Creating Additive Value

New Developments in Coatings Applications

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AGENDA

1. Introduction
2. Overview of New waxes and Bio polymers
3. Bio Polymers and waxes for wood coatings, coil coatings etc.
4. General information for texturing and haptic additives
5. ECO-compliant aqueous wax dispersions for Architectural coating
6. Overview of Ecolabel compliant wax dispersions
7. How Munzing Eco-products support our customers
8. Test of Eco-products in architectural paint
9. Wax additives for powder coatings- test results and recommendations
10. Summary

INTRODUCTION

The environmental awareness is growing and because of that the requirements for green coatings increase. As a result, there are also environmentally friendly wax additives needed to produce a green coating. MUNZING offers a wide range of bio-based wax dispersions as well as wax dispersions which are possible to use for coatings with several ECO-Labels.

Wax-additives are used to improve different properties of a powder coating. Depending on the wax type the degassing and leveling, the scratch resistance or the gloss can be improved. With special wax additives it is also possible to adjust a textured powder coating surface

OVERVIEW OF THE NEW X-SERIES PRODUCTS

Chemistry	Melting range[2] / Thermal behavior	Average particle size[1]	Maximum particle size[1]
Polyolefin	155-165°C (311-329°F)	35-40µm	85µm
Polyolefin	155-165°C (311-329°F)	20-25µm	75µm
Polyolefin	155-165°C (311-329°F)	10-15µm	40µm
Polyamide	170-180°C (338-356°F)	25-30µm	55µm
Polyamide	170-180°C (338-356°F)	15-20µm	35µm
Bio-Polymer	Decomposition over 200°C (392°F)	30-35µm	120µm
Bio-Polymer	Decomposition over 200°C (392°F)	20-25µm	80µm
Bio-Polymer	Decomposition over 200°C (392°F)	15-20µm	60µm

1 = Laser Diffraction Analysis (DIN EN ISO 1542)
2 = Differential Scanning Calorimetry (DIN EN ISO 11357-3)

> 50% Renewable content classification

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WOOD COATING APPLICATION

- **Application: 100µm wet film thickness, sanding, 60µm wet film thickness on wood substrate with acrylic based waterborne wood coating, dosage: 8%**

- **Natural, wood-like look**
- **Organic haptic impression**
- **”Dead Matt“ properties**
- **Increased scratch resistance**
- **Unobtrusive surface texture**

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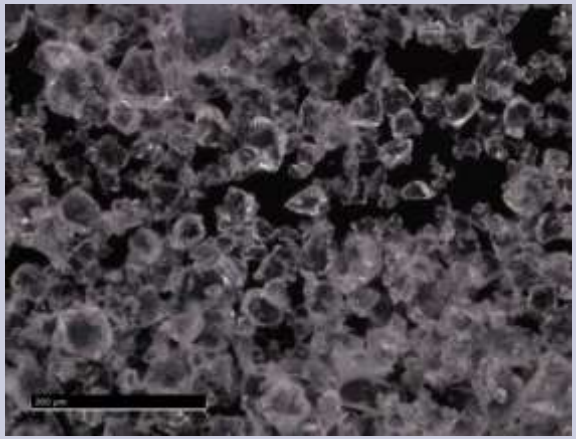
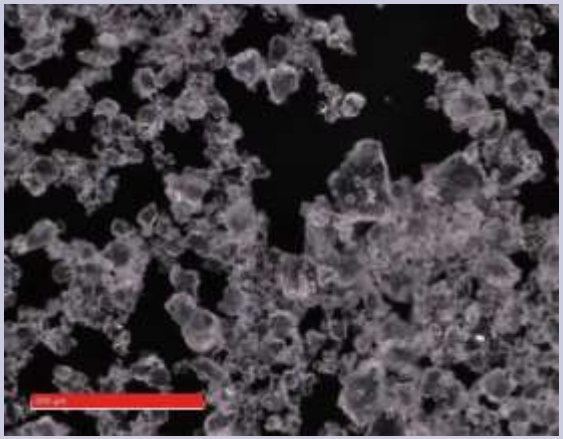
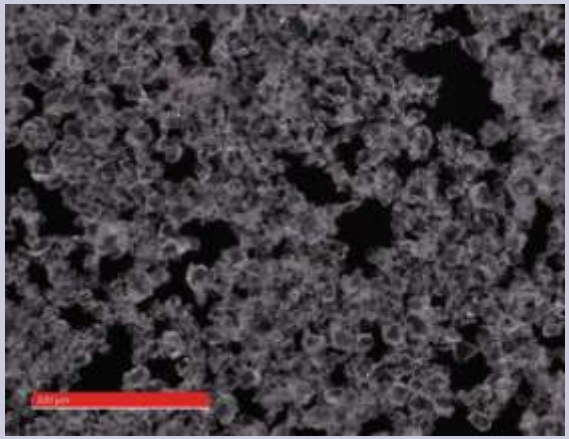
WOOD COATING APPLICATION
Polyolefin types

Polyolefin A	Polyolefin B	Polyolefin C
		
		
• Slighly rough touch • Fine visible texture	• Smooth touch • Barely visible texture	• Smooth soft touch • No visible texture

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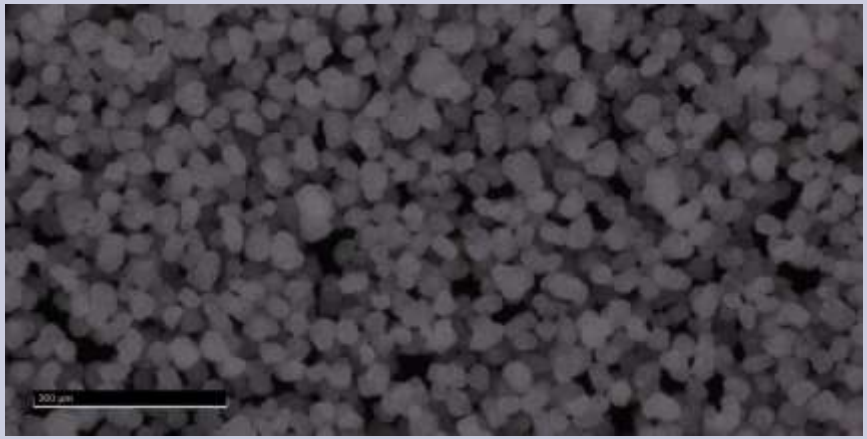
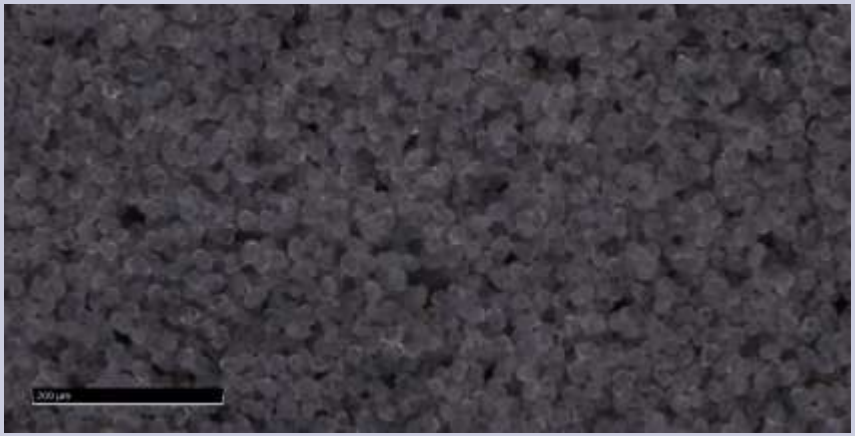
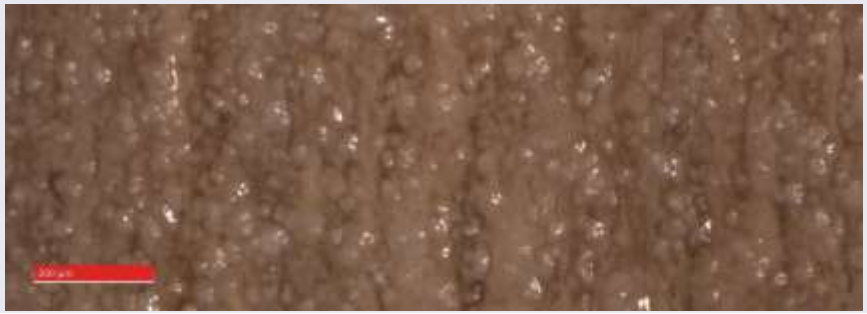
WOOD COATING APPLICATION
Polyamide type

Polyamide A	Polyamide B
	
	
• Smooth touch • Slightly visible texture	• Smooth soft touch • Texture not visible with the bare eye

200µm

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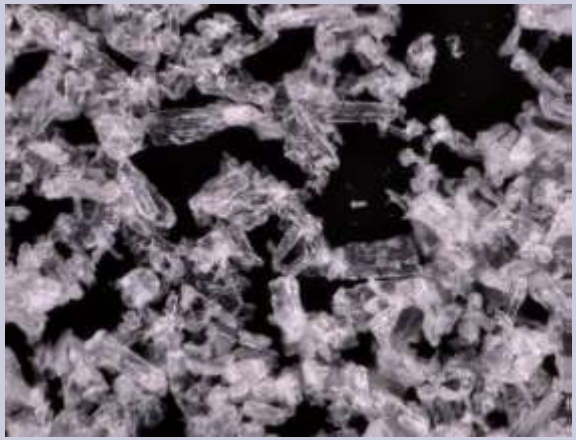
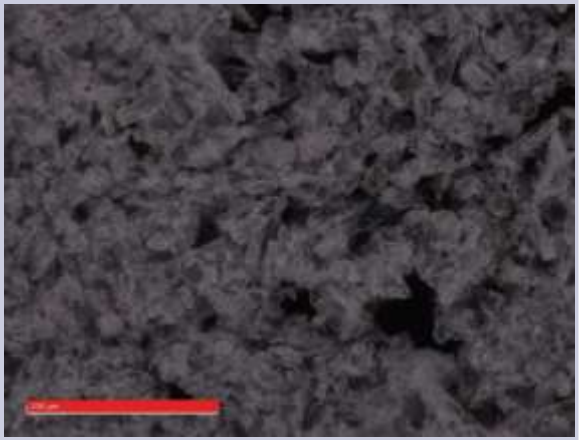
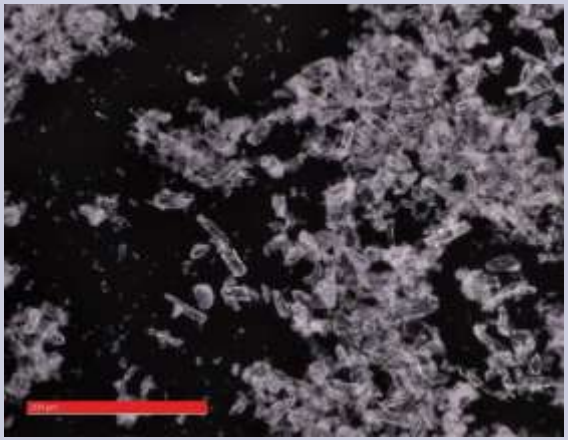
WOOD COATING APPLICATION

