ELEMENTIS

A global specialty chemicals company

THIXATROL® PM & AS – Sustainable and high performance rheology modifiers for non-aqueous systems

HUNGAROCOAT, BUDAPEST, HUNGARY

Presented November 29th/30th, 2022

by Udo Schonhoff, Technical Sales Manager

Agenda

NISAT BASED RHEOLOGY MODIFIERS

- Company introduction and sustainable approach
- Technical background organic thixotropes
- Product overview THIXATROL® grades
- Case study
- Conclusion

Company introduction

Elementis company introduction

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RECOGNIZED LEADER IN RHEOLOGY AND PERFORMANCE ADDITIVES

Established in **1844**

Employs **>1,400** colleagues around the world

Serving Coatings, Personal Care, Energy and Chromium markets

>26 locations

- **23** manufacturing plants
- **3** innovation centers

2020 sales revenue of **$751m**

World's largest source of high-quality hectorite clay

Mining and supplying of high-performance natural **talc** out of own mine in Finland at highest regulatory standards

- Strong network of supply and technical/application support
- Leadership in rheology and specialty additives
- Renowned brands (BENTONE® , RHEOLATE® , NUOSPERSE® and THIXATROL®) and technologies
- Established in coatings applications (architectural, industrial, waterborne and solvent borne, adhesives and sealants, and more)
- Strong focus on sustainable products and solutions

Diamide based organic thixotrope Product overview and Background

THIXATROL® - Diamide based thixotropes

Composition

- 100 % active powder based on special diamide (0% castor derivative)
- Thixotropic additive for low to high polarity systems
- > 75% based on renewable resources

THIXATROL® Max

- Very efficient for primers and top coats and MS polymer based systems

THIXATROL® AS 8053

- Low-temperature applicable for adhesive and sealants applications
- Especially recommended for MS polymer sealants and adhesives

THIXATROL® PM 8054

- Broad band applicable, highly effective grade for industrial application

THIXATROL® PM 8056

- Low-temperature applicable, highly effective grade for industrial systems

THIXATROL® PM 8058

- Low-temperature applicable, highly effective grade for industrial systems; suitable for highly polar systems

Activation of organic thixotropes

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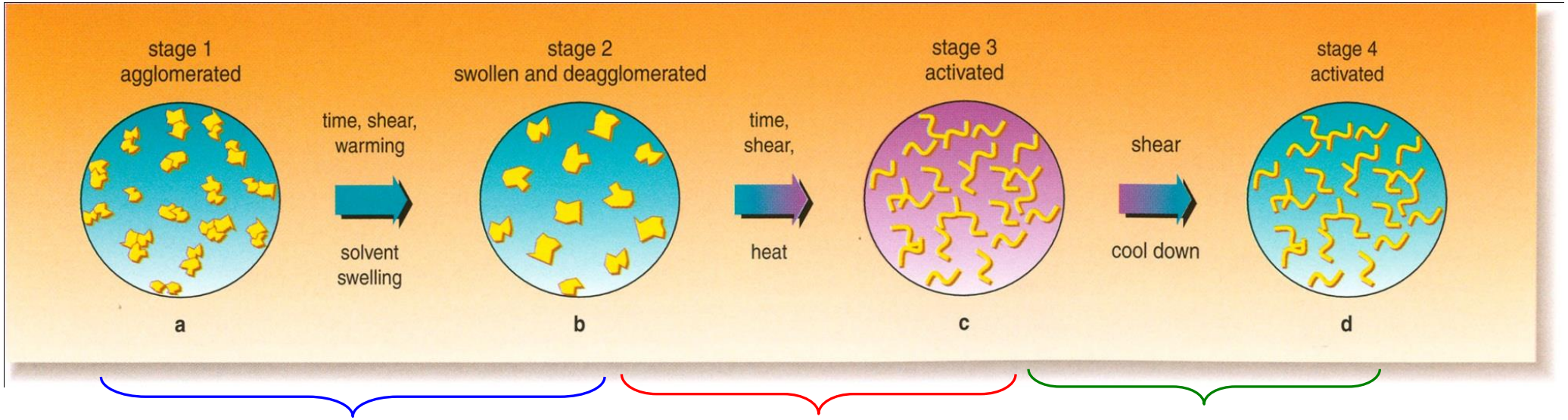
SCHEMATIC REPRESENTATION OF THE MECHANISM



Wetting/ Deagglomeration

- **15'- 20' mixing @ ambient temperature**

Dispersion/ Activation/Dwell Time

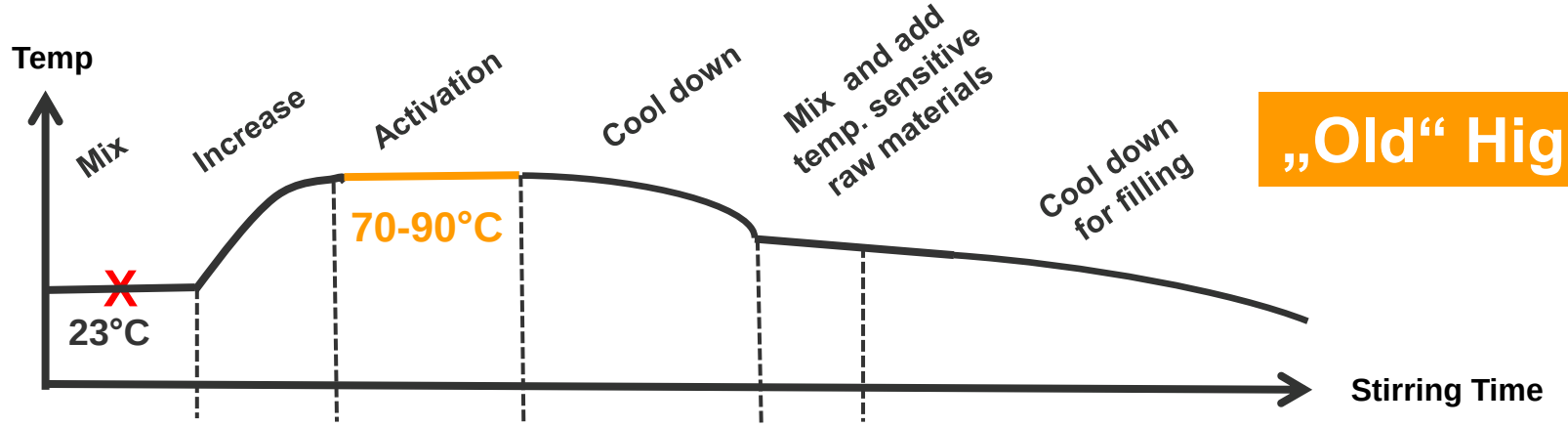
- **15'- 20' dispersion @ target processing temperature**

