New Rheological Additive for 2K Waterborne Epoxies

CTT 2019, Chicago
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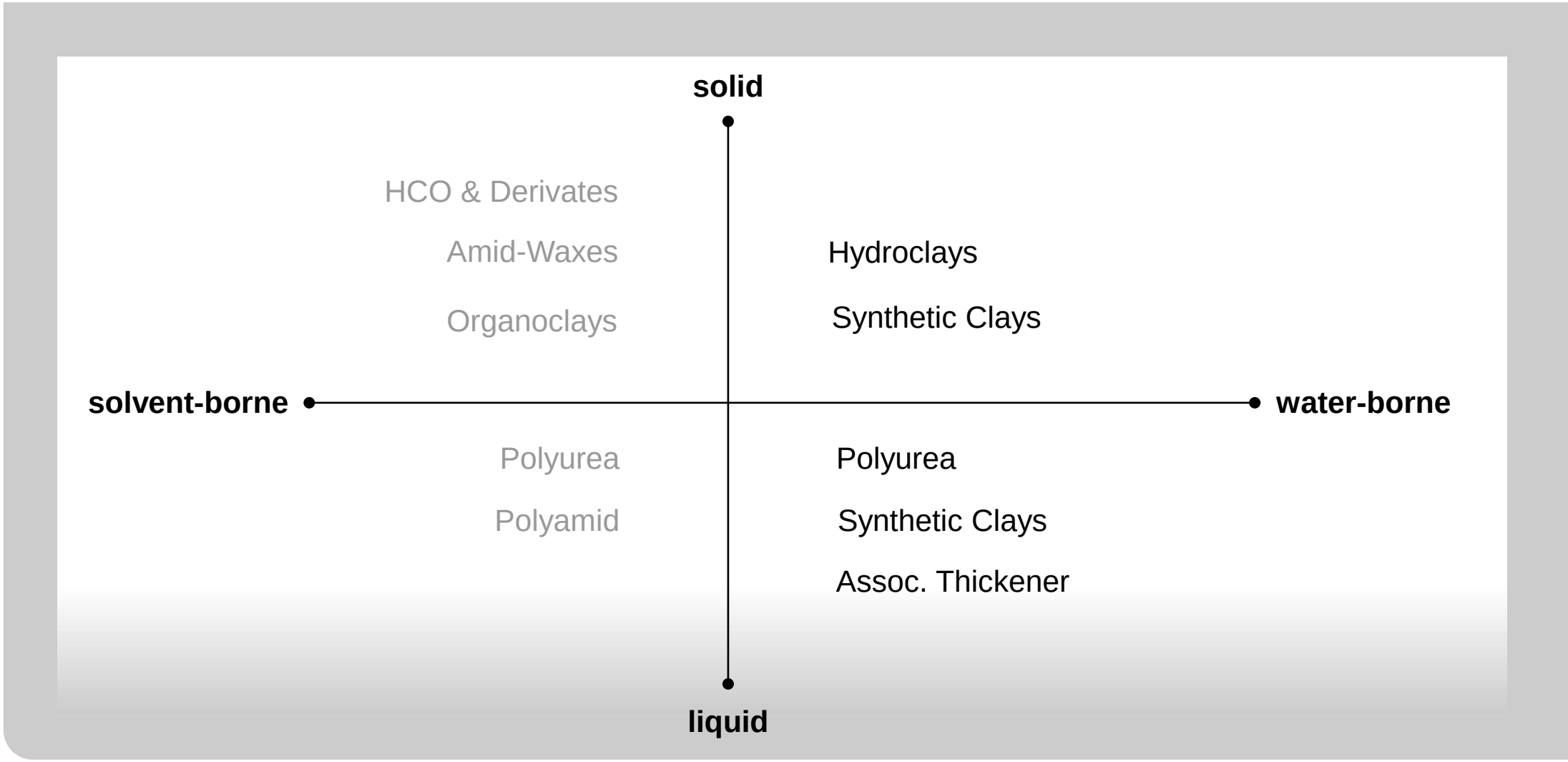
Summary of todays discussion

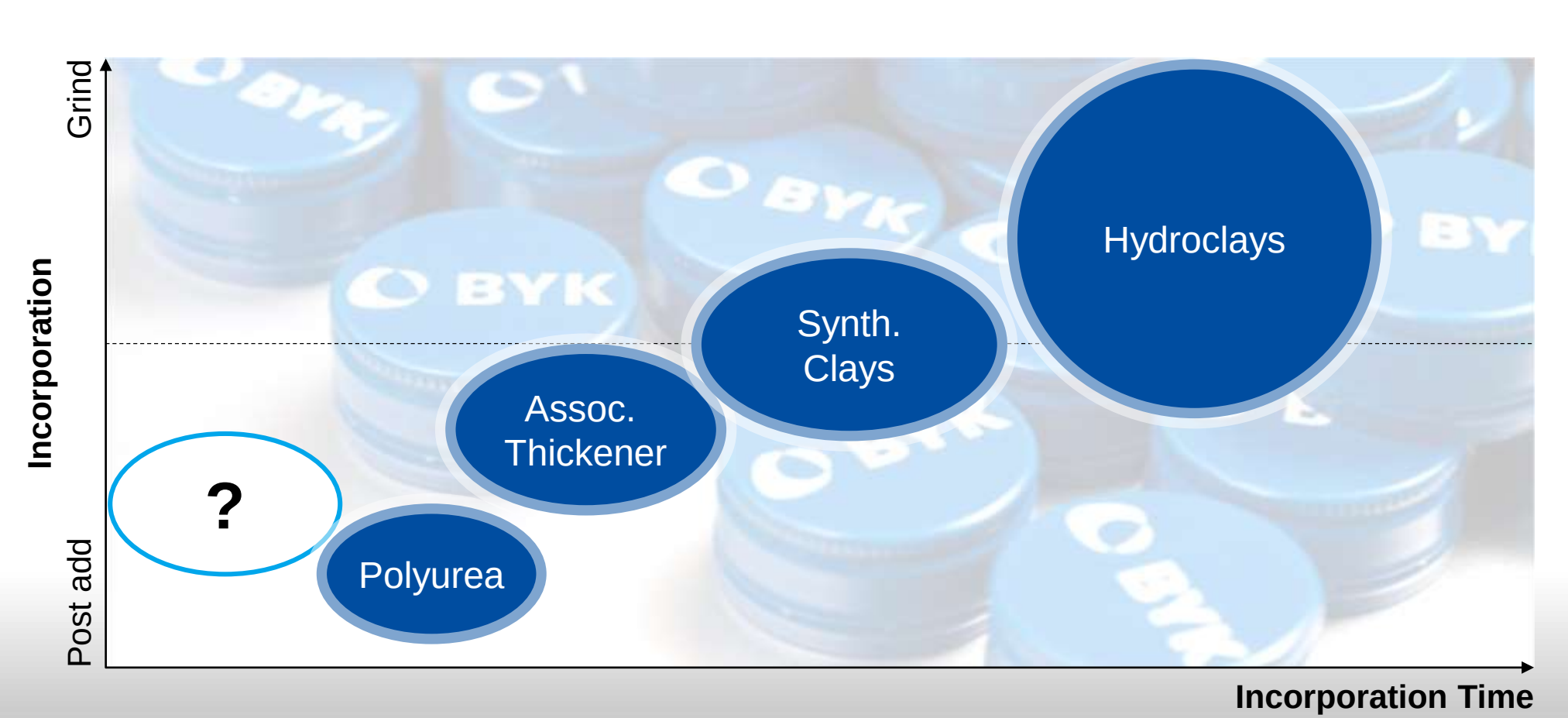
- Rheological additives for epoxies
- Some of the challenges
- New polyamide additive for water-borne epoxies
  - chemistry
  - its heritage
- How the new polyamide compares to other technologies
  - Incorporation
  - Stability
  - Sag resistance
  - Activation temp

