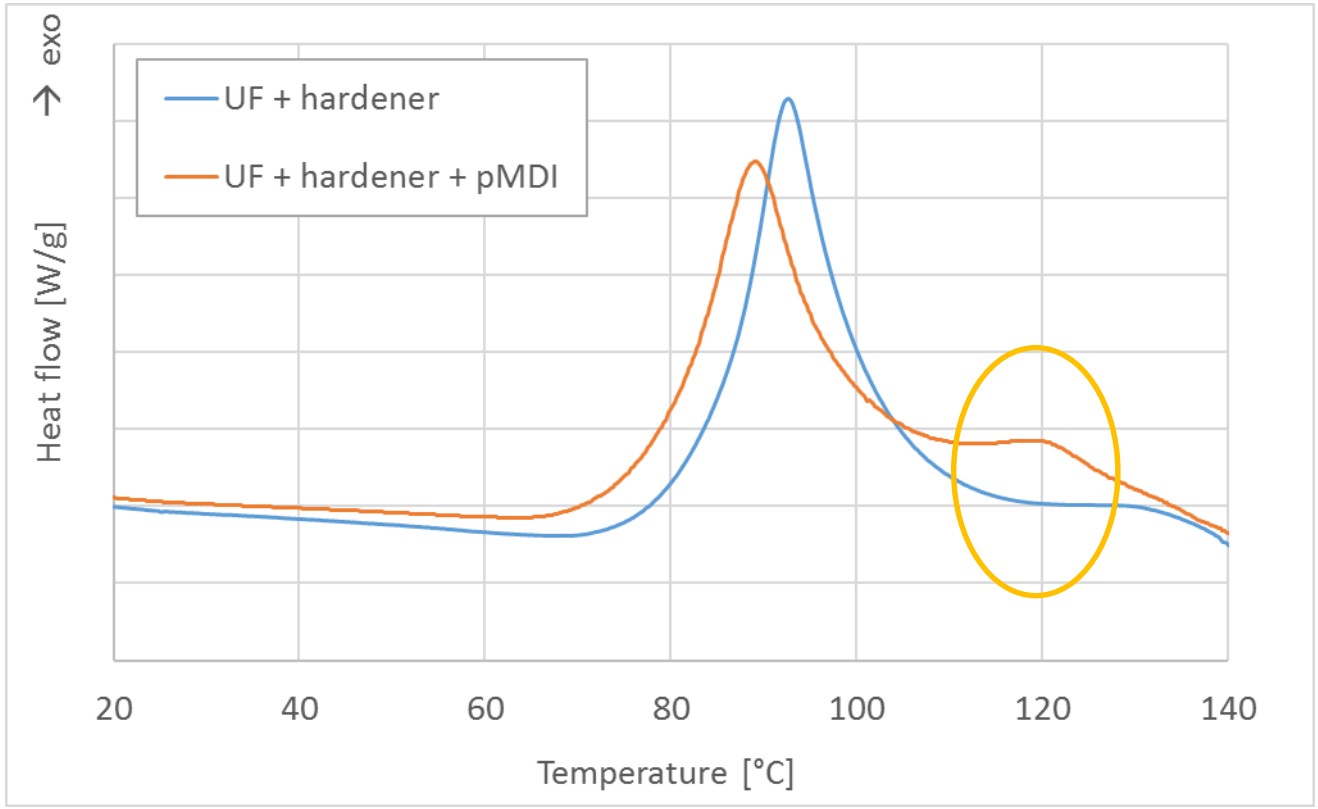
a water-emulsifiable prepolymer based on pMDI was used

Nevertheless, they can act synergistically !