Cool Down

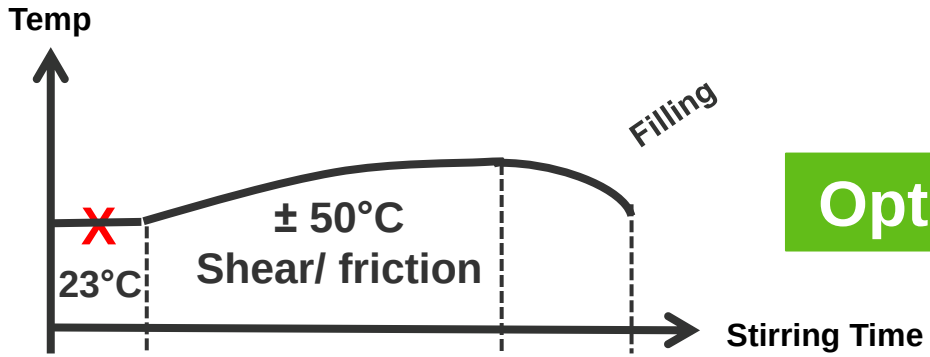
- **Agitate! (castor based)**
- **Cool to below target activation temperature**

Optimisation of Process

REDUCTION OF PROCESS TIME WITH THIXATROL® PM & AS



„Old“ High Temperature Process



Optimized Process

- → No temperature control/ heating
- → No cool down phases
- → Less complex process
- → Energy savings
- → Capacity enlargement

X Addition of Diamide

Recommended processing

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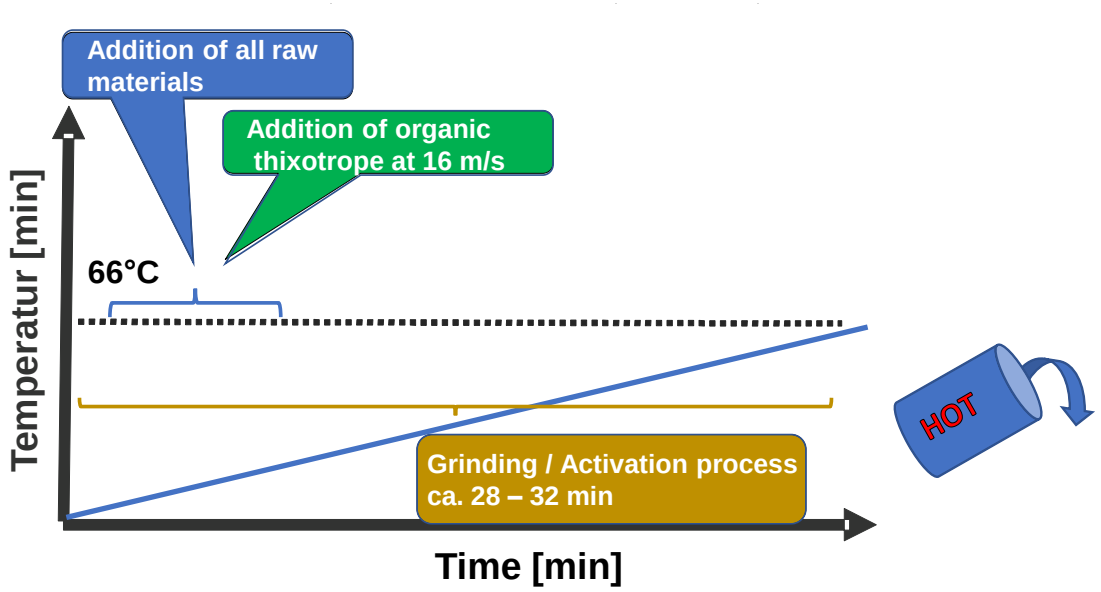
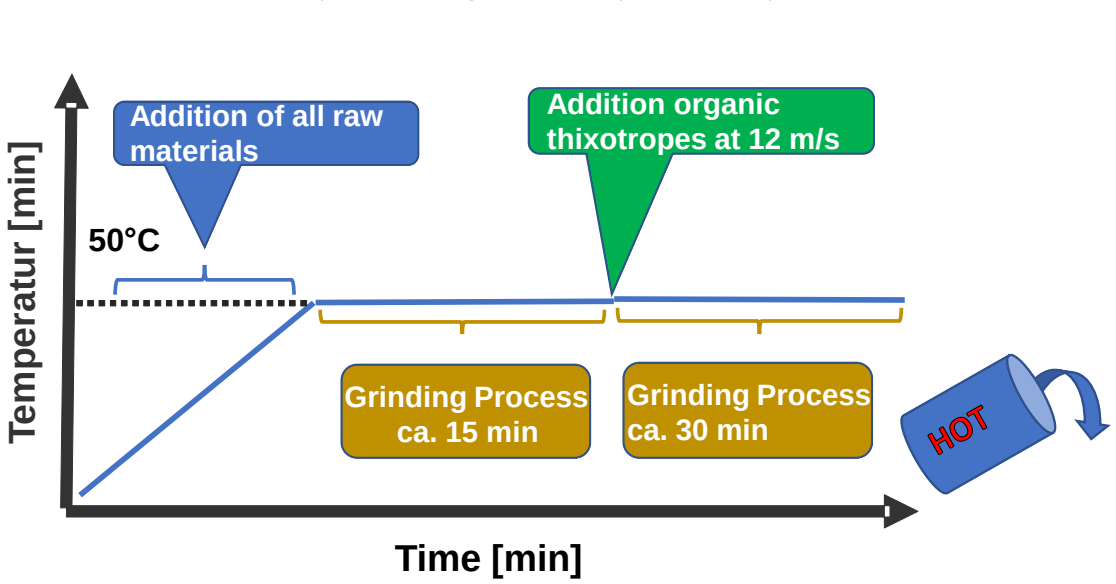
Grind Process