Rheology Additives available for Epoxies



BYK

Incorporation Rheology Additives
Water-borne Coatings



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Incorporation Rheology Additives
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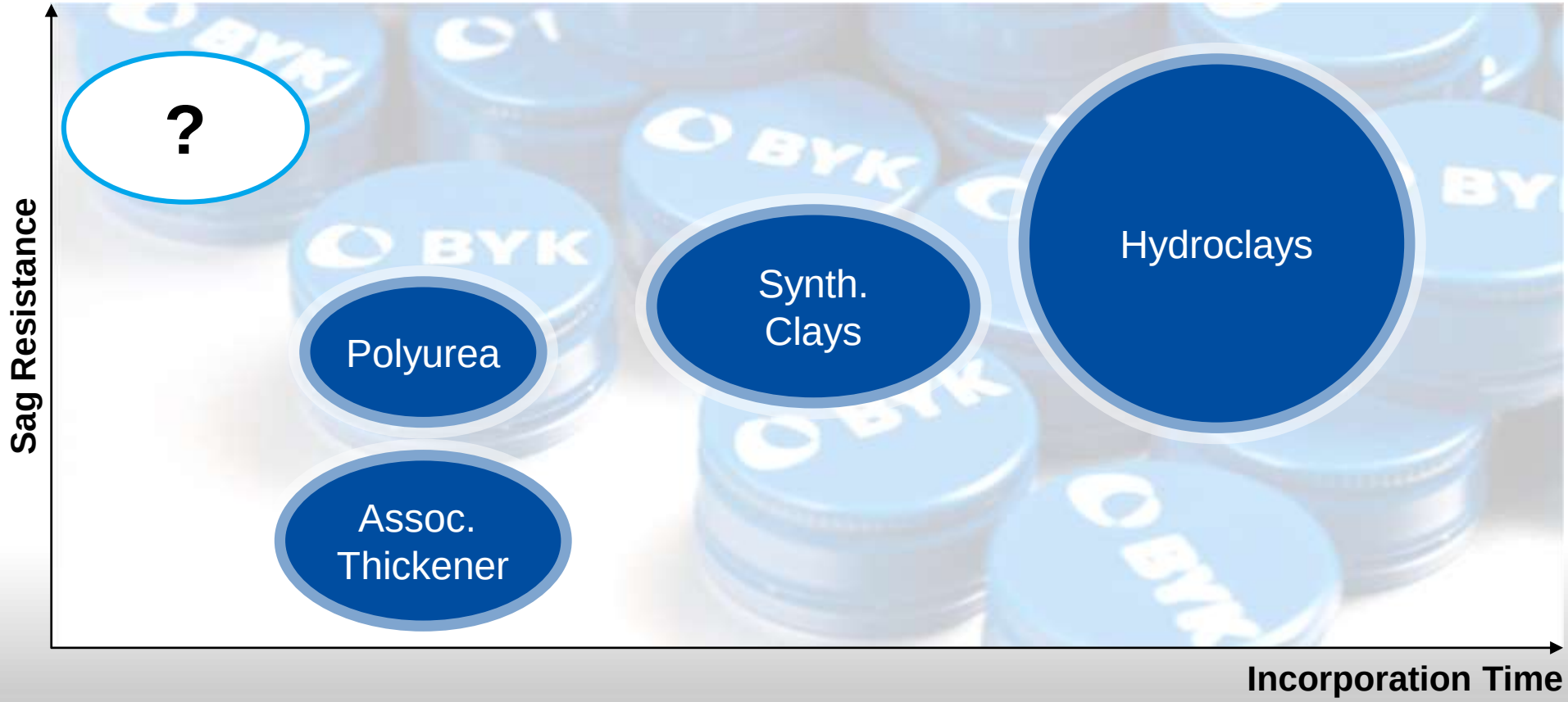
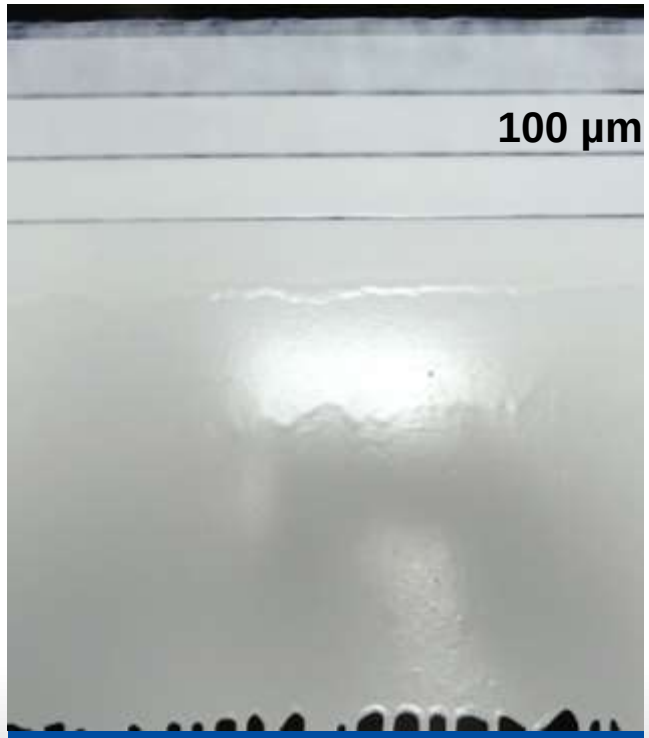