Polyurea network contributes to final board properties

Curing of pMDI → polyurea network



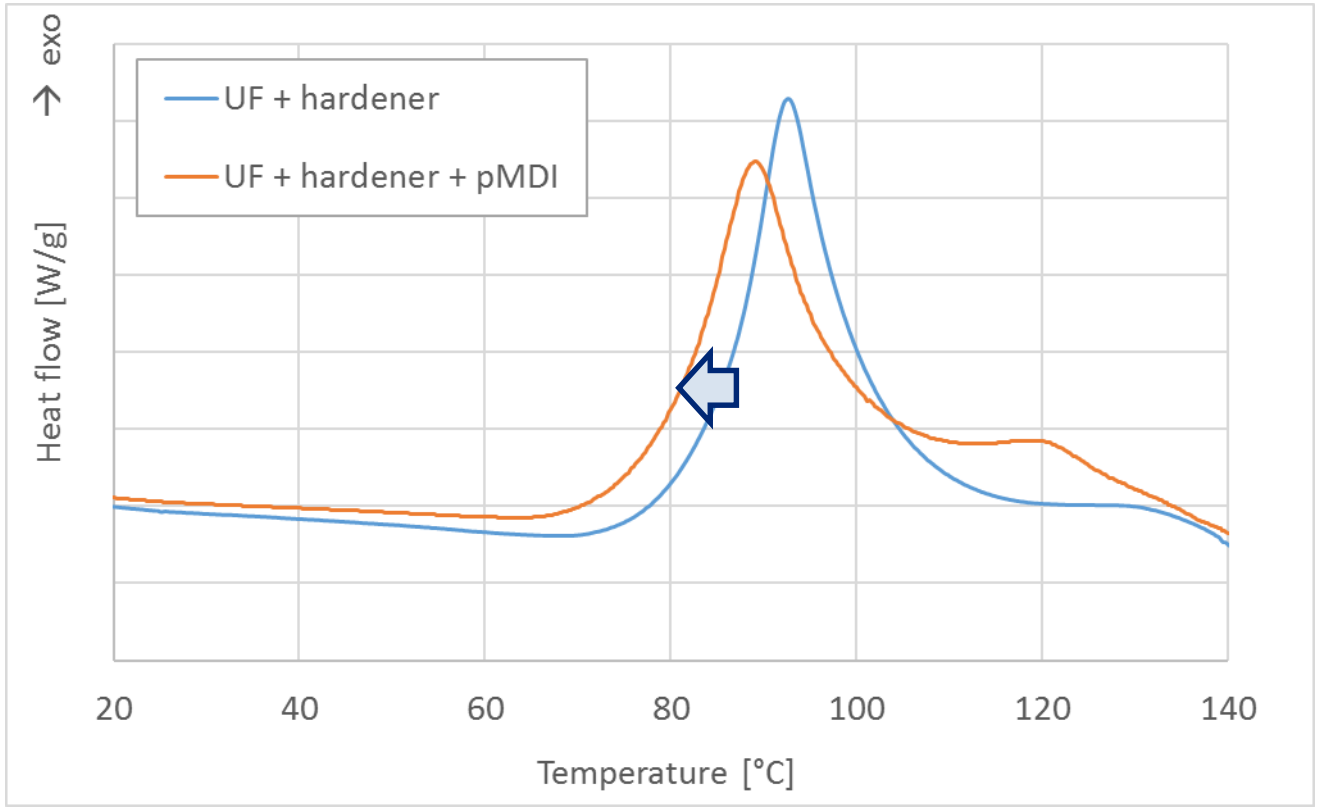


Source: Brodel, Zillessen, Marutzky, unpublished results

Synergistic effect: reactivity increase

Curing onset is shifted

to lower temperature

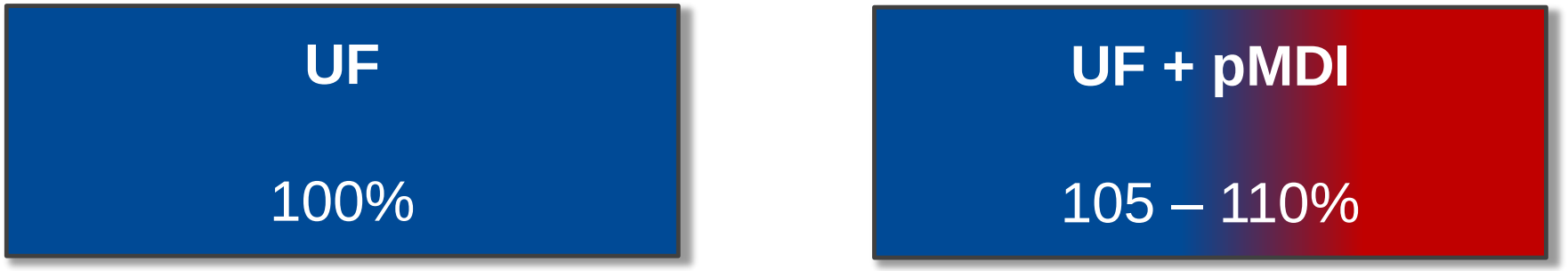


Potential explanation:

UF methylol groups react with isocyanate

Simon, et al., Holzforschung, **2002**, 56, 327-334
and
Brodel, Diploma thesis, Fraunhofer WKI, **2011**

These known UF/pMDI synergies are allready used by particle board producers to increase productivity



x% = relative maximum process speed*

Can we enhance this effect?

Is it possible to increase speed by more than 10%?

* BASF internal data, estimated for particle board production

The purpose of our R&D project

deepen the understanding of the UF/pMDI synergies

develop a new isocyanate component to enhance synergies

reduce cost in particle board production

Unique conditions

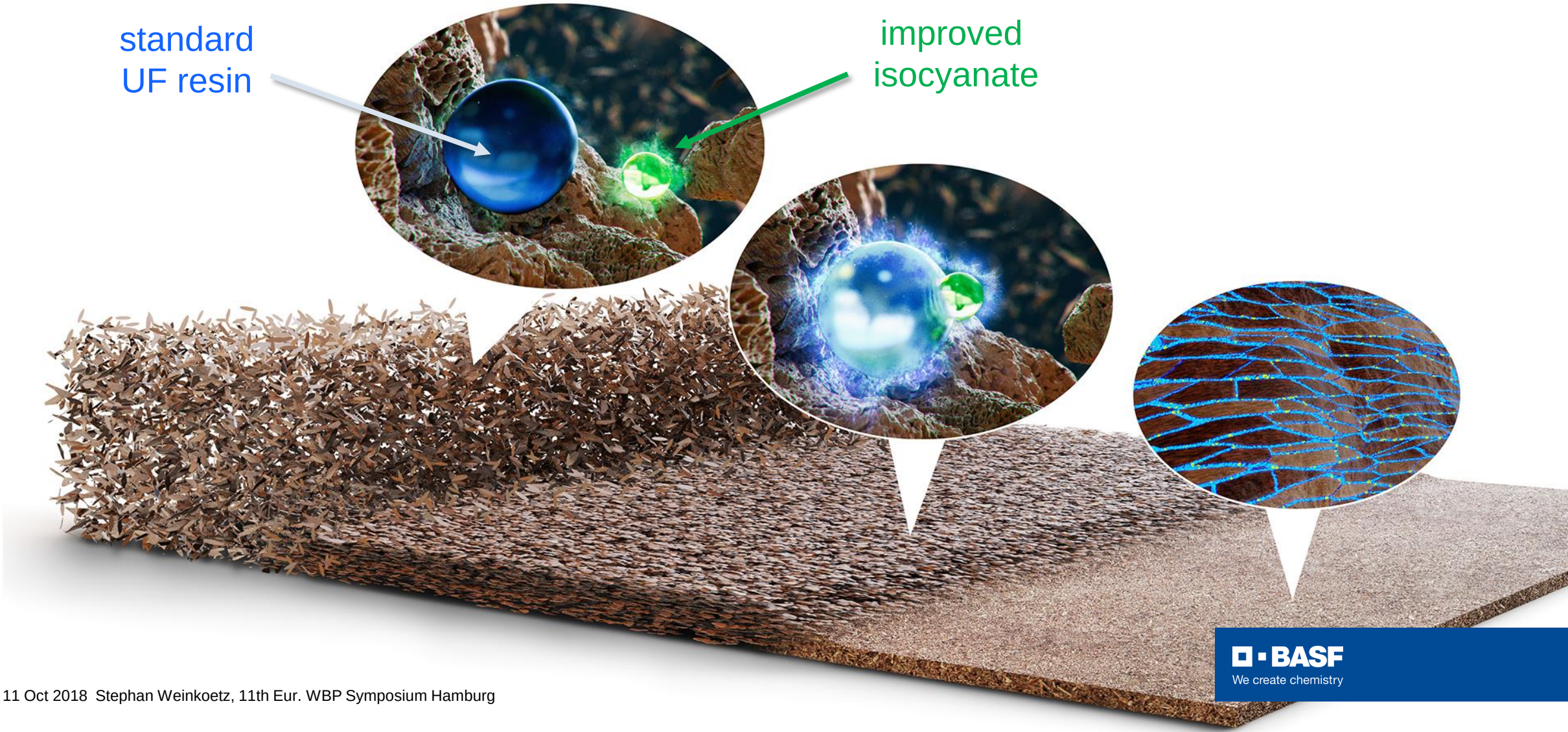
Two binder types – one company

- **Production**
  several facilities for
  amino resins and isocyanates

- **Application**
  long term experience
  with both wood-binder technologies

- **Research**
  strong expertise for
  condensation resins and polyurethanes

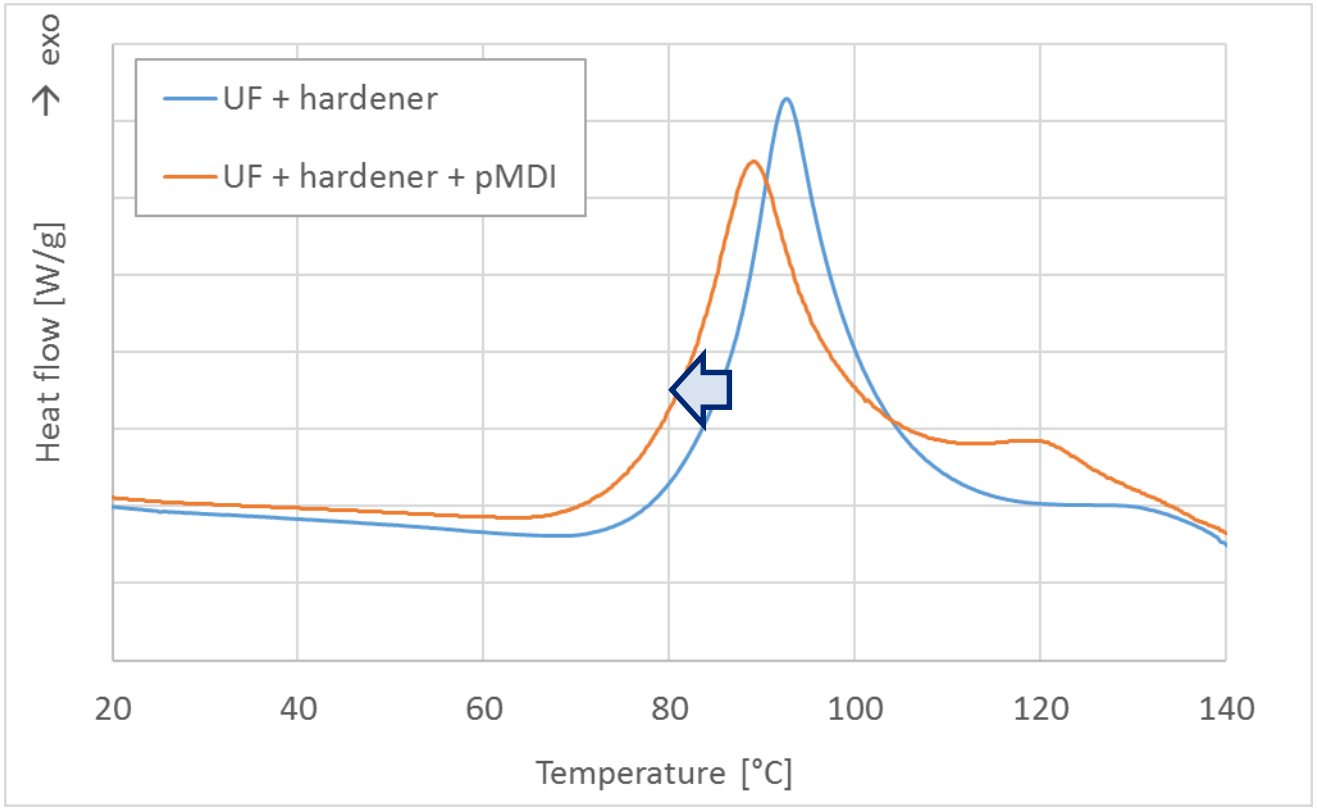
The technological concept: additional activation of the UF by an improved isocyanate component