Speed 16 m/s



„Lab Screening“ Process

Speed 12 m/s



THIXATROL® for Marine & Industrial Coatings

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EXAMPLES THIXATROL® PM AND AS GRADES (AMIDE BASED RHEOLOGICAL ADDITIVE)

TECHNICAL BENEFITS

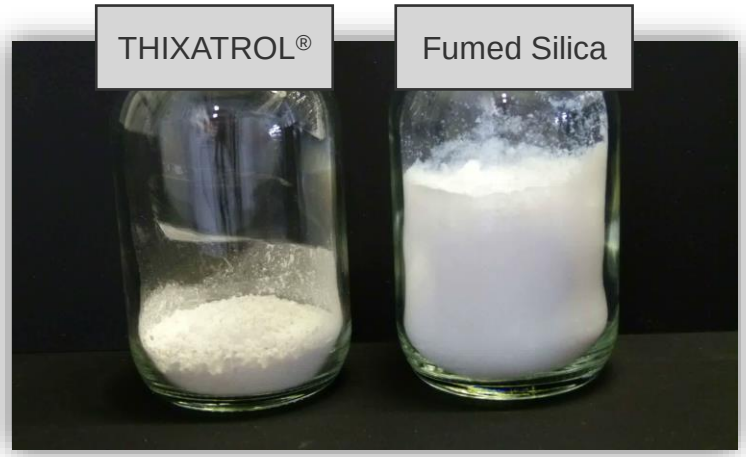
- Imparting strong shear-thinning rheology properties
- Improved sprayability
- Excellent sag resistance at high film thickness
- Higher efficiency compared to market standard
- Wider application window (more robust process)
- Improved storage stability of final formulation
- Higher elasticity compared to mineral based rheological additives

SUSTAINABILITY

- Powder
- Safety – no solvent handling
- Labelling-free
- Saving resources
- Energy savings
- Waste reduction
- Longer life-cycle of final product

Product	Renewable content (ISO 16128 calculated) in %	Renewable carbon content* in %
THIXATROL® AS 8053	69,7	78,3
THIXATROL® PM 8056	72,0	81,8
THIXATROL® PM 8058	74,8	82,5
THIXATROL® MAX	86,8	92,3

Comparison volume (3g powder each)



* % Renewable carbon calculates percentage of renewable carbon to total organic carbon, as per ASTM D6866, and can be validated via measurement of ^{14}C content.

Case study

THIXATROL grades tested in industrial coating systems based on epoxy and PU

Comparison THIXATROL® vs. Fumed Silica

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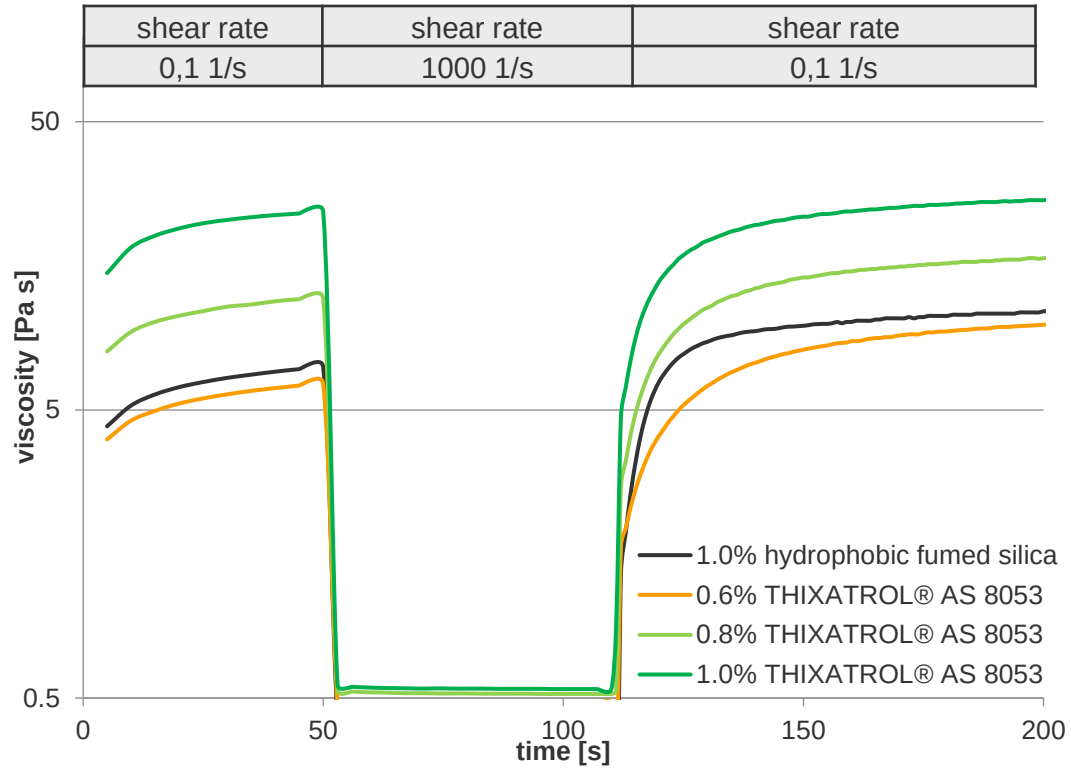
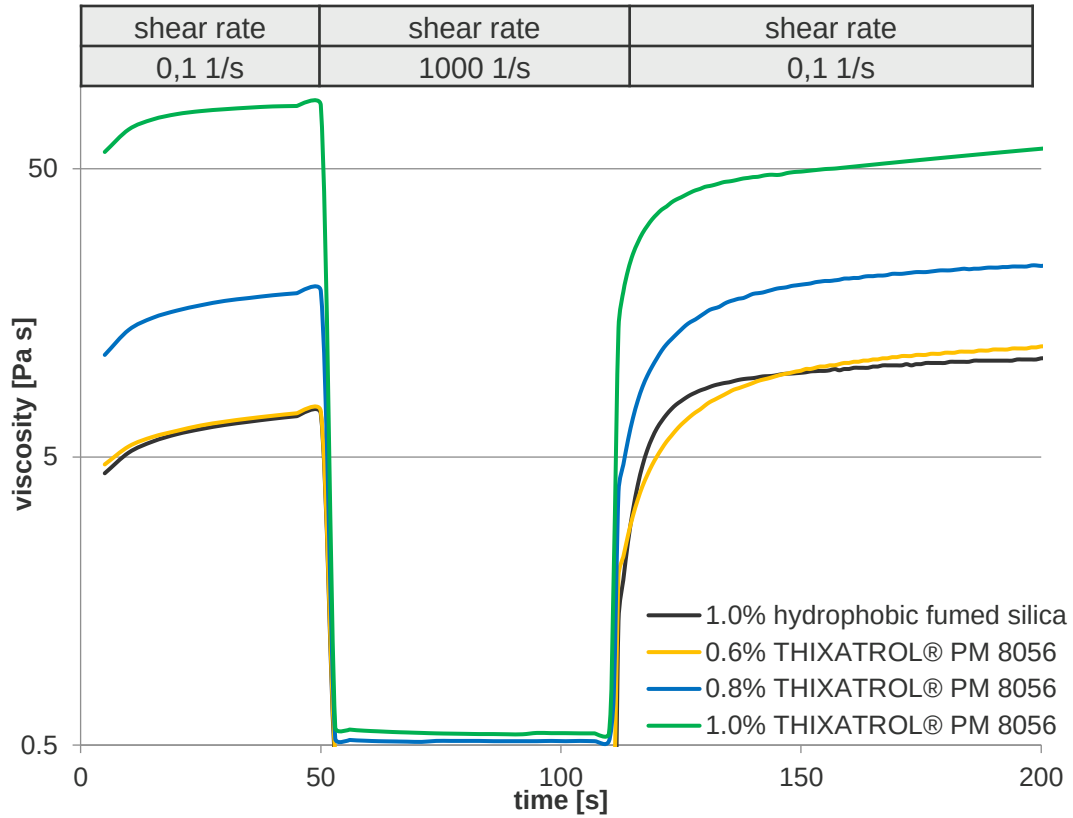
TEST IN SB PU COATING - VISCOSITY RECOVERY