Rheology Additives in Water-borne Epoxies
Technologies so far…

Incompatible

Increase in viscosity
over storage time



High KU-viscosity,
but low sag resistance

New Polyaide for water - Chemistry

Liquid, polyamide-based rheology additive for water-borne systems

Polyamide backbone → Hydrogen bonds for rheological effect

Compatibility providing unit (EO, PO, Alkyl-chains)

Rheology enhancing group

Completing the Family of Liquid Polyamides

Polyamide for solvent

urea-modified, medium polarity

Polyamide for solvent

modified, high polarity

New Polyamide for water-borne

modified, high polarity

Polyamide backbone → Hydrogen bonds for rheological effect

Compatibility providing unit (EO, PO, Alkyl-chains)

Rheology enhancing group

Urea unit

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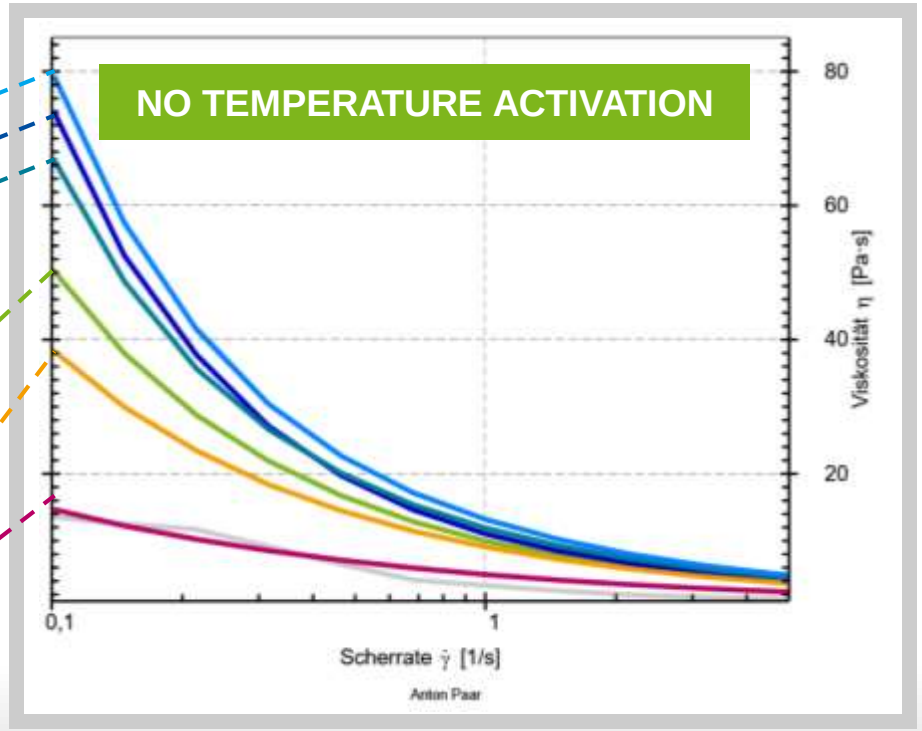
New liquid polyamide in water-borne epoxies
Incorporation: Point, Time and Shear Forces

Test method:
WB 2-pack Epoxy

Dosage liquid polyamide:
4% as supplied

Sag resistance	Post addition
500 µm	10 min. 10 m/s 5 min. 10 m/s 5 min. 7 m/s
450 µm	10 min. 3 m/s
350 µm	5 min. 3 m/s
	Control