Bio-polymer type — **100% Renewable**

Biopolymer A	Biopolymer B	Biopolymer C
		
		
• Slightly coarse touch • Fine texture visible	• Smooth touch • Barely visible texture	• Silky smooth touch • No visible texture

200µm

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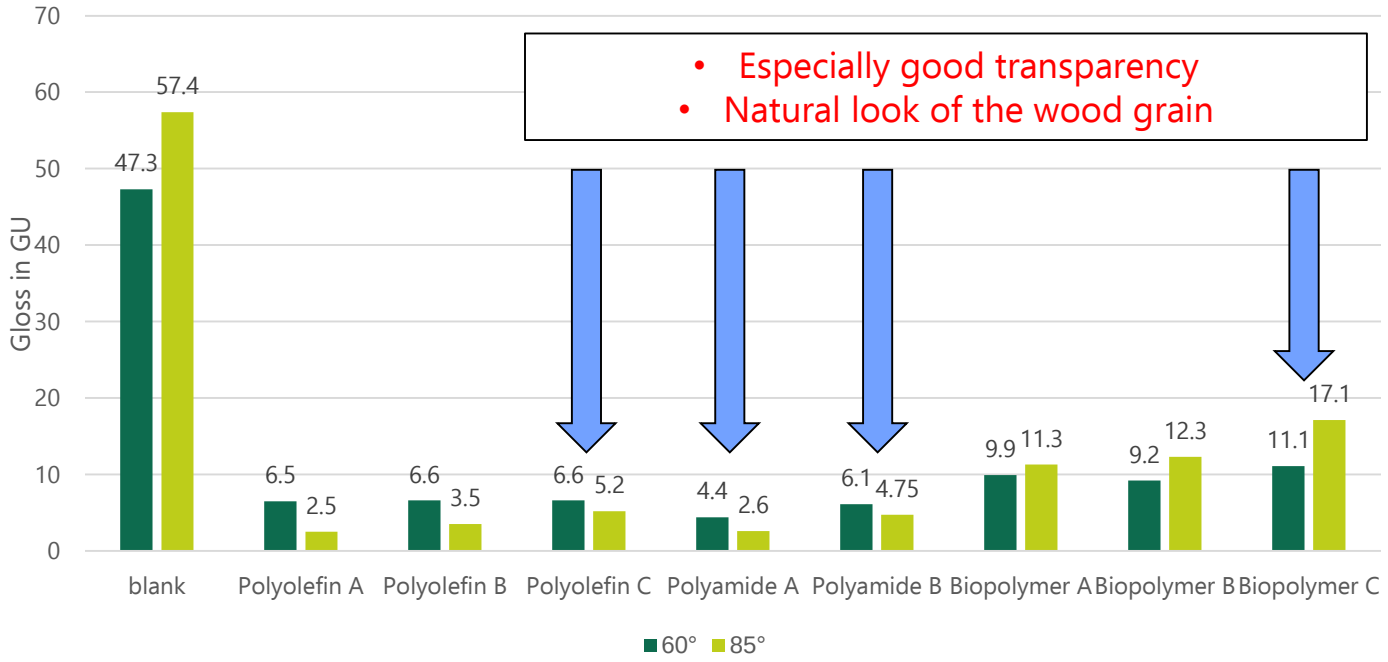
WOOD COATING APPLICATION
Influence on gloss – 8% dosage



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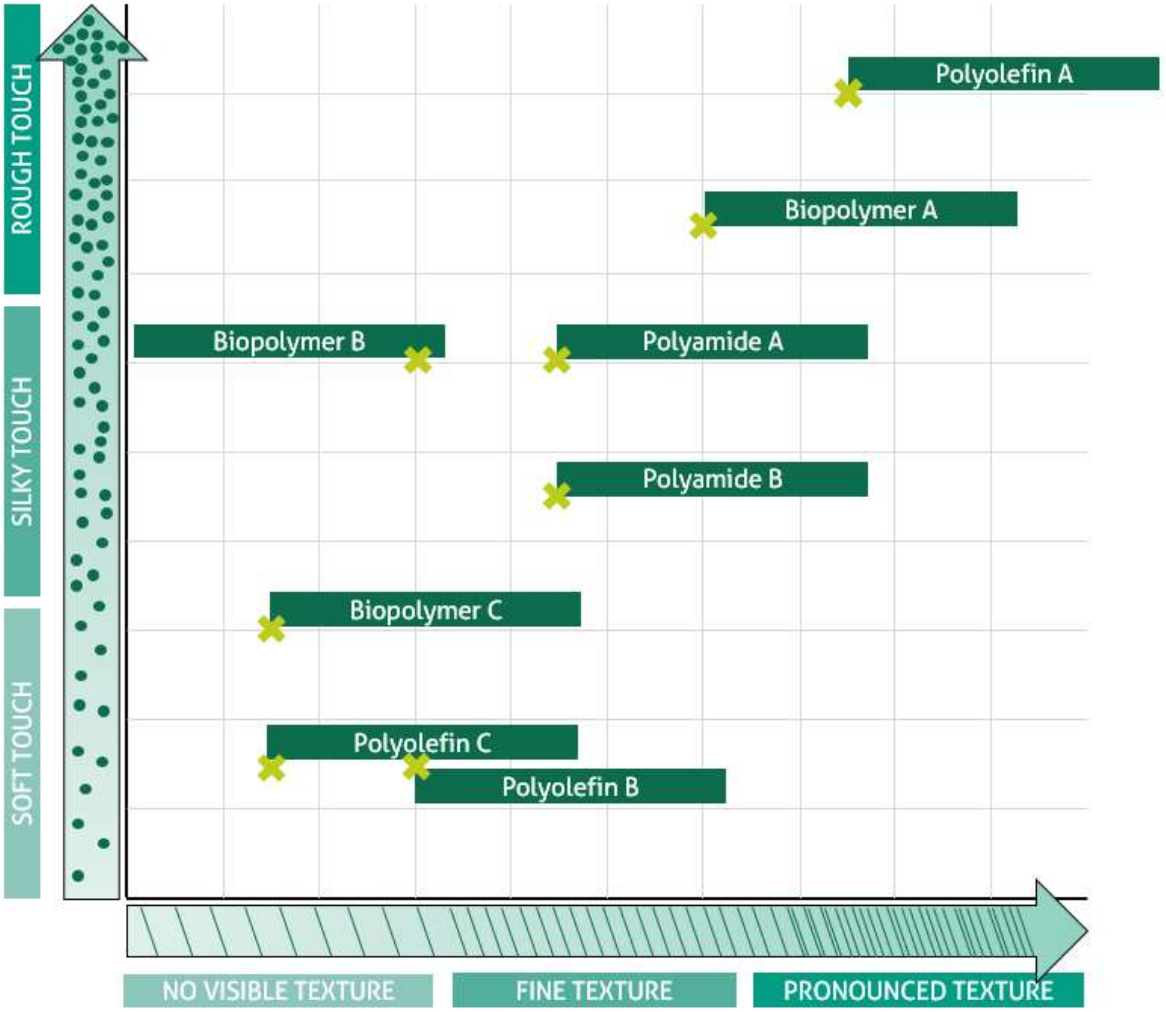
WOOD COATING APPLICATION
Comparison: Texture vs. Haptics



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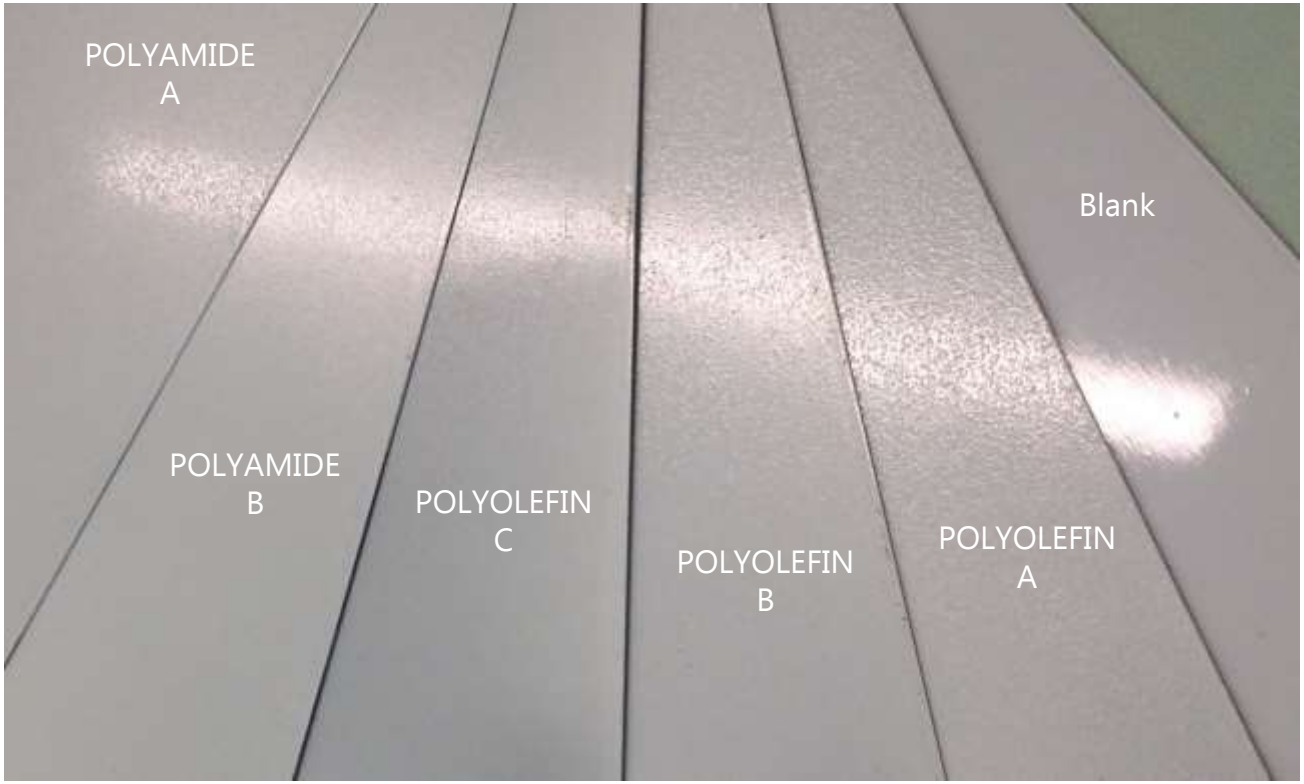
COIL COATING APPLICATION