THIXATROL® AS 8053



THIXATROL® PM 8056



Both Organic Thixotropes show significantly higher efficiency compared to fumed silica.

Comparison THIXATROL® vs. Fumed Silica

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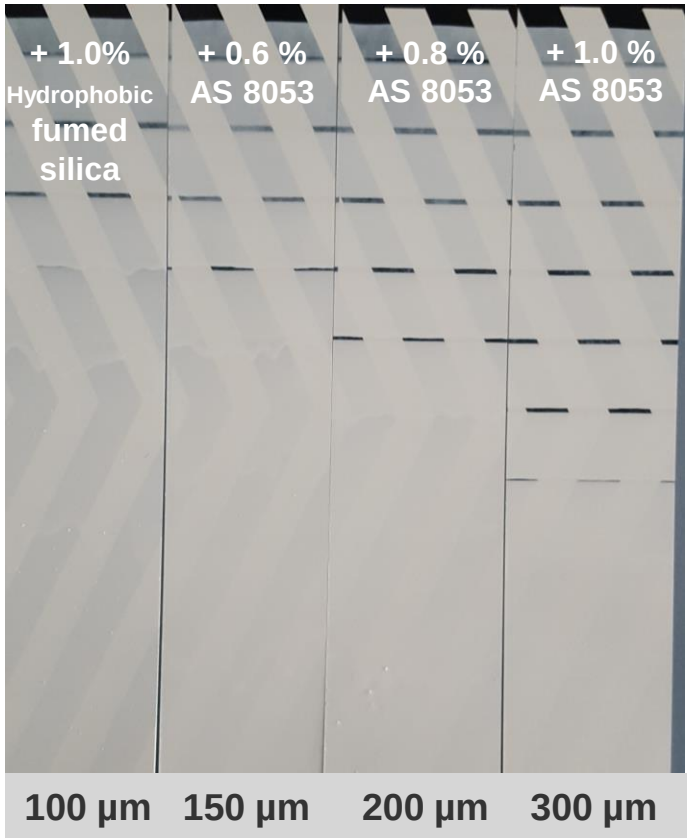
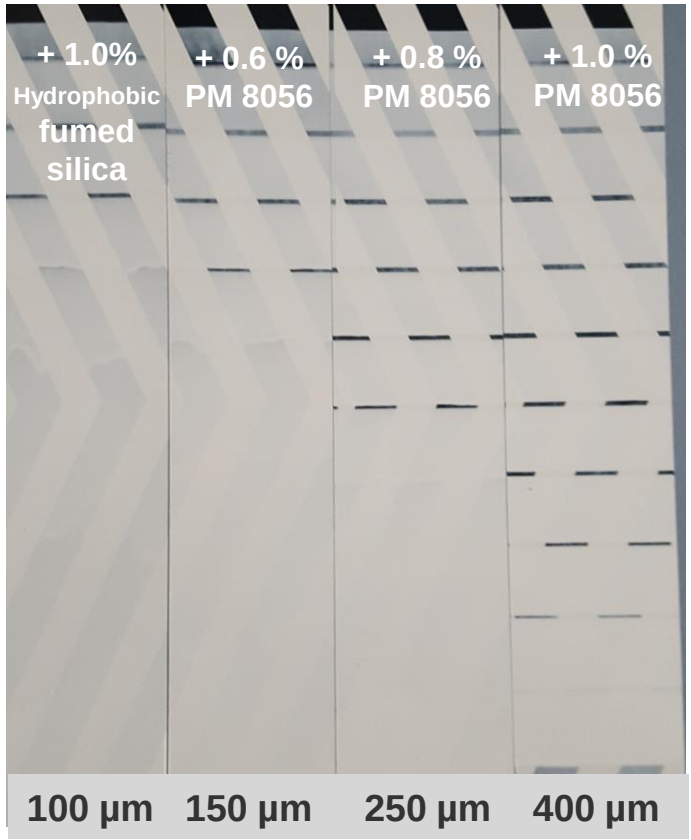
APPLICATION PERFORMANCE – SAG RESISTANCE (BLADE 50 – 500 µm)

THIXATROL® AS 8053



THIXATROL® PM 8056



Both Organic Thixotropes show improved sag performance of the PU coating.