→ **Liquid polyamide – Post addition recommended**

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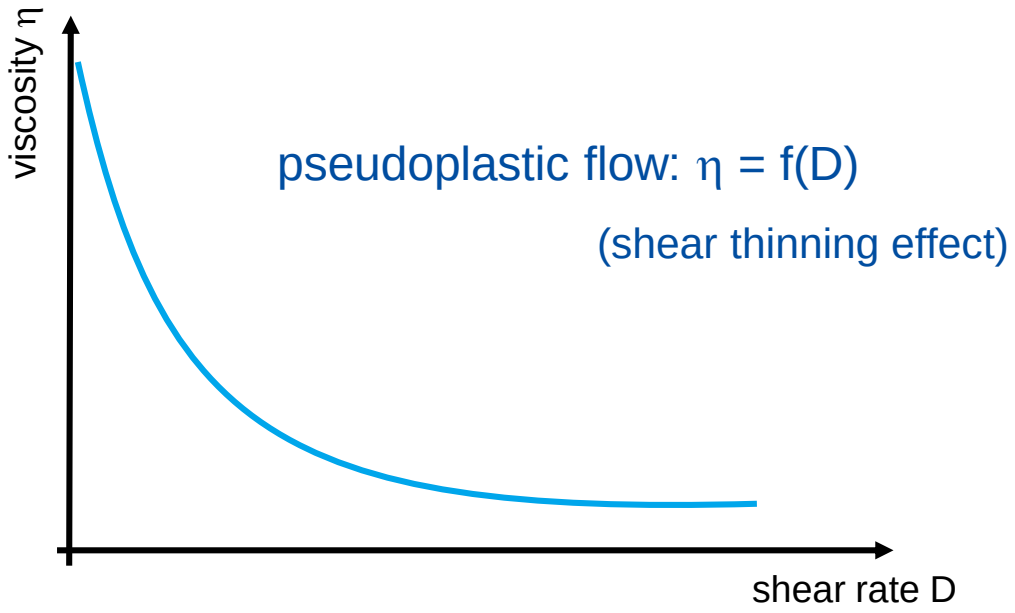
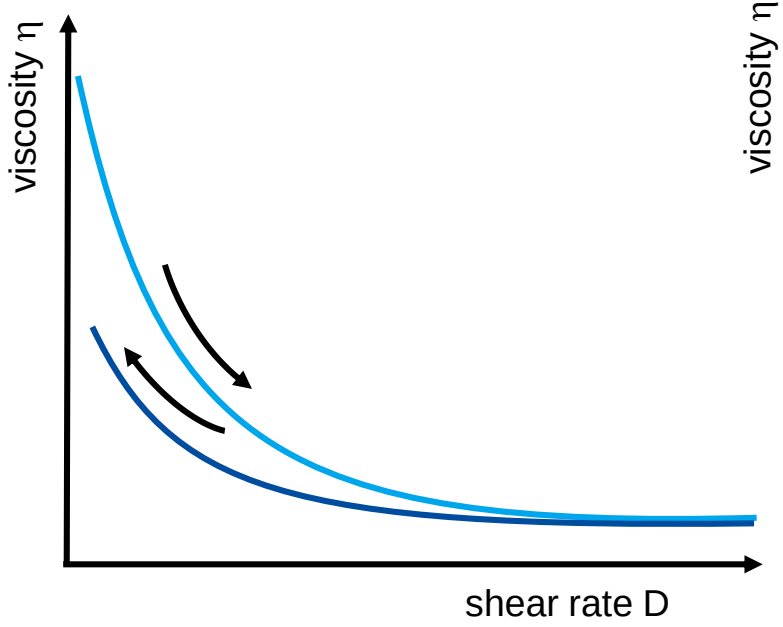
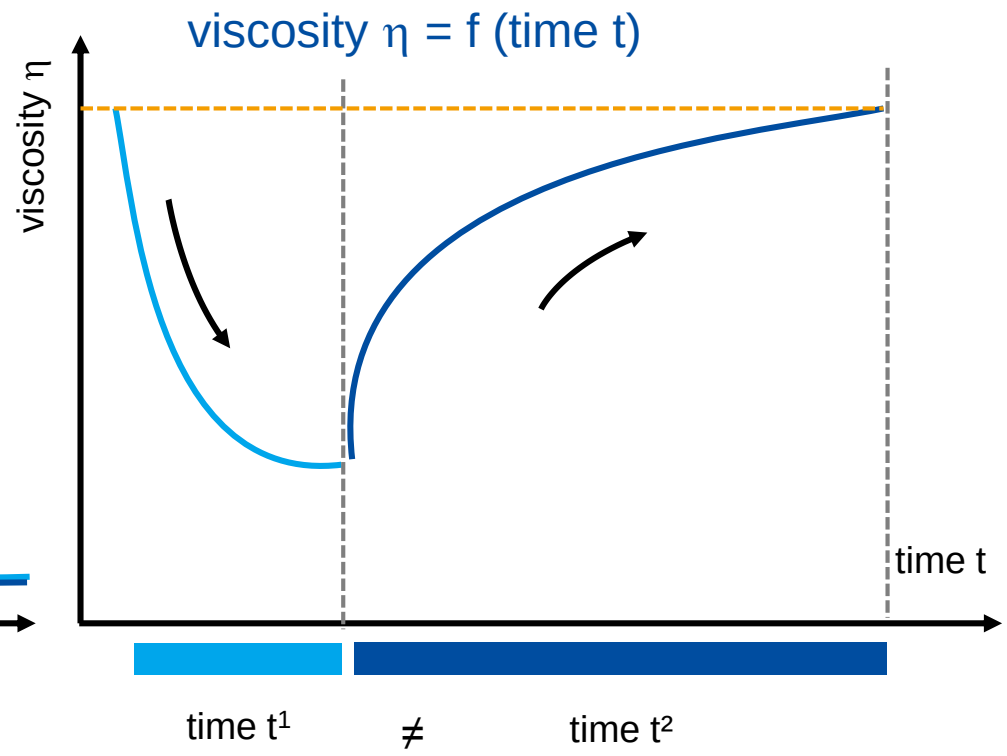
Rheology
Pseudoplastic Flow



Pseudoplastic liquids show a **shear thinning effect**. The viscosity is dependent on the shear rate. The higher the shear rate is, the lower the viscosity appears.

Rheology
Thixotropic Flow





Thixotropic liquids show a **shear thinning effect <u>and</u> a time depending recovery effect.** The viscosity is depending on the shear rate. The shear thinning is faster than the recovery of the initial viscosity. This time difference is called thixotropy. The higher the thixotropy the longer the recovery time is.