Proof of concept by DSC measurements

known effect of previous hybrid systems

(standard UF + standard pMDI)



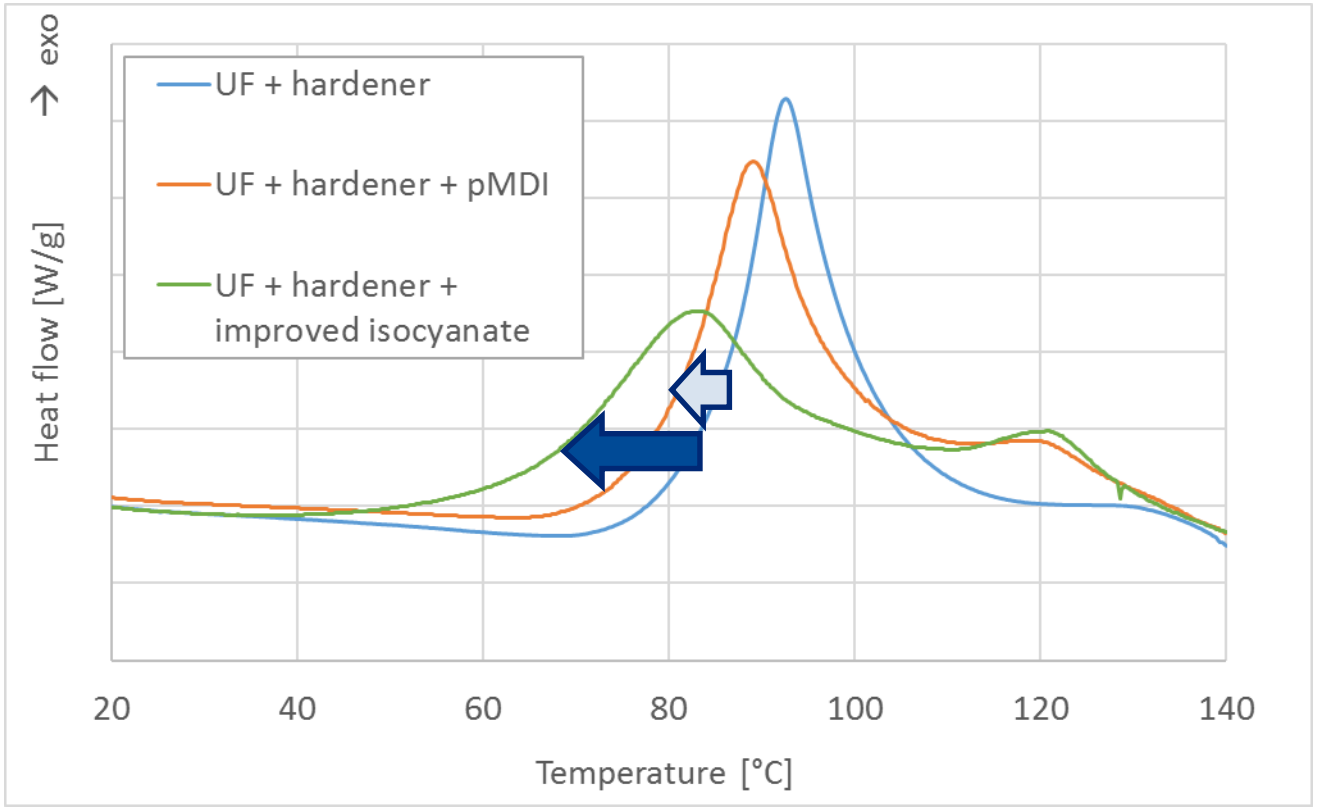
Proof of concept by DSC measurements

known effect of previous hybrid systems

(standard UF + standard pMDI)

enhanced effect of test system

(standard UF + improved isocyanate)