THIXATROL® PM vs conventional diamides

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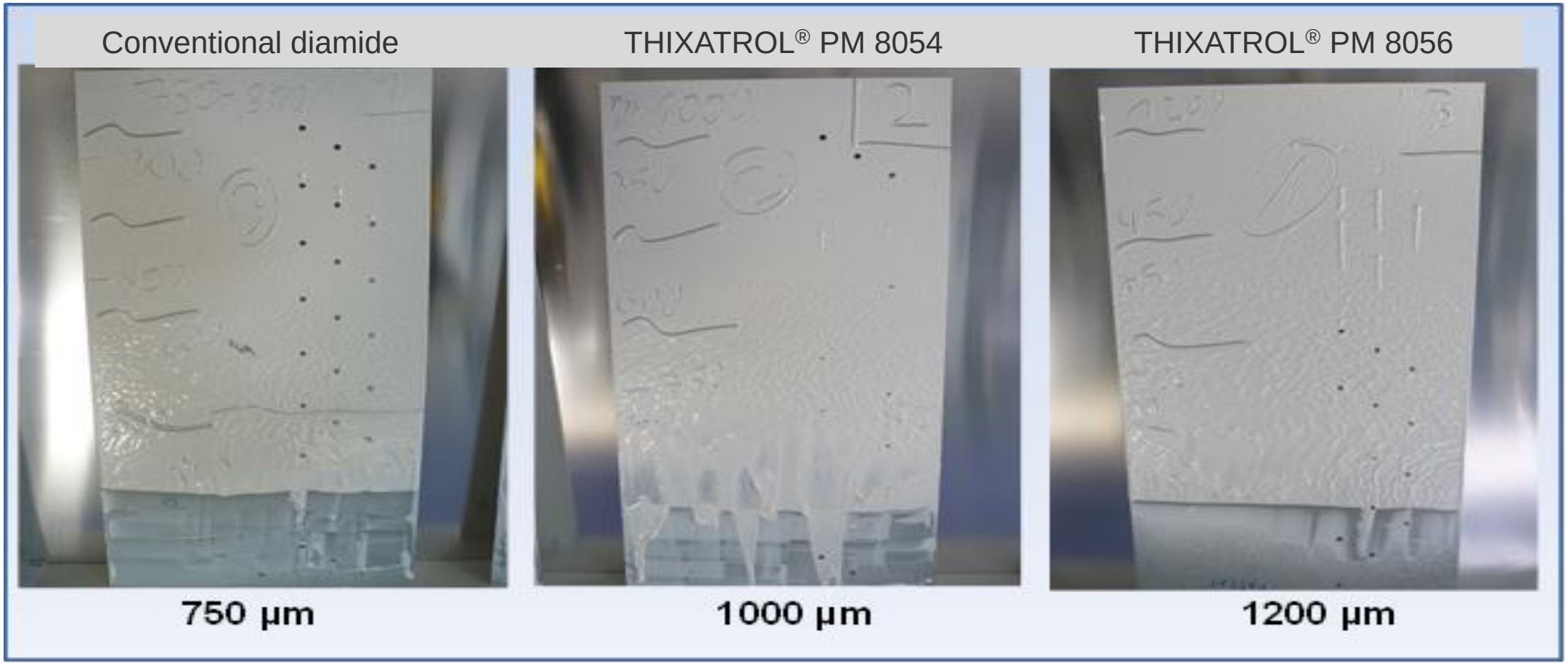
Sag stability up on spray application



Additive concentration of all tested organic thixotropes was 1%; Test system, solvent based industrial epoxy coating

Testing formulations

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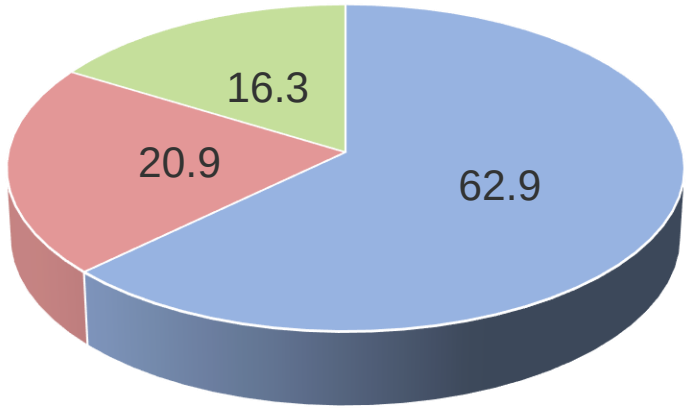
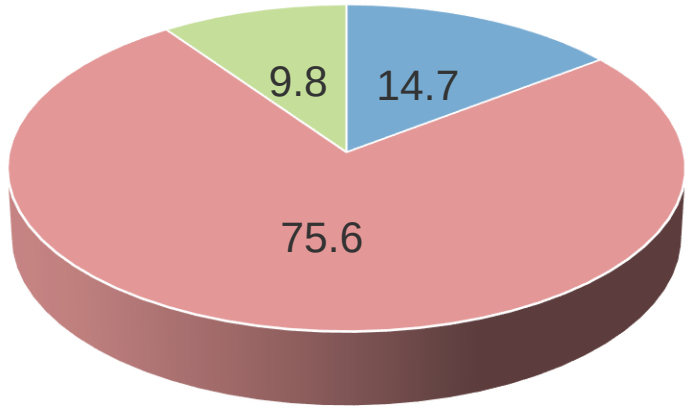
2C EPOXY VHS-1 FORMULATION FORMULATED WITH VARIOUS SOLVENT COMPOSITION