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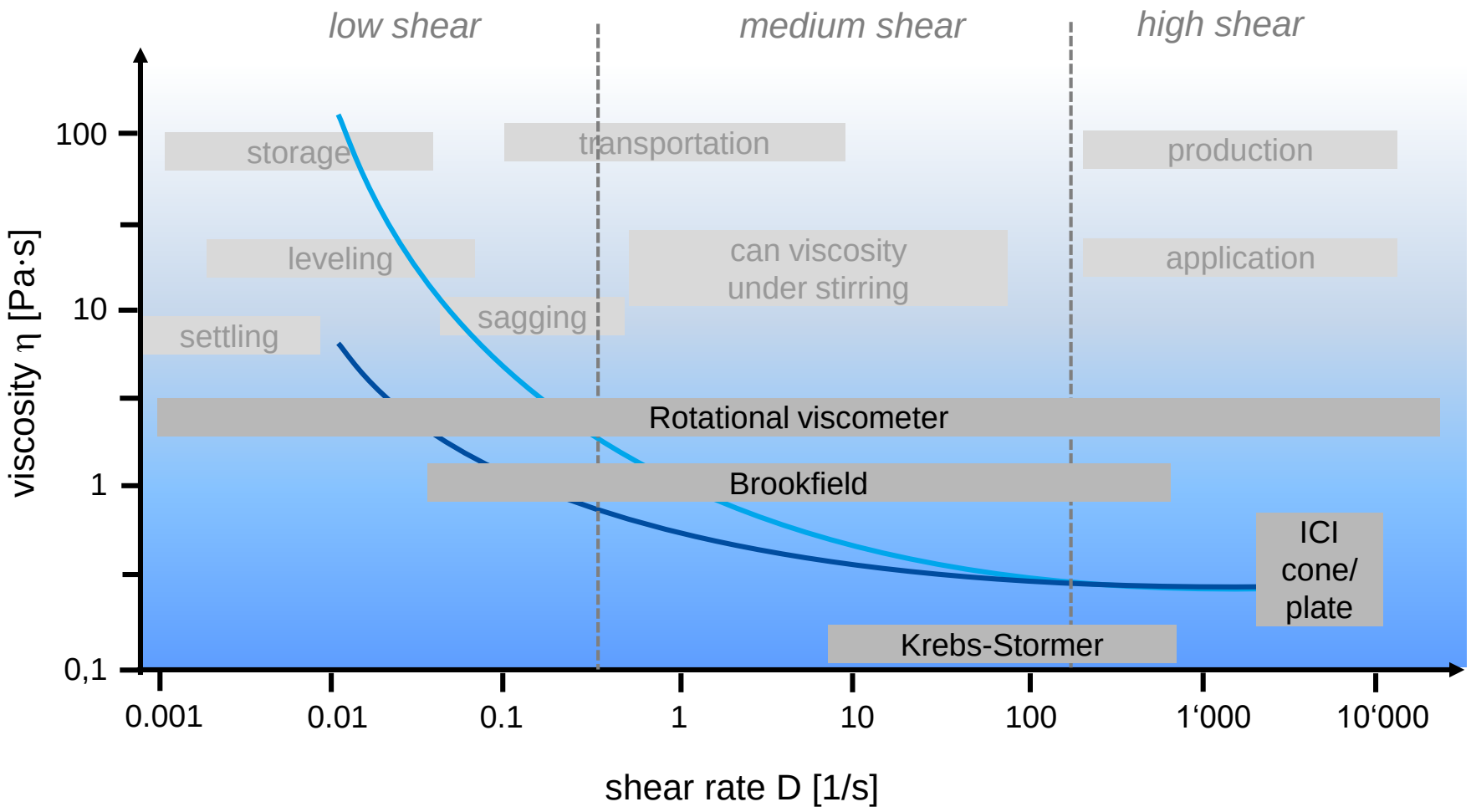
Viscometry
Equipment Selection



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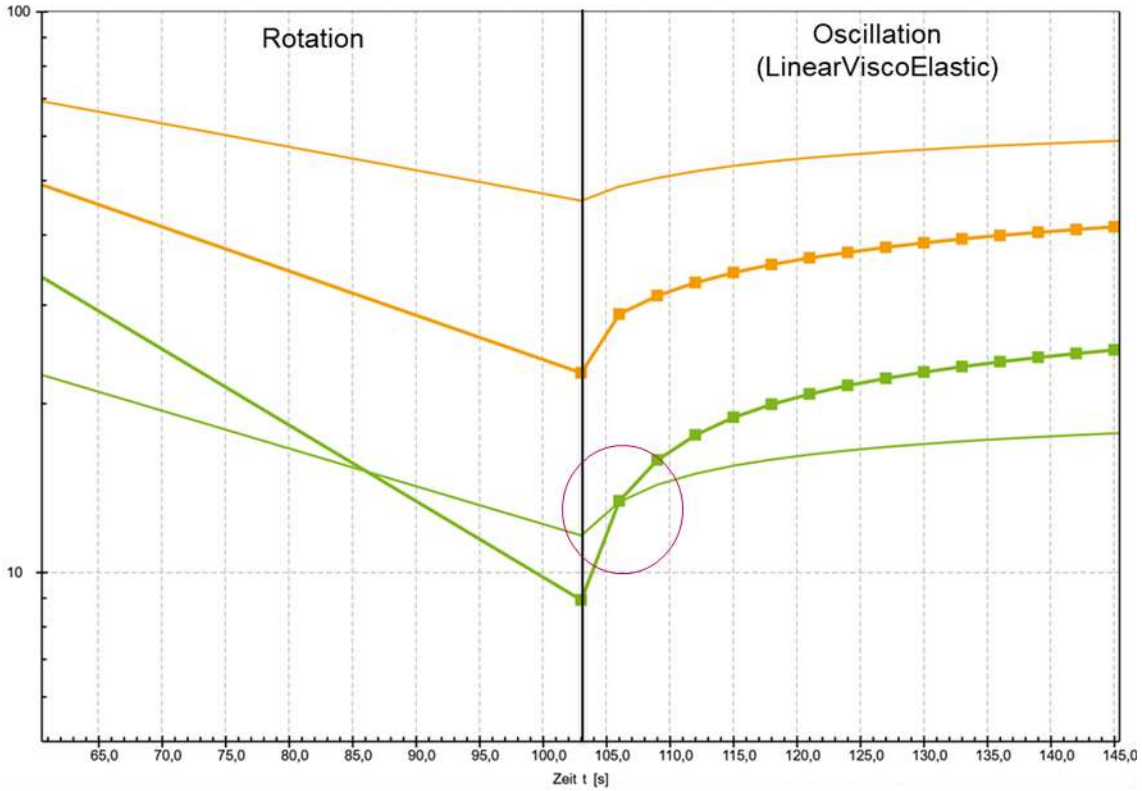
New Liquid Polyamide in Water-borne Epoxies
3-Interval Thixothropy Test (Osc.Rot.Osc.)