- **Waterbased, transparent Coil Coating formulation, 60µm wet film thickness, 250°C (482°F) for 30 seconds**
- **Solventbased, white-pigmented polyester formulation, 60µm wet film thickness, 180°C (356°F) for 10 minutes**



- **Significant matting**
- **Wide range of surface textures, from strong to very fine**
- **Increased scratch resistance**

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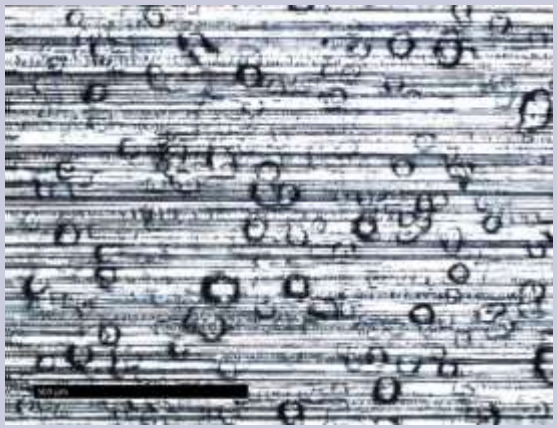
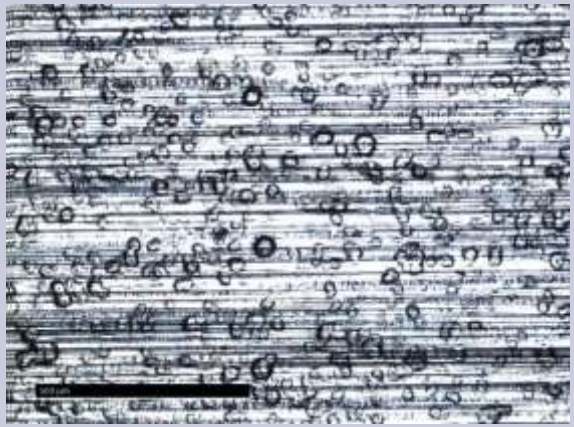
COIL COATING APPLICATION
Polyolefin types

POLYOLEFIN A	POLYOLEFIN B	POLYOLEFIN C
		
		
• Rough touch • Coarse texture visible	• Smooth touch • Medium texture visible	• Smooth, silky touch • Fine texture visible

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COIL COATING APPLICATION
Polyamide types

POLYAMIDE A	POLYAMIDE B
	
	
• Smooth, but not silky touch • Fine texture visible	• Very smooth touch and soft feel • Very fine texture visible

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COIL COATING APPLICATION
BIOPOLYMER C

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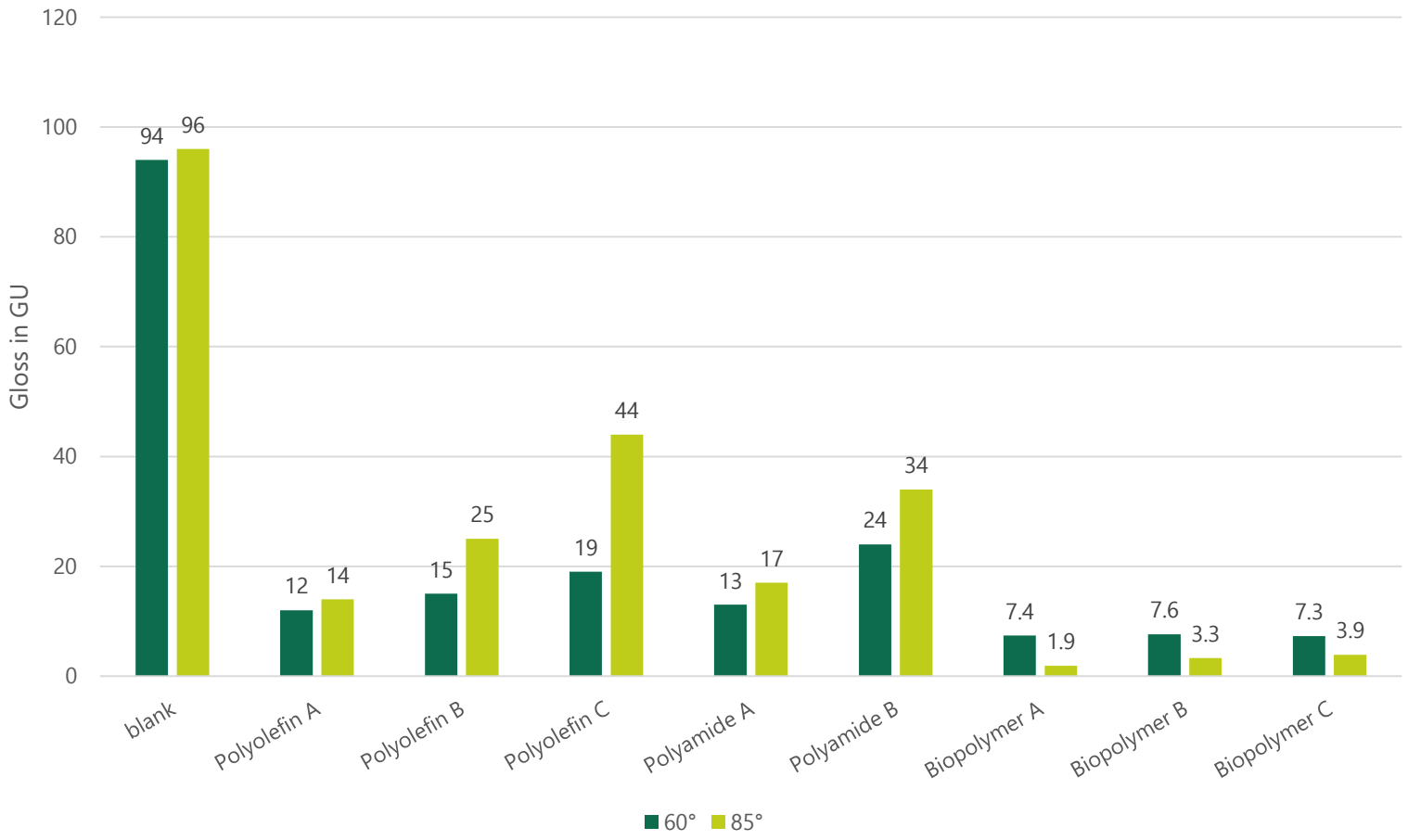
COIL COATING APPLICATION
Influence on gloss — 8% dosage



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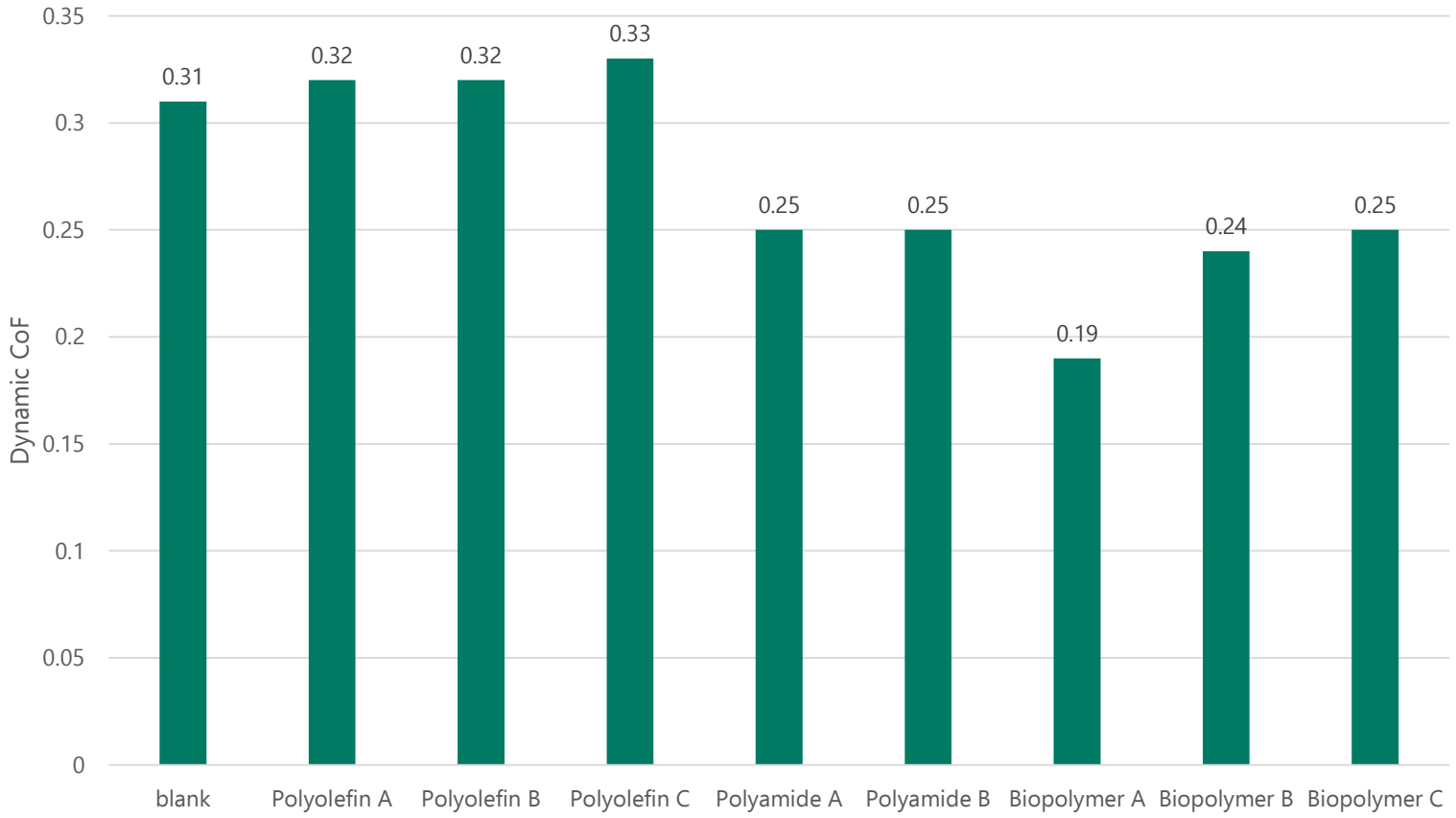
COIL COATING APPLICATION
Influence on COF — 8% dosage