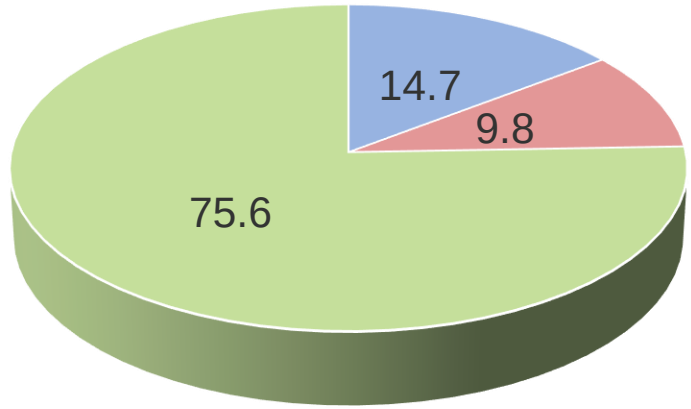
XYLENE RICH



ISOBUTANOL RICH



BENZYL ALCOHOL RICH



Xylene Isobutanol Benzylalcohol

High build epoxy coating equipped with varying solvent compositions; 0.5% rheology modifier; Solvent ratio calculated only including parts of the component A! Xylene content includes also the solvent part of the epoxy resin

THIXATROL® PM 8058 vs Reference

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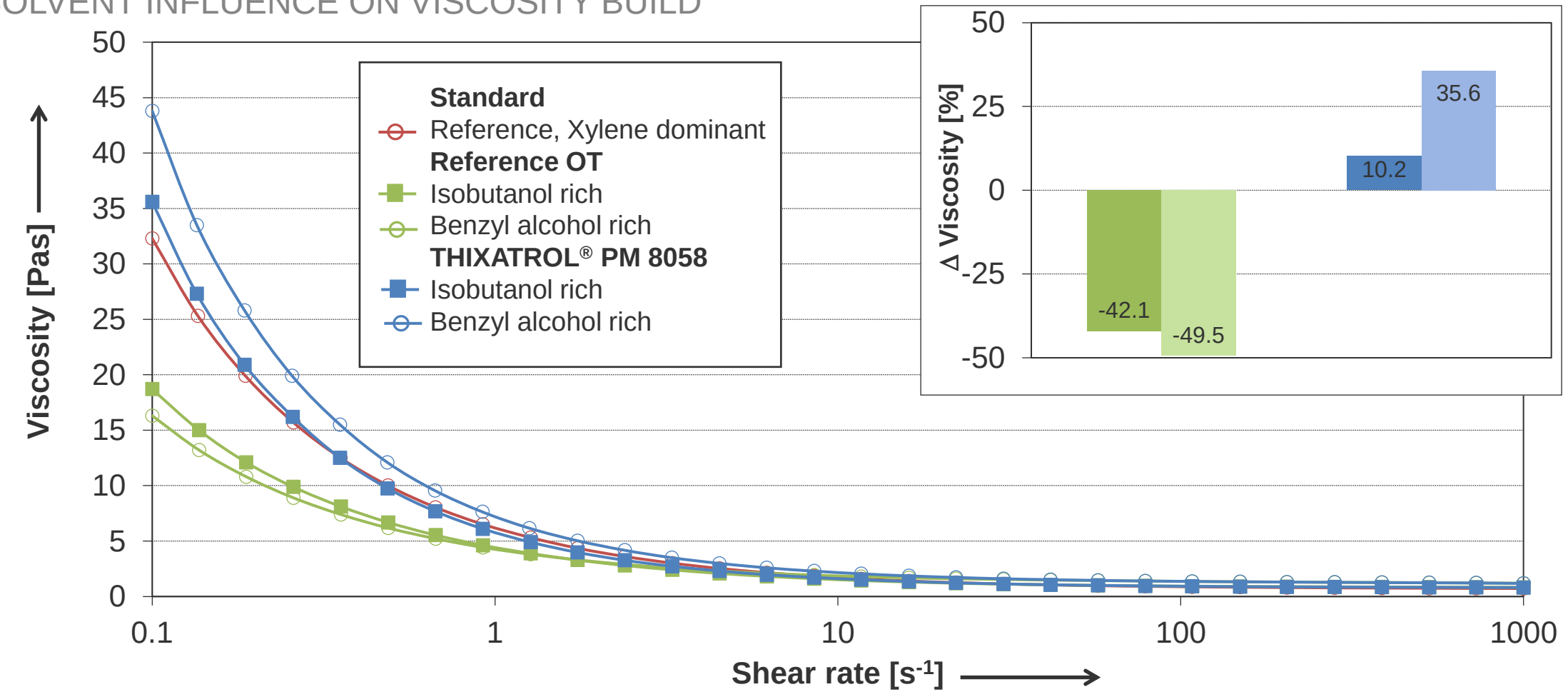
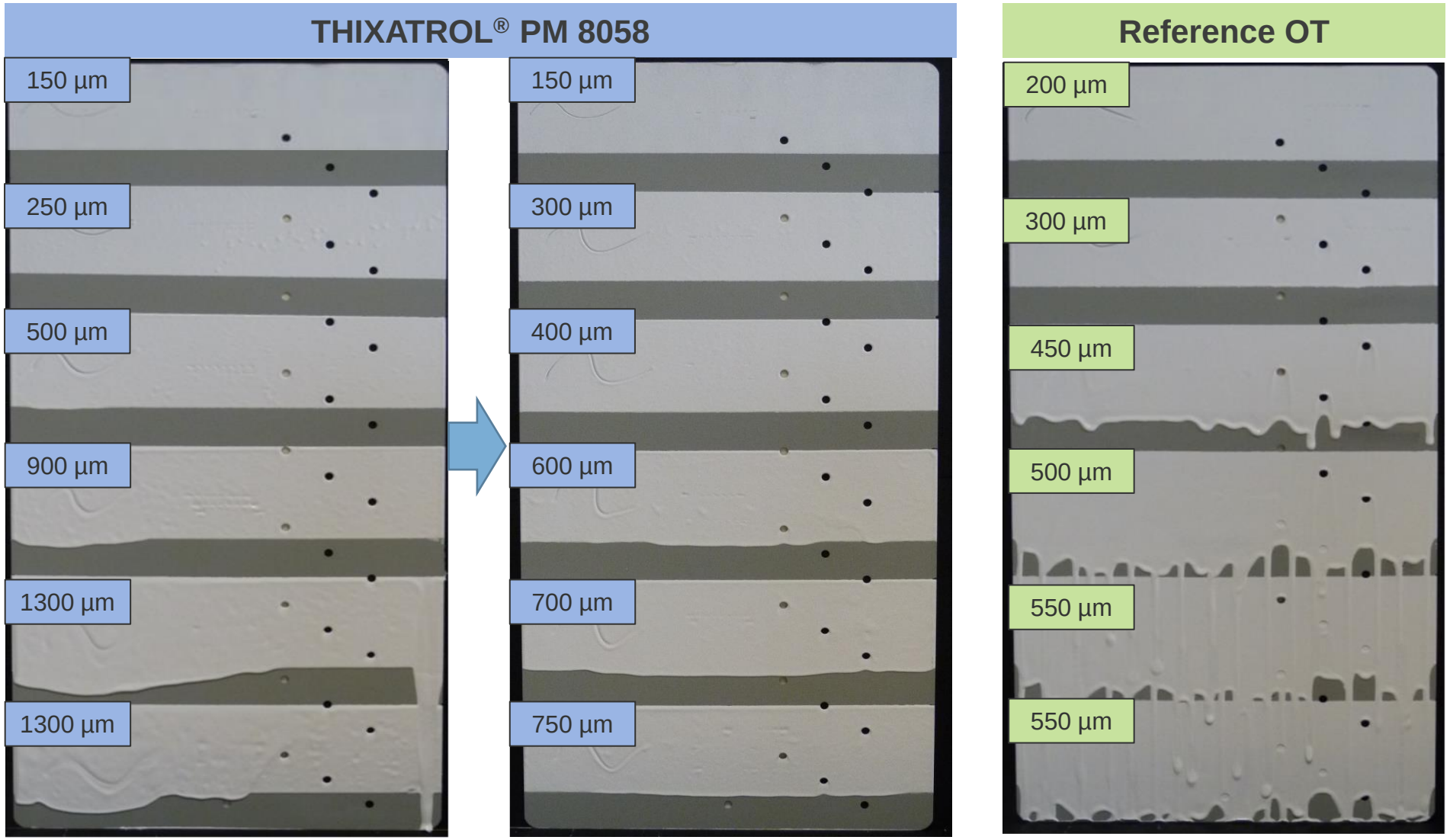
SOLVENT INFLUENCE ON VISCOSITY BUILD