Test System
WB 2-pack Epoxy :

Additive Dosage
0.5% active substance on component A

Anton Paar Rheometer MCR 302

Viscosity measurement
Oscillation:
γ= 1%
f = 1Hz
Rotation:
$\dot{\gamma}$= 1000 1/s

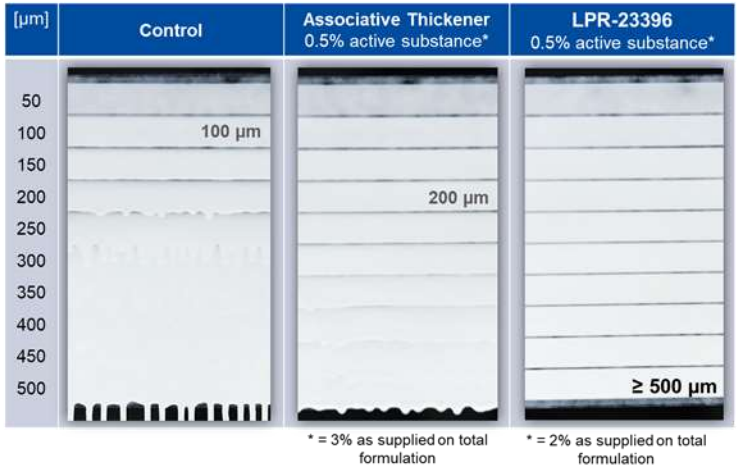


Associative Thickener (A+B)
Storage modules
Loss modulus

New Liquid Polyamide

Higher viscosity, but…
→ More viscous than elastic parts
= **Less sag resistance**

Storage modulus higher than loss modulus after deformation, means…
→ More elastic than viscous parts
= **High sag resistance**



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New liquid polyamide in Water-borne Epoxies
High Sag Resistance

Test method:
WB 2-pack Epoxy

Sag resistance:
after mixing A and B

* = 3% as supplied on total formulation * = 2% as supplied on total formulation

[µm]	Control	Associative Thickener 0.5% active substance*	Liquid polyamide 0.5% active substance*
50 100 150 200 250 300 350 400 450 500			

→ **New liquid polyamide – Fast structure recovery – perfect sag resistance**

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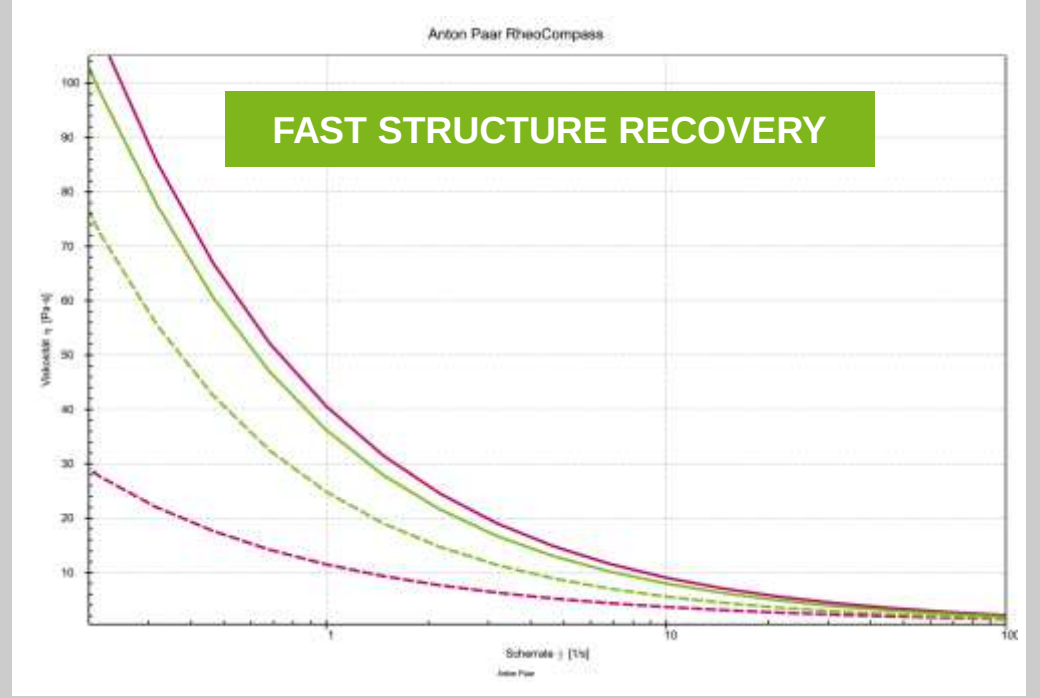
New liquid polyamide in Water-borne Epoxies
Perfect anti sagging – Perfect anti settling

Test method:
WB 2-pack Epoxy

Viscosity:
measurement with amine hardener



Thixotropic Additive*

Liquid Polyamide

— Up-curve

--- Down-curve

* No storage stability 40o C - 14 days

→ **Liquid polyamide – Fast structure recovery – pseudo plastic! behaviour**

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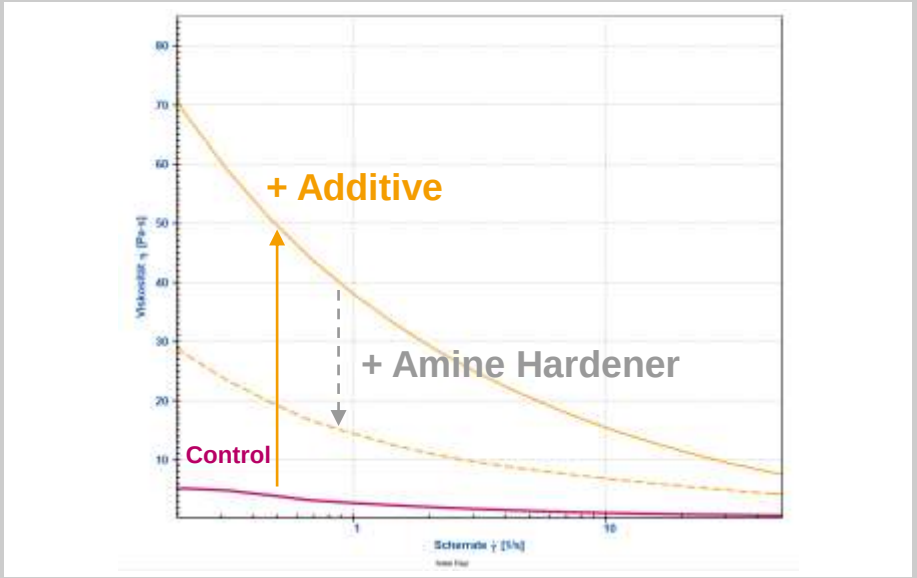
New liquid polyamide in Water-borne 2P Epoxies
Optimized Flow Behaviour