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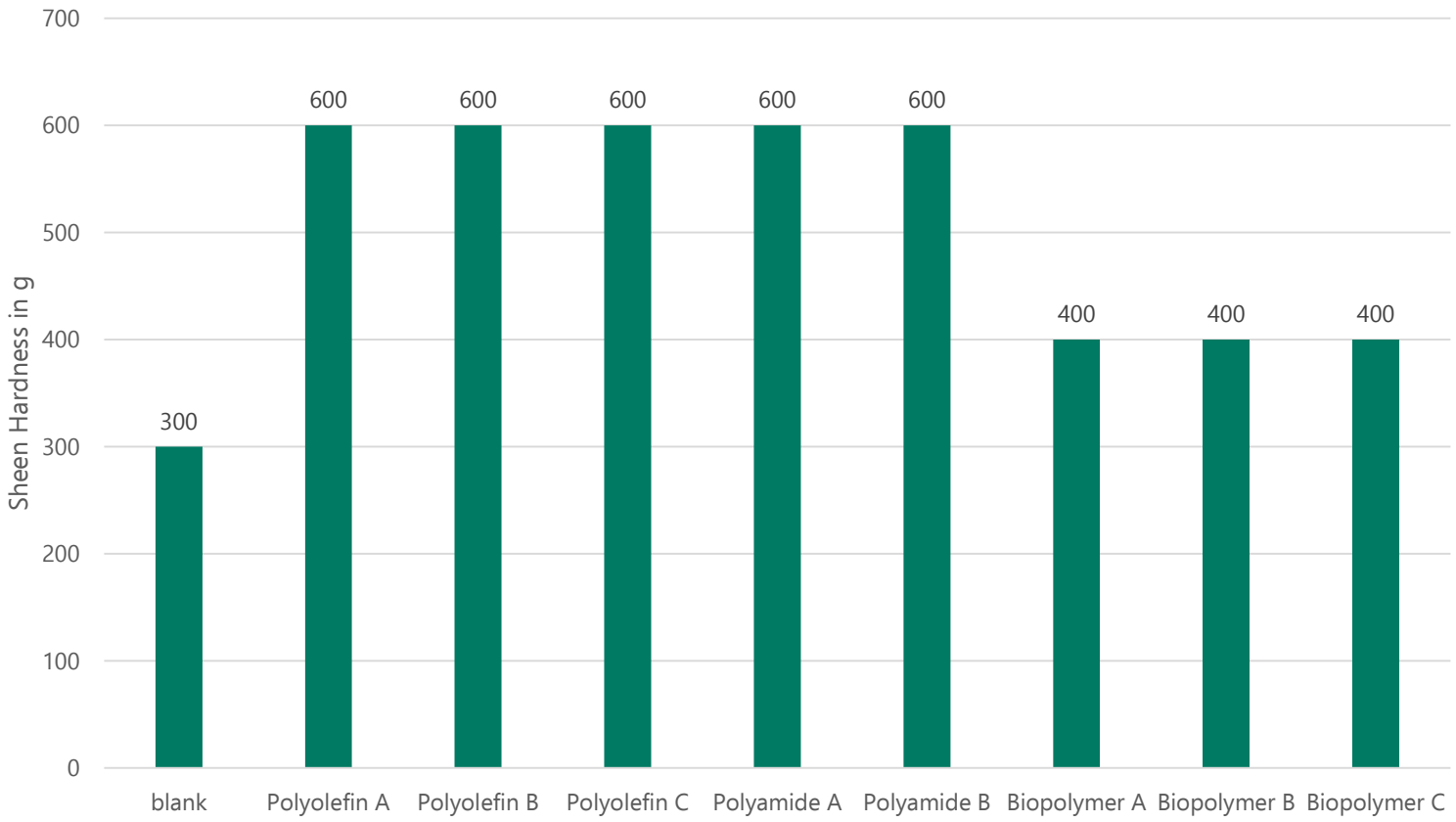
COIL COATING APPLICATION

Influence on scratch resistance — 8% dosage



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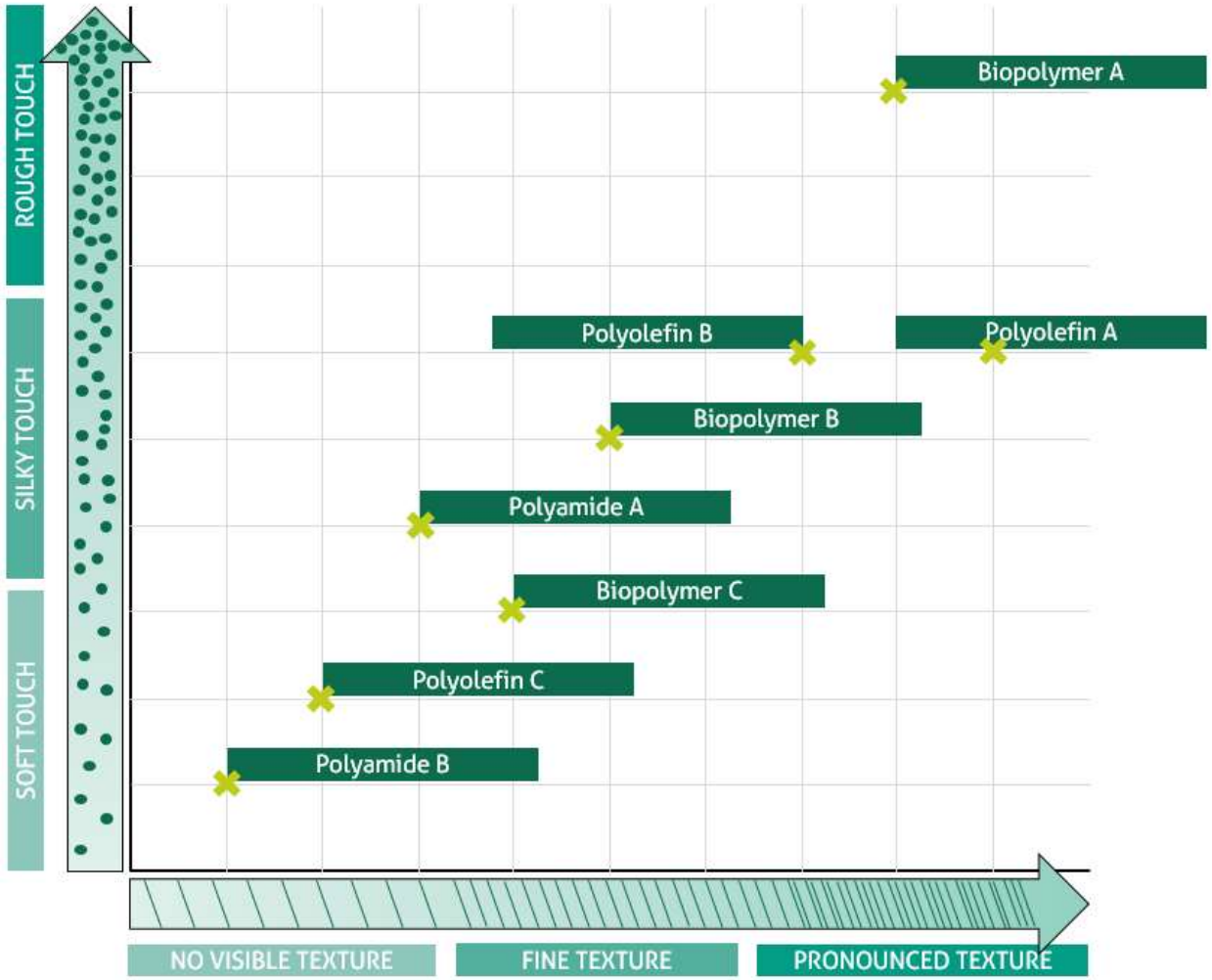
COIL COATING APPLICATION
Comparison: Texture vs. Haptic



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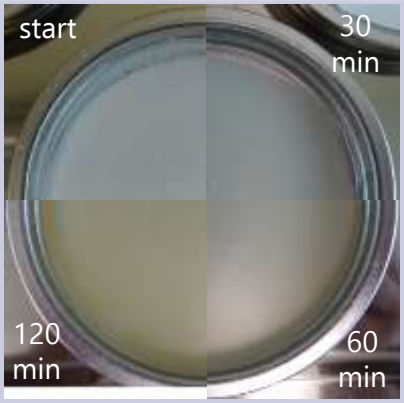
THERMAL STABILITY
at 200°C (392°F)

POLYOLEFIN A	POLYOLEFIN B	POLYOLEFIN C	POLYAMIDE A
			

POLYAMIDE B	BIOPOLYMER A	BIOPOLYMER B	BIOPOLYMER C
			

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FURTHER POSSIBLE APPLICATION

Possible substrates:

- **Plastic**
- **Paper**
- **Metal**
- **Wood**
- **Leather**
- **Textiles**

Common applications:

- **Electronics**
- **Automotive interiors**
- **Wall coverings**
- **Parquet and vinyl flooring**
- **Furniture**

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GENERAL "RULE OF THUMB"

Product name	Recommended *wet* film thickness	Recommended *dry* film thickness	Process temperature / drying conditions	
			Physically drying and stoving below 200°C (392°F)	Stoving above 200°C (392°F)
POLYOLEFIN A	>60µm	30-45µm	✓	✓
POLYAMIDE A	>40µm	25-40µm	✓	(✓)
POLYOLEFIN B	>50µm	15-30µm	✓	✓
POLYAMIDE B	>25µm	15-30µm	✓	(✓)
POLYOLEFIN C	>25µm	10-25µm	✓	✓
BIOPOLYMER A	>65µm	25-40µm	✓	(✓)
BIOPOLYMER B	>45µm	15-30µm	✓	(✓)
BIOPOLYMER C	>35µm	10-25µm	✓	(✓)

GENERAL INFORMATION FOR TEXTURING AND HAPTIC ADDITIVES

- **Generally, all additives are suited for water- and solvent based applications, as well as 100% UV-curable coatings**
- **A dosage of up to 10% is not uncommon in this application, depending how pronounced the effect should be**
- **Partly or entirely melting of the wax can be beneficial for the texturing effect**
- **Coefficient of friction, scratch- and abrasion resistance can be enhanced with these additives, if the application is suited**
- **The visual impression of the surface texture and the sensoric modification is very subjective and system depending. Especially the used binder has a strong influence on the haptic properties**
- **For coatings with high film thickness, the additive has to migrate to the surface to be effective regarding the haptic and texture effect. The stated dry film thickness at the ″Rule of Thumb“ can be much higher, if the coating system and film building process supports the migration of the additive**

ECO-label compliant aqueous dispersions for Architectural Coatings

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What does MÜNZING Eco Product Range stands for?