Rheology curves determined using the Anton-Paar MCR 301 rheometer, equipped with PP 50 measuring geometry at a temperature of 23°C and a gap width of 1 mm;High build epoxy coating equipped with varying solvent compositions; 0.5% rheology modifier activated at 66°C; Solvent ratio calculated only including parts of the component A! Xylene content includes also the solvent part of the epoxy resin

THIXATROL® PM 8058 vs Reference

SAG CONTROL



THIXATROL® PM 8058 vs Reference

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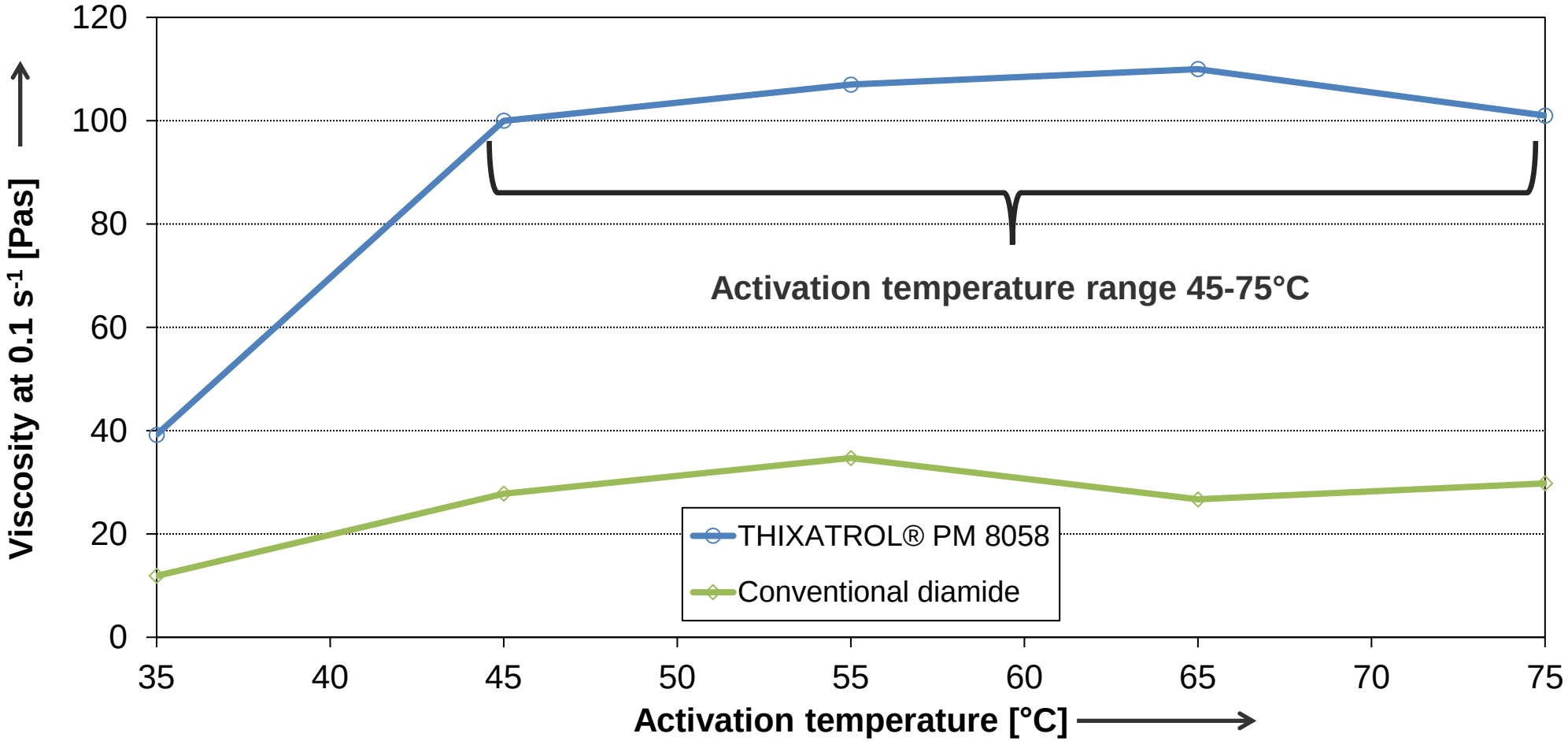
ACTIVATION WINDOW