Test method:
WB 2-pack Epoxy

CSR measurement:
Anton Paar Rheometer MCR 302

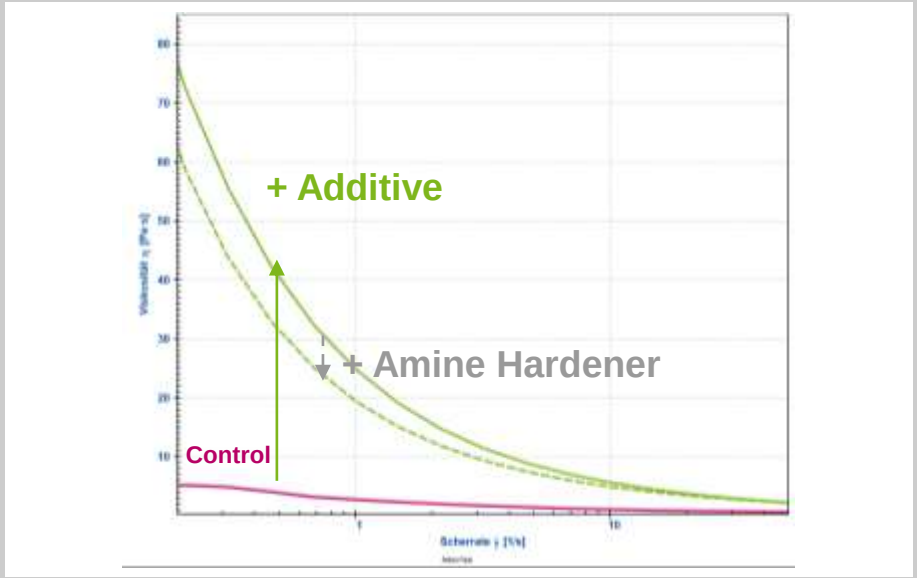
* = 2.6% as supplied on total formulation

Associative Thickener
0.4% active substance*



* = 1.6% as supplied on total formulation

Liquid Polyamide
0.4% active substance*



→ **Liquid Polyamide – Highly shear thinning & stable rheology with hardener**

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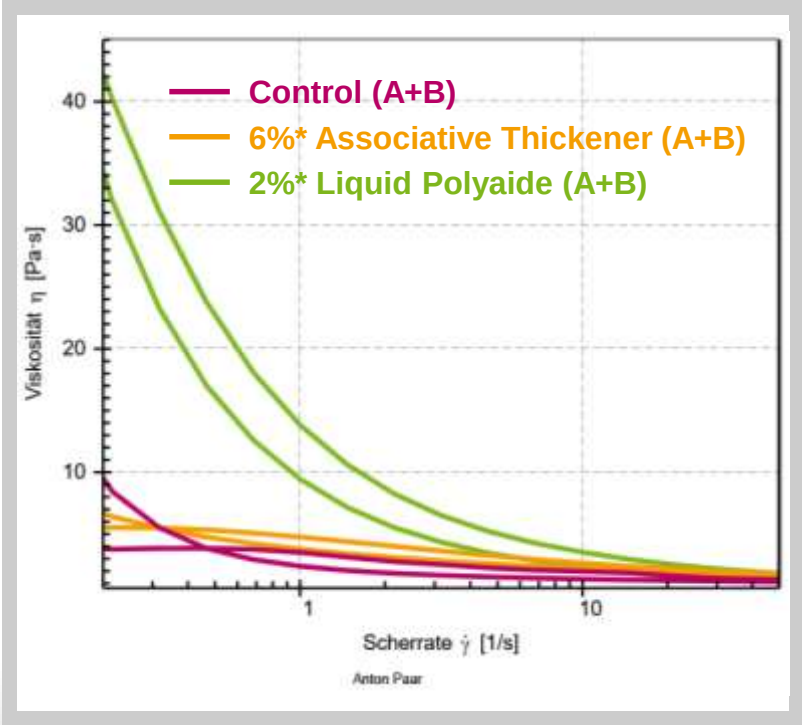
New liquid polyamide in water-borne epoxies
Post Added in Amine Formulation

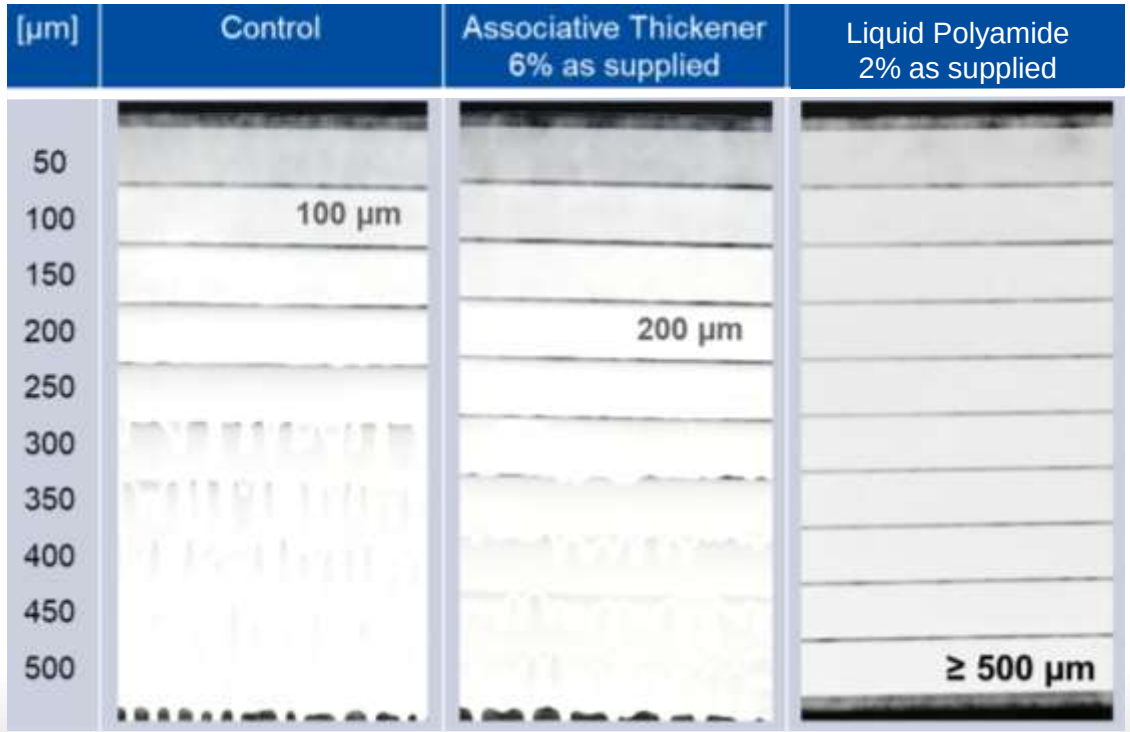
Test method:
WB 2-pack Epoxy

CSR measurement:
Anton Paar Rheometer MCR 302

Sag resistance:
directly after mixing
A and B

* as supplied on total formulation





→ **Liquid Polyamide – Post added in amine grind formulation**

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New liquid polyamide in Water-borne Epoxies