MÜNZING Eco Product range supports our customers ambitious targets to produce and sell their

Deco Paints (indoor and outdoor),

Varnishes

Wood Stains and Wood Paints

Floor Coatings and Floor Paints

Tinting systems

Masonry Coatings

…

according to Eco label standards, like:

EU – Ecolabel (2014/ 312/ EU);

Blue Angel (UZ – 102/ interior wall paints and UZ – 12a/ coatings);

Nordic Swan (indoor paints and varnishes),

Thailand Green Label (TGL 04 – R4 – 14/ paints);

Chinese GB/T 35602 – 2017;

Australia (Red List) and other

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Overview: Eco-label compliant wax dispersions

Product	Wax type	Active content	pH value	VOC content
Eco Product A	Polymer wax	50 +- 1 %	9 +- 1	VOC free
Eco Product B	Paraffin-wax	50 +- 1 %	9 +- 1	VOC free
Eco Product C	Paraffin-wax	60 +- 2 %	9 +- 1	0.2 %
Eco Product D	Compound	45 +- 1 %	7 +- 1	VOC free
Eco Product E	Polymer wax	30 +- 1 %	7 +- 1	VOC free
Eco Product F	Polymer wax	30 +- 1 %	7 +- 1	VOC free
Eco Product G	Synthetic wax functional blend	30 +- 1%	9 +-1	VOC free

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Overview: Eco-label compliant wax dispersions

Product	UZ- 102 UZ-12a	EU-Ecolabel (2014/312/EU)	Nordic Swan for indoor paints and varnishes	Thailand: Green Label TGL-04-R4-14 for paints	China: GB/T 35602-2017	Australia: Red List
Eco Product A	Yes	Yes	Yes	Yes	Yes	Yes
Eco Product B	Yes	Yes	Yes	Yes	Yes	Yes
Eco Product C	Yes	Yes	Yes	Yes	Yes	Yes
Eco Product D	Yes	Yes	Yes	Yes	Yes	Yes
Eco Product E	Yes	Yes	Yes	Yes	Yes	Yes
Eco Product F	Yes	Yes	Yes	Yes	Yes	Yes
Eco Product G	Yes	Yes	Yes	Yes	Yes	Yes

Dosage must be adjusted to the amount of chemicals which are allowed in the final paint.
The Blue Angel and EU-Ecolabel is always given for the final paint, not for our additive.

Others (not checked yet): GreenLabel Singapore, Sirim Ecolabel, greenstar, ten-ring certification

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Information on Eco Labels – Criteria; for what kind of products can we get an Eco label?

Criteria to get an Ecolabel for a product:

- Many different criteria depending on the Eco label e.g.:

- Restrictions for (hazardous) substances
- Quality standards of the final product (good scrub resistance, hydrophobicity,..)
- VOC restrictions
- .....

For what kind of products can you get an Ecolabel:

- Different Ecolabels for different products e.g.
- Paints
- Wood coatings
- Care products
- .....

→ No Ecolabel for the MUNZING additive
→ Ecolabel is given to the final product

How can MUNZING additives help to get an Ecolabel:

- No forbidden substances and very low content of hazardous substances
  → Amount of additive must be calculated by including the amount of all hazardous substances in the final paint
- Improvement of the paint properties like hydrophobic effect,..
- No or low VOC content

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Information on selected Eco Labels

Blue Angel (UZ-102)

→ Ecolabel for low-emission interior wall paint

→ The label is given to interior wall paints which are under the definition:
- dispersion paint
- primer for wall paint
- dispersion type silicate paint
- Pigment pastes for wall paint

Blue Angel (UZ-12a)

→ Ecolabel for low-emission coatings

→ The label is given to coatings like for example:
- waterbased coatings
- primer (not for wall paint)
- furniture coatings
- floor coatings

EU-Ecolabel (2014/312/EU)

The EU-Ecolabel is a label for products with high environmental standards regarding raw material extraction, production, distribution and disposal.

It is given to products of different product groups:
Personal care products, cleaning products, clothing and textile products,
electronic equipment, coverings, furniture, gardening,
lubricants, paper products, **Paints and varnishes (**indoor and outdoor decorative paints and varnishes, Wood stains and paints and related products, Floor coatings and paints)

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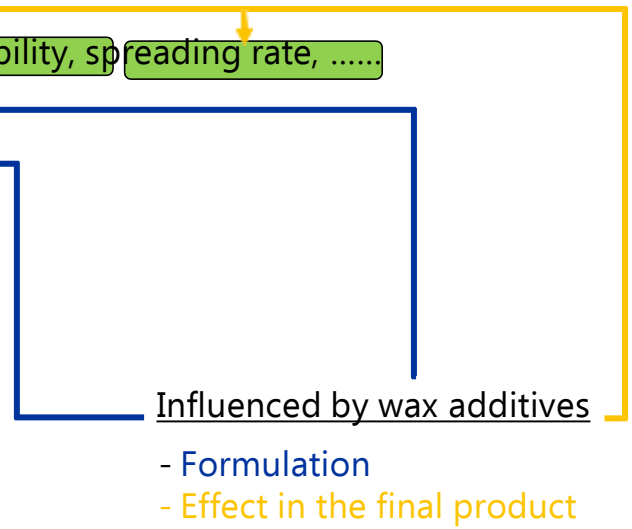
How MÜNZING ECO products support our customers´ formulations, e.g. for EU-Ecolabel (2014/312/EU)

General criteria for awarding the EU Ecolabel (2014/312/EU) to paints and varnishes:

- White pigment and scrub resistance
- Efficiency in use like resistance to water, liquid water permeability, spreading rate, ...
- VOC and SVOC
- Restriction of hazardous substances and mixtures
- Consumer information
- Information appearing on the EU Ecolabel



SVOC- Semivolatile Organic Compounds

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Hydrophobicity – Definition and influences

Hydrophobicity:

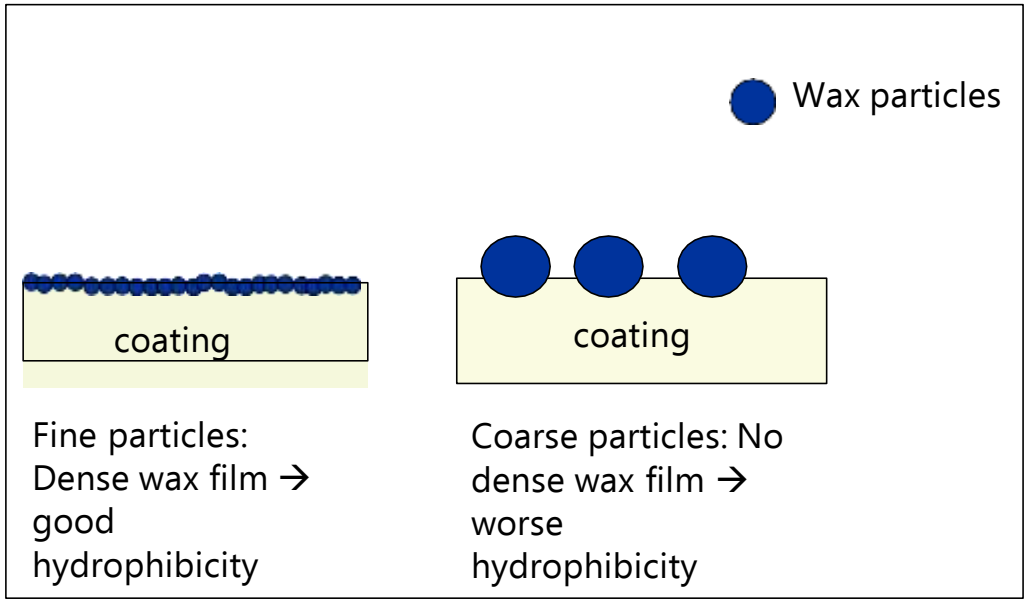
- Is the water repellent property of a surface
- Possible Measurements:
  - Contact angle of a water droplet on the surface,
  - water uptake within a defined time
  - water repellent test
  - water droplet test

Additives may influence hydrophobic behavior of a paint by:

- Type and content of active ingredient
- Type and content of emulsifiers and other components
- Particle size
- Additive dosage in the final product
- Interaction of the additive and the paint

Further factors influencing hydrophobic behavior

- PVC of the paint formulation
- Film thickness of the paint
- Application type
- Absorbency of the substrate



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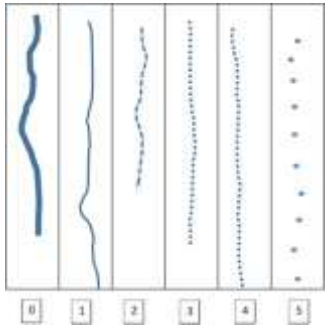
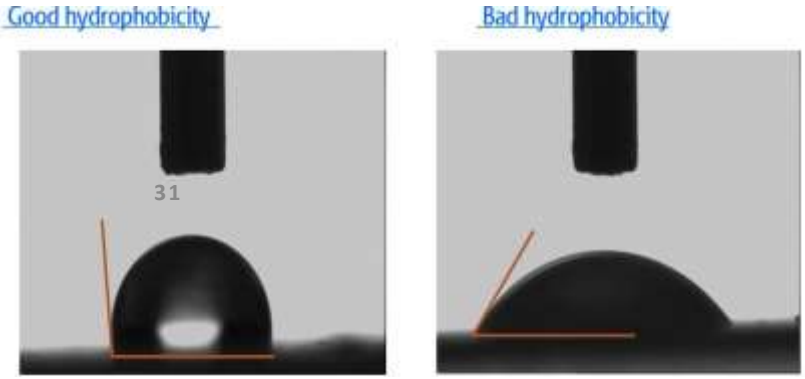
Tests for measuring the Hydrophobicity

Water uptake during defined time and substrate

Water repellence test



Droplet contact angle



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Tests in interior wall paint

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Test of the Eco-products against the non eco products in interior wall paint

Water uptake during defined time:

Parameters and test procedure:

- Dosage: 2 % (calculated on solid wax)
- Time: 120 s
- Water column: 1.6 cm
- Wet film thickness: 200 µm
- Box type coater
- Substrate: cardboard

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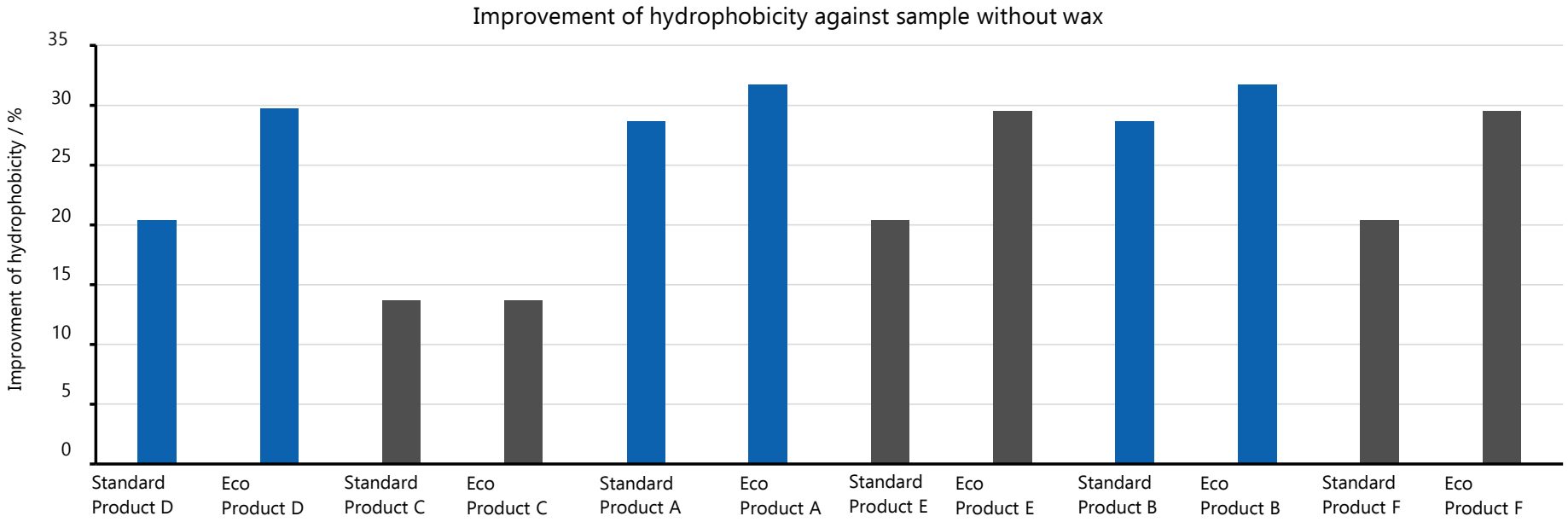
Application test: Eco-products against the standard products in interior wall paint