Rheology data determined using the Anton-Paar MCR 301 rheometer, equipped with PP 50 measuring geometry at a temperature of 23°C and a gap width of 1 mm; High build epoxy coating with a standard, Xylene rich solvent composition; 0.5% rheology modifier activated at various temperature; the individual activation time was held constant for 30 minutes at high shear for minutes

Conclusion

THIXATROL® PM and AS grades

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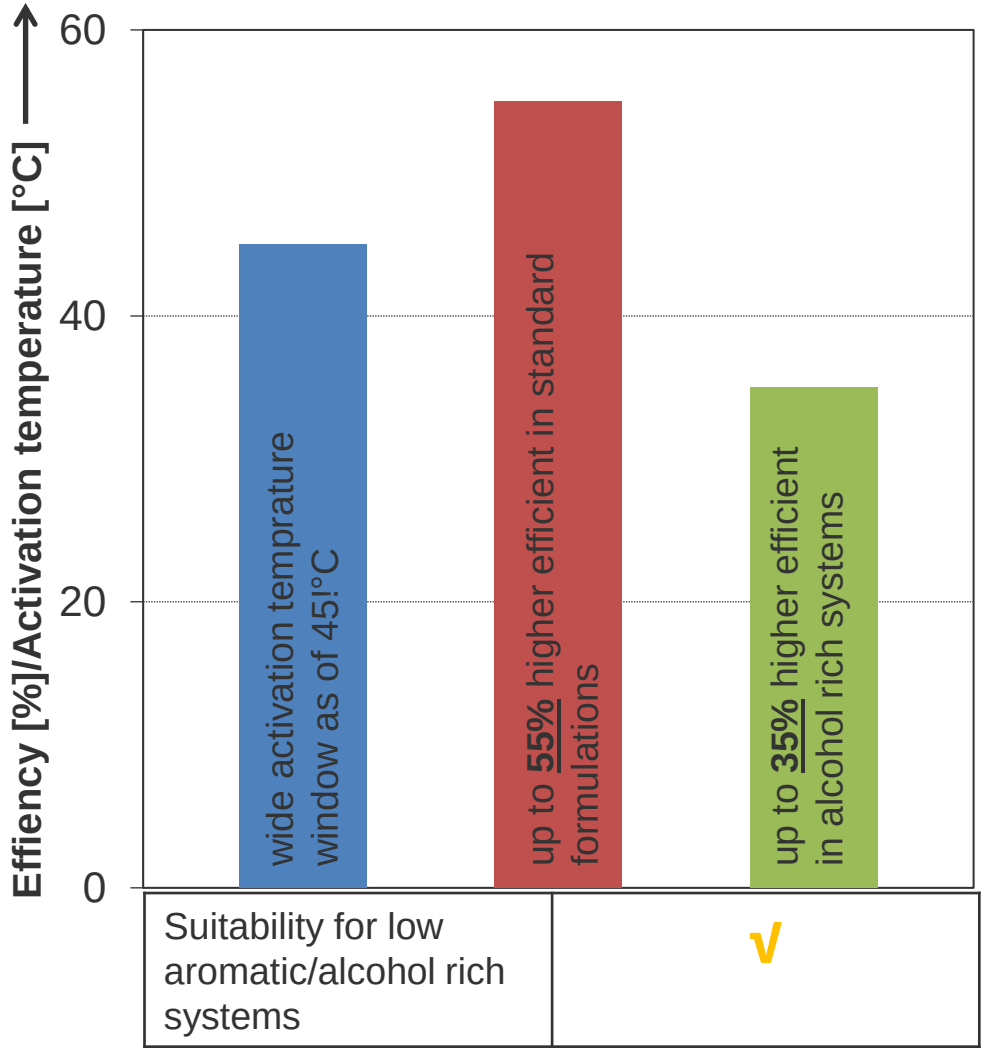
SUSTAINABILITY TAKE-AWAYS – COMPARISON TO STANDARD DIAMIDE BASED ORGANIC THIXOTROPES

- >75% based on renewable raw materials for sustainable formulations
- Provides a broad activation window as of low temperatures from 45 – 75 °C
  - Low temperature activation for shorter processing time
  - Lower activation temperature = significant energy savings
  - Excellent storage stability provided
- Provides highest performance for maximum material saving
  - Up to 55% higher effective than conventional grades in std. Systems
  - Ability to cost savings by replacing standard grades
- Highly effective in low aromatic systems (PM 8058)
  - 35% higher effective than conventional grades in alcohol rich systems



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A Mural for a More Sustainable Future

OUR SUSTAINABLE
COMMITMENT

Elementis is driven with purpose to achieve sustainable progress

To date, we have joined the UN Global Compact, introduced a Sustainability Council, evaluated our existing processes, and begun to adopt more environmentally conscious programs. Our unique, naturally-derived technologies and creative sustainable solutions enable cleaner, more natural and more effective products – from natural personal care products, to lighter weight cars for reduced vehicle emissions, to low order and low VOC paints. Our innovations deliver sustainable options in the marketplace.

Now, it is time for us to formalize our efforts and strive towards ambitious sustainability targets, emboldening our environmental stewardship and working towards carbon neutrality.

It's the nature of our business to protect our environment.

INNOVATION
Accelerating innovation for more natural and sustainable ingredients and solutions

EFFICIENCY
Investing in enhanced processes and operational efficiencies for a more sustainable business

PEOPLE
Empowering our entire organization to effect positive change

INNOVATION
PEOPLE
EFFICIENCY

Our Values

SAFETY
SOLUTIONS
AMBITION
RESPECT
TEAM

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