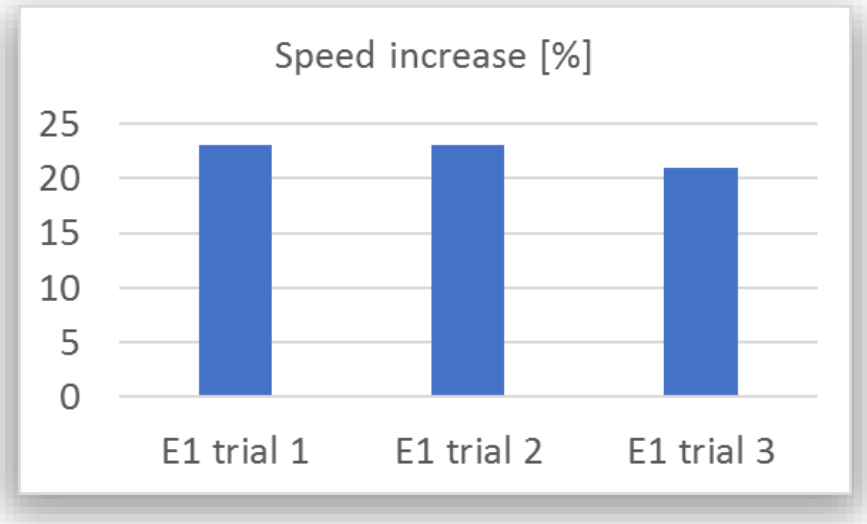
From the test system to the final formulation

	Final formulation	**Standard pMDI** (for comparison)
✓ Optimization of reactivity	NCO number[1)] ca. 32% + additional adjustments	NCO number[1)] ca. 32%
✓ Adjustment of viscosity	100 mPas[2)]	ca. 250 mPas[2)]
✓ Extension of storage stability	> 6 months	> 6 months
✓ Lab board trials	Significant reduction of presstime Suitable board properties	

1) ASTM D 5155
2) at 25 °C, DIN 53018

Final check by pilot customer trials

- 18 mm particle boards on a continuous line (without pre-heating)

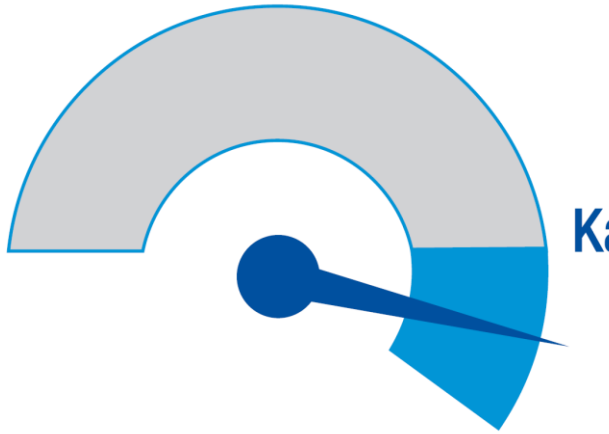


surface	10 % Kaurit glue 347 S + hardener
core	7% Kaurit glue 347 S + hardener + 0,4 % new pMDI
surface	10 % Kaurit glue 347 S + hardener

Typical recipe (E1)

E1	Large scale trials (> 20 tons new pMDI): Reliable speed increase by > 20% Confirmed by a trial with a second pilot customer
CARB 2, F4*	First customer trials: speed increase > 15%

Product Launch in September 2018



Kauranat MS 1001: special pMDI grade for UF/pMDI hybrid binders

New product

can be used like standard pMDI (storage, safety, application, etc.)

Drop-in solution

enables **higher productivity** at same emission level

enables **lower FA emission** at same production speed

Benefits

Important to know

Kauranat®

Mixed immediately before application (preferred)
or separate application

FA emission is mainly determined
by the UF component

New hybrid binder
UF + Kauranat MS 1001

Binder system for the core layer
(not recommended
for surface layers)

contribution of Kauranat
to board properties (IB and swelling)
analogous to standard pMDI

Recommended ratio
UF (solids) : **Kauranat** =
100 : **3** to 100 : **10**

BASF
We create chemistry

Just the two from us

Kaurit glue + Kauranat MS 1001

New hybrid binder for the core layer of particle boards

Benefit

Increased productivity by > 20 %