Water uptake during defined time:

- The water uptake of every sample was measured
- The improvement of hydrophobicity was calculated with the values of the water uptake of the samples compared to the sample without wax



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Tests: Pure products

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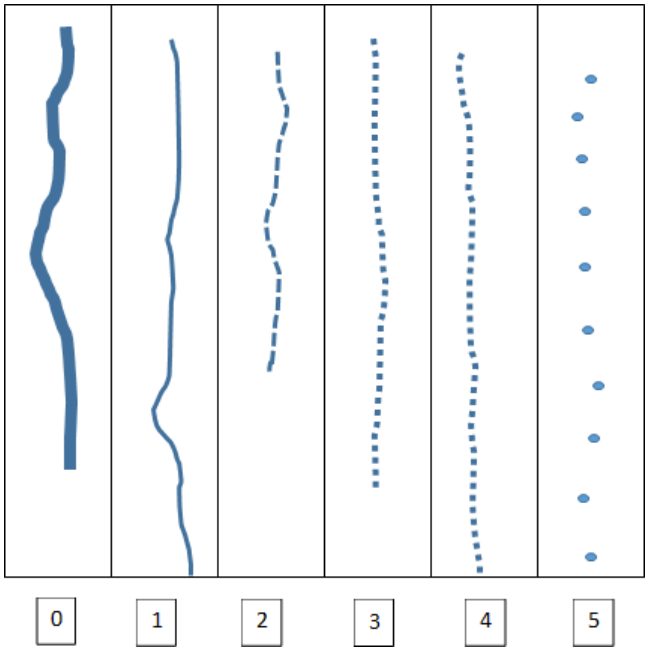
Comparison of the pure products: Water repellency test

Water repellency test

- Substrate is placed on a stand in a 45° angle
- Distilled water is placed on the surface in defined intervals
- Water repellency is evaluated with the rating scale

- 0: Not water repellent
- 5: Very good water repellency



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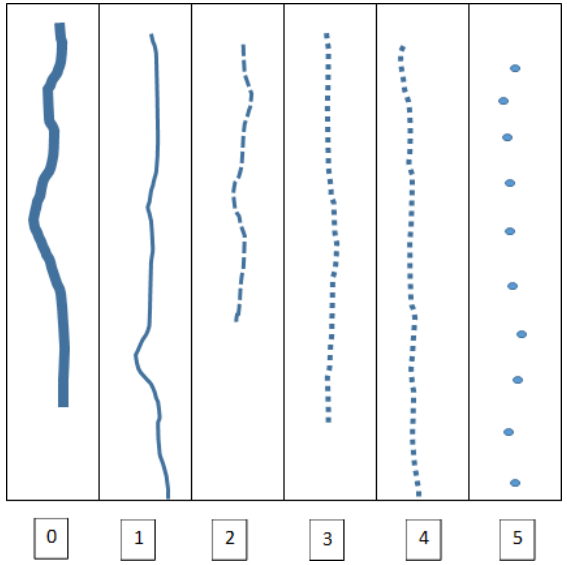
Comparison of the pure products: Water repellency test

Water repellency test

	Value
Eco Product A	4
Standard Product A	4
Eco Product B	4
Standard Product B	4
Eco Product E	5
Standard Product E	5
Eco Product F	5
Standard Product F	5
Eco Product D	5
Standard Product D	5
Eco Product C	5
Standard Product C	5
Eco Product G	3
Standard Product G	3



→ Very good water repellency with all the products
→ Comparable values with eco- and standard products

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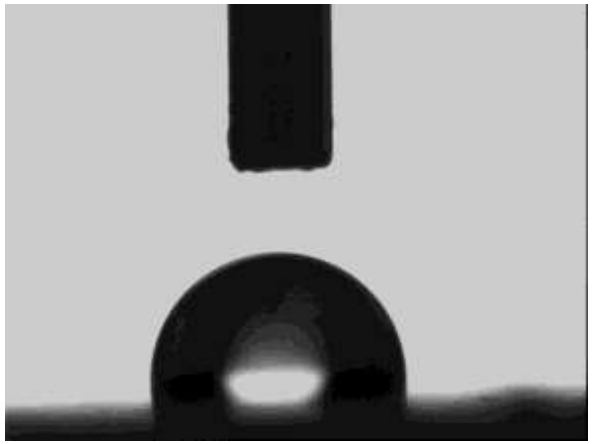
Comparison of the pure products: Contact angle measuring

Contact angle measuring

- Application of pure product with wet film thickness of 150 µm
- Drying over night at room temperature
- Measuring substance: Distilled water
- Measuring equipment: KRUSS EasyDrop contact angle measurement

Good hydrophobicity



Bad hydrophobicity

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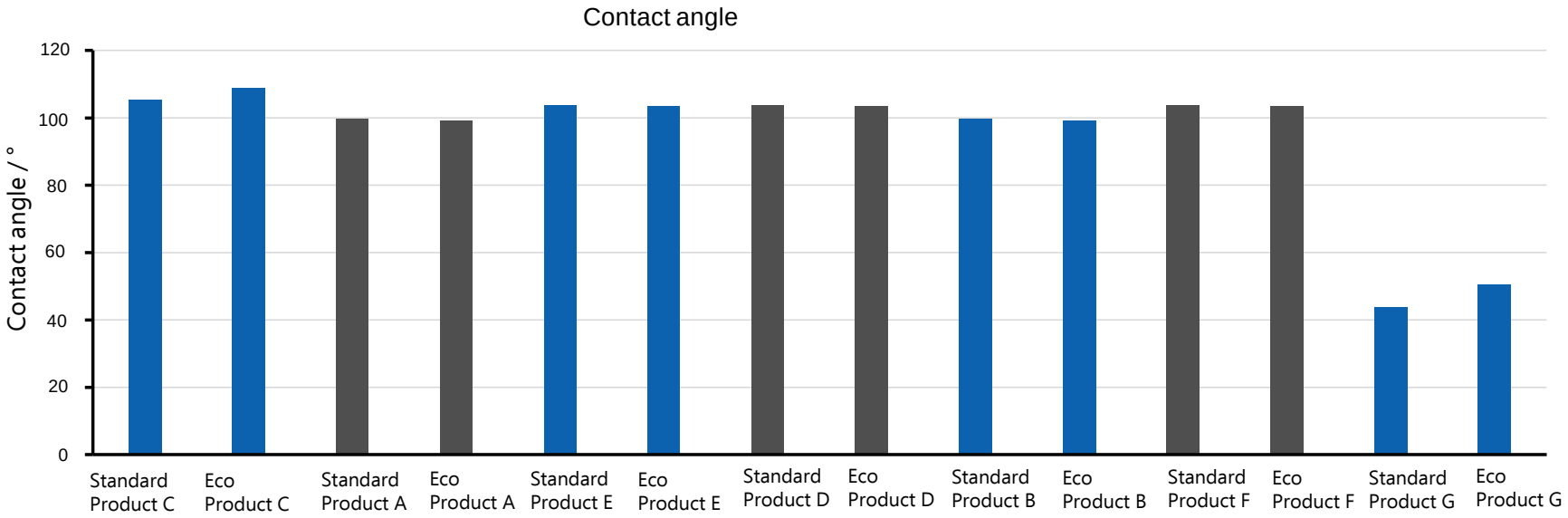
Comparison of the pure products: Contact angle measuring

Contact angle measuring



Values for Eco and standard products are more or less comparable

Hydrophobicity can be different when using it in a paint

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WAX ADDITIVES FOR POWDER COATING

» **Introduction**

- Tested powder coating systems: Hybrid system (Epoxy-Polyester) and Primid system (Polyester- Hydroxyalkylamide)
- Formulation and application details
- Overview over the tested micronized wax products

» **Test results and comparison**

- Visual comparison of the coated surface and texturing additives
- Influence on the gloss
- Surface roughness
- Scratch resistance

» **Summary and recommendation table**

Formulation and application details

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Component	Percentage
Crylcoat 1783-0	39.0
Araldite GT 7004	18.0
Titanium dioxide	29.0
Barium sulfate	10.5
Flow promoter	3.0
Benzoin	0.5

ri i te ol e ter ro al la i

Component	Percentage
Crylcoat 2698-3	65.0
Primid XL 552	3.5
Titanium dioxide	25.0
Barium sulfate	5.0
Surface additive	1.0
Benzoin	0.5

- Components premixed for 5 min at 2000 rpm (Mixaco-Mixer)
- Extruded, double screw-type, 115°C/239°F (zone 1) and 105°C/221°F (zone 2) at 200 rpm
- Crushed and grinded with Retsch-mill at 10 000 rpm
- Sieved over 150 µm-grid
- Corona application, 90 kV on aluminum (50-80 µm)
- Cured for 10 min at 180/200/220°C (356/392/428°F)
- Waxes added with a dosage of 2 %