No Negative Influence on Salt Spray Resistance and Adhesion

Corrosion tests in artificial atmospheres – Salt spray tests
(ISO 9227:2006)

Test formulation:
WB 2-pack Epoxy

Substrate:	smooth steel
DFT:	80 µm
Drying:	7 d ambient
Duration:	360 h

No rheology additive		Other liquid rheology additive		Liquid Polyamide	
					
Before scratching	After scratching	Before scratching	After scratching	Before scratching	After scratching

→ **Liquid Polyamide – No negative impact on corrosion**

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New liquid polyamide - General Industry
Excellent Anti-Settling Properties

Test Method

Test System:
2-pack Acrylic
Metallic Topcoat
STAPA® IL HYDROLAN 2154

Additive Dosage:
0.1% active substance
on total formulation

One day

1 2 3 4

7 days

1 Control

2 Synthetic clay

3 Polyurea

4 New Polyamide for Water

→ **Liquid Polyamimde – Perfect anti settling properties**

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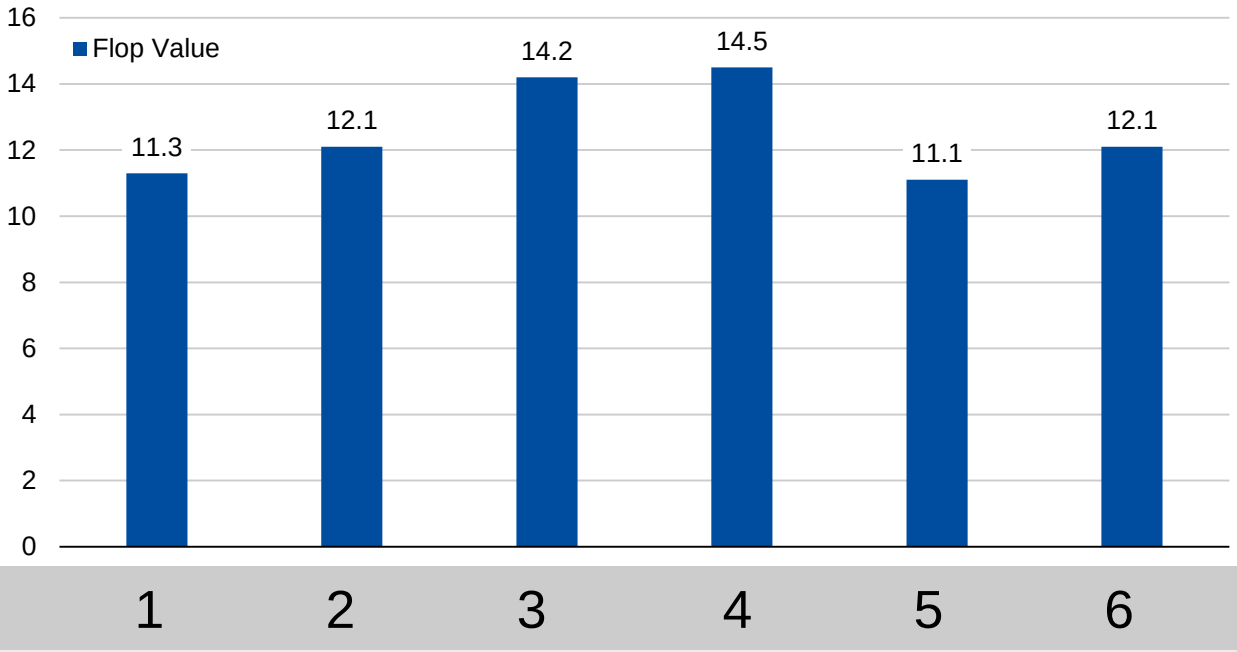
New liquid polyamide
Results Transportation Coatings

System:
Acrylic Copo. Disp.
Plus
Hydrolan IL 2156

Film thickness:
10 µm

Flop Value Results – OEM Basecoat – ESTA Spray Application



→ **Liquid Polyamide – Perfect metallic pigment orientation**

1-wax, 2-wax+syn clay, 3-polyamide, 4-polyamide+syn clay, 5-comp, 6-comp+syn clay

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New liquid polyamide
Special – Extraordinary – Unique

Especially designed for the latest water-borne epoxy systems

- ✓ Improves anti-sagging and anti-settling properties.
- ✓ Provides fast structure recovery. Highly shear thinning.
- ✓ Stable rheology when mixed when hardener.
- ✓ No gelling or viscosity increase over storage.

Easy to handle and to incorporate

- ✓ Pre-activated, liquid product
- ✓ Post-addition
- ✓ No pH-value adjustment necessary and pH-value resistant

Final coating properties are not affected (e.g. corrosion resistance, adhesion, …)

New liquid polyamide
Not only for latest water-borne Epoxy-Technologies


Marine & Protective


Transportation


General Industrial


Architectural


Wood & Furniture

RECOMMENDED


Floor Coatings

SUITABLE

Suitable Water-borne Systems e.g.

- 2-pack Epoxy
- 2-pack PUR
- Acrylate / Melamine
- 1-pack Acrylics
- 1-pack PUR

Summary

- Rheological additives for epoxies
- Some of the challenges
- New polyamide additive for water-borne epoxies and its heritage
- How the new polyamide compares to other technologies
  - Incorporation
  - Stability
  - Sag resistance
  - Activation temp

Thank you for your attention.

BYK