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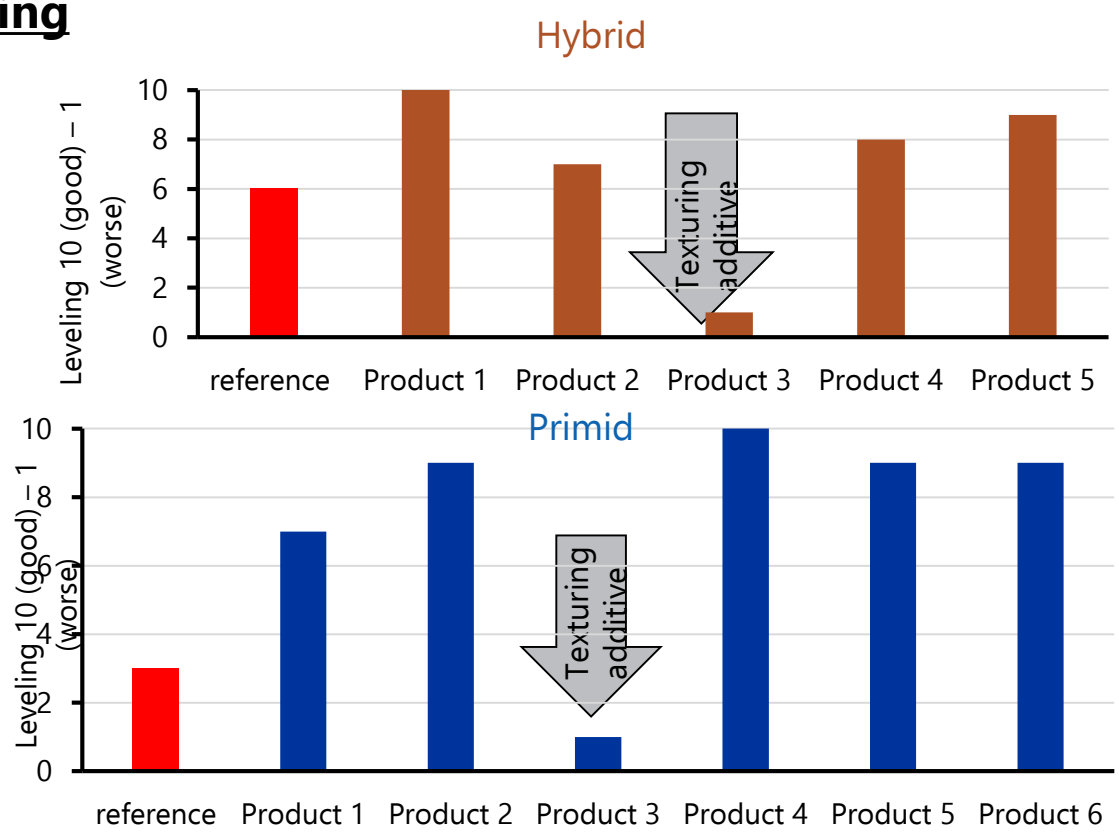
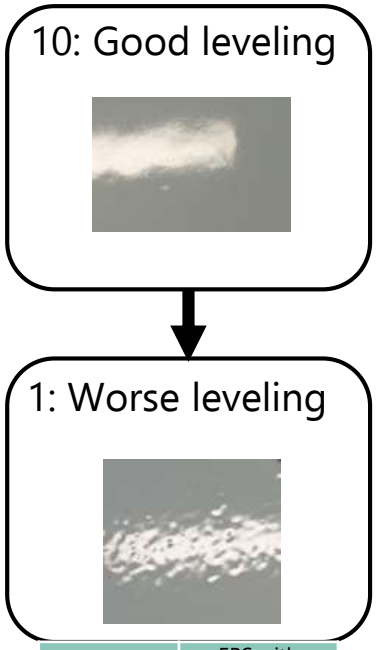
Tested Micronized Waxes

Product	Wax	Particle size d50/d99 in µm	Drop point in °C
Product 1	EBS with Benzoin	13 / 55	135-145
Product 2	Wax blend with diamond like hardness	4 / 20	138-146
Product 3	Wax blend with PTFE	50 / -	108-118
Product 4	EBS	6 / 19	143-151
Product 5	Polyethylene	8 / 25	110-118
Product 6	Polypropylene	10 / 20	156-164

Visual subjective comparison of the surfaces

Leveling





Product 1	EBS with Benzoin coating
Product 2	Wax & high hardness
Product 3	Wax blend with PTFE coating
Product 4	EBS
Product 5	Polyethylene
Product 6	Polypropylene

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Visual comparison of samples

Hybrid system

Product 1	EBS with Benzoin coating
Product 2	Wax & high hardness
Product 3	Wax blend with PTFE coating
Product 4	EBS
Product 5	Polyethylene
Product 6	Polypropylene

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Visual comparison of samples

Hybrid system

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Visual comparison of samples

Primid system

Product 1	EBS with Benzoin coating
Product 2	Wax & high hardness
Product 3	Wax blend with PTFE coating
Product 4	EBS
Product 5	Polyethylene
Product 6	Polypropylene

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Visual comparison of samples

Primid system

Product 1	EBS with Benzoin coating
Product 2	Wax & high hardness
Product 3	Wax blend with PTFE coating
Product 4	EBS
Product 5	Polyethylene
Product 6	Polypropylene

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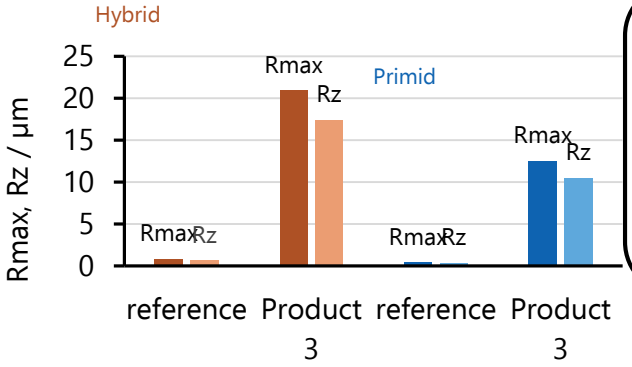
Texturing additive Product 3

Rmax and Rz: The surface roughness of the powder coating panels was measured with a perthometer. A diamond needle is pulled over the coated surface. It scans every mountain and valley of the surface and put the measured values in a diagram. So **Rz** is the arithmetic average of all single depth of roughness. **Rmax** is the largest single depth of roughness.
The higher the values for Rz/Rmax, the stronger the surface roughness and the stronger the texturing of the surface. To make it a bit easier: **High Rz/Rmax values = stronger roughness = stronger texturing**

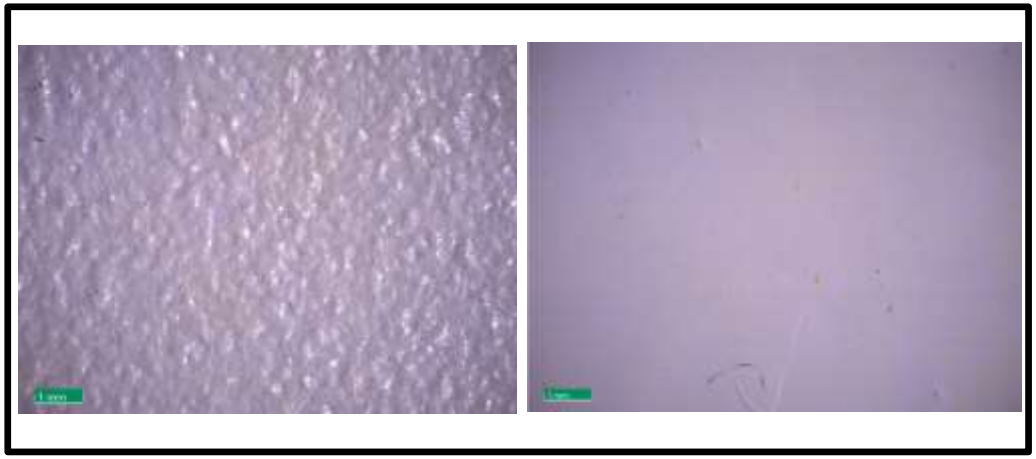
Product 3 No wax



Product 3:

- Texturing
- Matting
- Scratch resistance
- No yellowing

Digital microscope



Brand new texturing additives for fine texturing, slight matting and scratch resistance:

- Product 8
- Product 9

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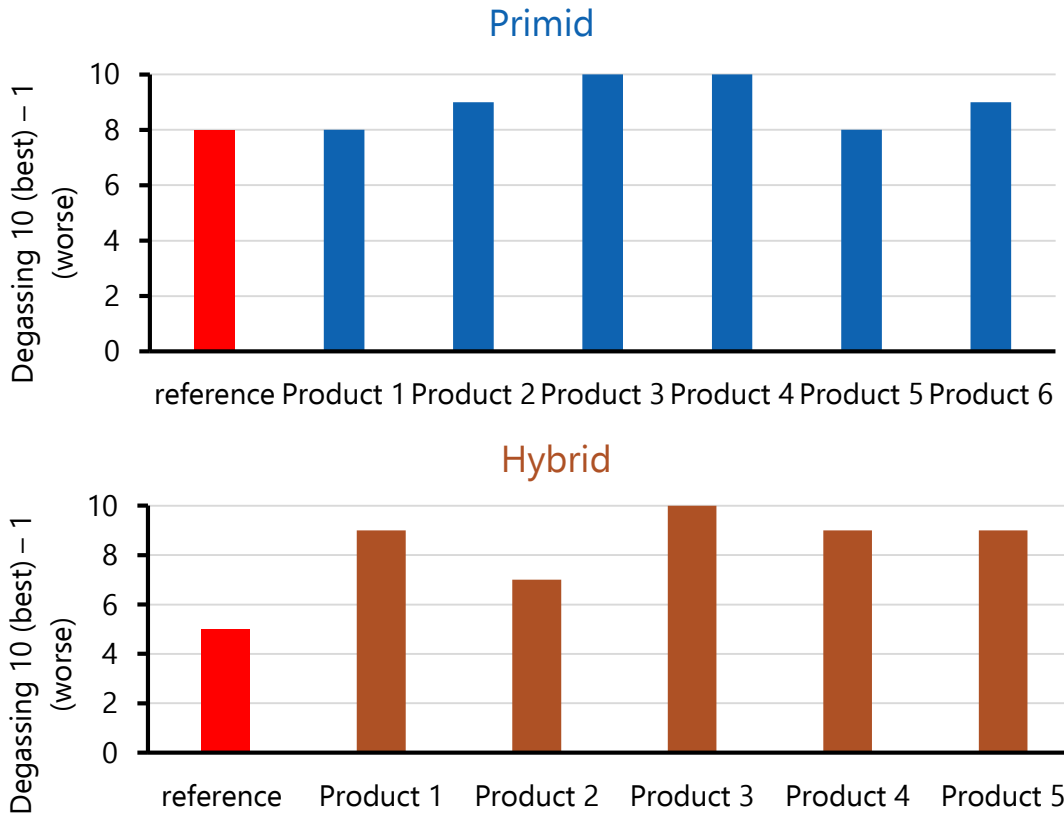
Visual subjective comparison of the surfaces

Degassing



Amide waxes are strongly recommended for degassing effects:

- Product 1
- Product 4

Brand new degassing additive for low temperature cure powder coatings:

- Product 7

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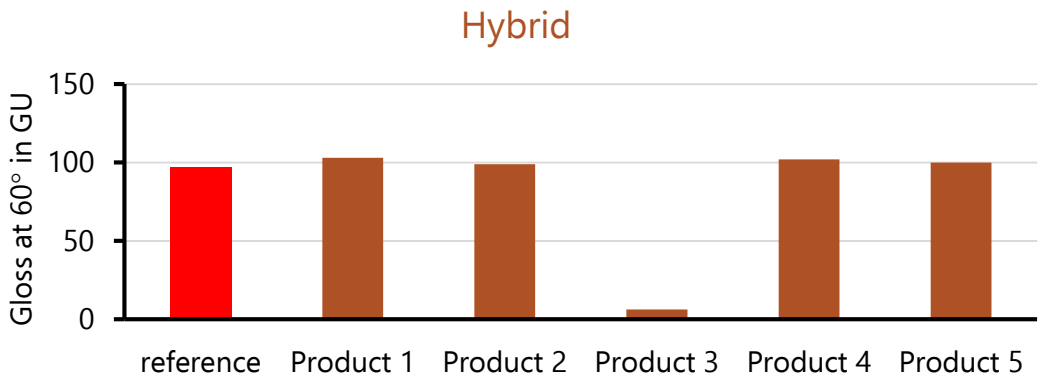
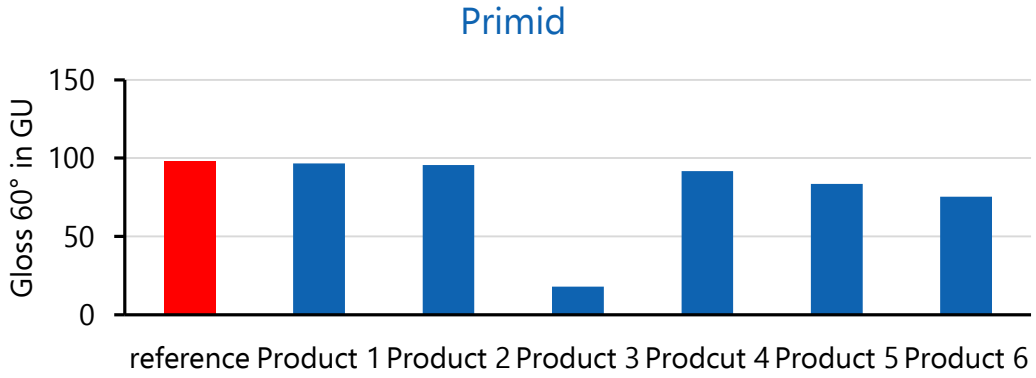
Influence on gloss in Primid and Hybrid system





- Strong matting with Product 3 (texturing additive)
- Slight matting with Product 5 and Product 6 in the Primid system
- Possible matting additive Product 10 (matting with no texturing effect)

- High gloss surfaces with Amide waxes and Product 2

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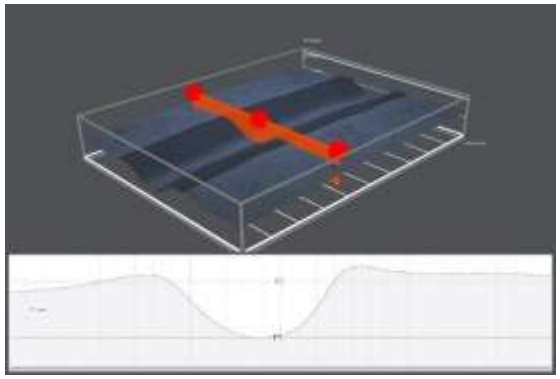
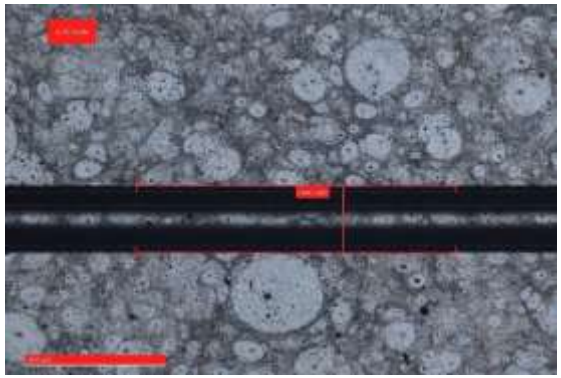
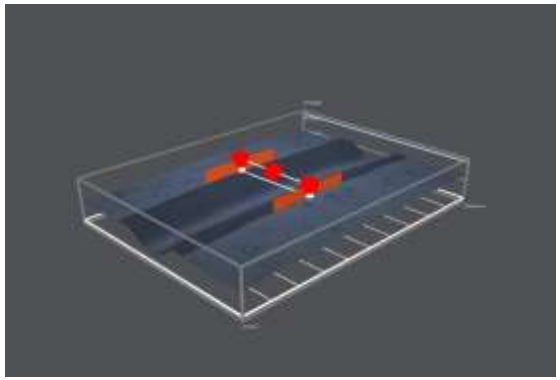
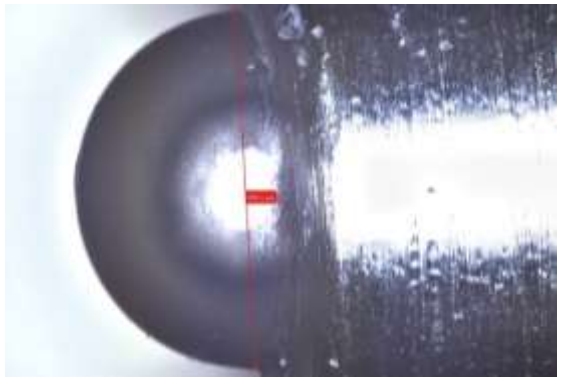
Scratch resistance









$$h = \frac{D - \sqrt{D^2 - d^2}}{2}$$

h- Depth of scratch
D- diameter of the steel needle
d-width of the scratch

For testing we used a **steel needle which is pulled over the coated surface three times with a force of 5 Newtons**. We measured the width of the scratch with our digital microscope (upper right corner) and calculated the depth of the scratch with the formula mentioned on the slide. Then we compared the depth of the scratch of the powder coatings with additive, compared to the sample without wax additive and calculated the improvement with the sample with the additive to zero sample.

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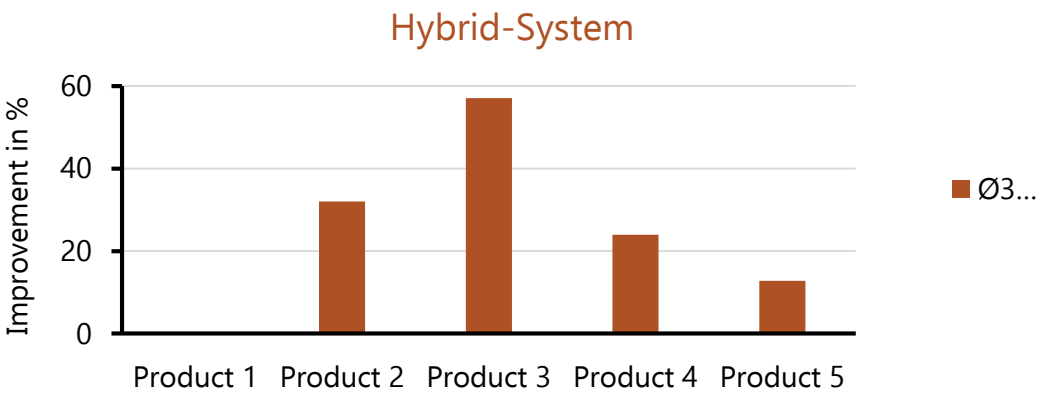
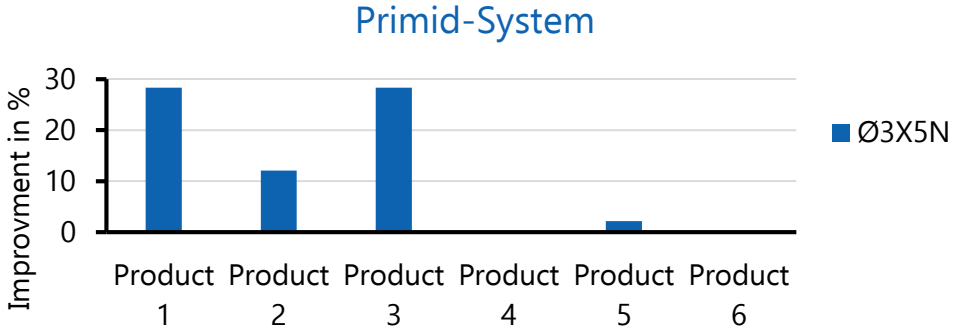
Scratch resistance

Evaluated by the depth of the scratches





- Improvement of scratch resistance with Product 3 and Product 2 (diamond like hardness coating)

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Summary
Recommendations

● = recommended for the Hybrid system / Primid system
●● = strongly recommended for the Hybrid system / Primid system

Product	Degassing	Matting	Gloss	Mechanical resistance	Flexibility	Leveling	Texturing	Special performance
Product 1	●● / ●●		●● / ●●	● / ●●	●● / ●	●● / ●●		No influence on yellowing in the Primid system. 100% Substitution of Benzoin can be possible.
Product 2	● / ●		● / ●	● / ●	●	● / ●		Good grinding process. Diamond-like hardness Smooth surface
Product 4	●● / ●●		● / ●●	● / ●	● / ●	●● / ●●		No influence on yellowing in the Primid system. Partial substitution of Benzoin is possible. Excellent grinding process.
Product 7	●● / ●●			● / ●	● / ●			Brand new product as degassing additive for low temperature cure powder coating systems
Product 5	●● / ●	●	●	●	● / ●	●● / ●		Matting in Primid system. Gloss in Hybrid system. No influence on yellowing in the Primid system. Excellent grinding process.
Product 6	● / ●	●			● / ●	●● / ●●		Anti-Slip No influence on yellowing in the Primid system.

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Summary

Recommendations Texturing and Matting

● = recommended for the Hybrid system / Primid system
●● = strongly recommended for the Hybrid system / Primid system

Product	Degassing	Matting	Gloss	Mechanical resistance	Flexibility	Leveling	Texturing	Special performance
Product 3	●● / ●●	●● / ●●		●● / ●●	●● / ●		●● / ●●	No influence on yellowing. Awesome texturing. Partial substitution of Benzoin is possible. Easier grinding process than with comparable competitor product. Roughness profile Rz = 17 µm
Product 8		●● / ●●		●● / ●●	● / ●		● / ●	Fine texturing Matting Scratch resitance
Product 9		●● / ●●		●● / ●●	● / ●		● / ●	Fine texturing (finer than with Product 8) Matting Scratch resistance
Product 10		● / ●		● / ●	● / ●			Matting agent without texturing Improves mechanical resistance Improves slip

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Summary

- **Munzing offers new waxes and Bio polymers that give matting, texturing and haptic effects for wood coatings, coil coatings etc.**
- **Munzing has several Eco label compliant wax products for architectural applications**
- **Munzing also offer several wax products for degassing, hardness, texturing, matting and slip in Powder Coating applications**

Thank you

Vielen Dank

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