Multi-Purpose Additive for Powder Coatings

TEGO® Powder Aid D01

Evonik Operations GmbH
BL Coating Additives
Industrial & Transportation Coatings

November 2022

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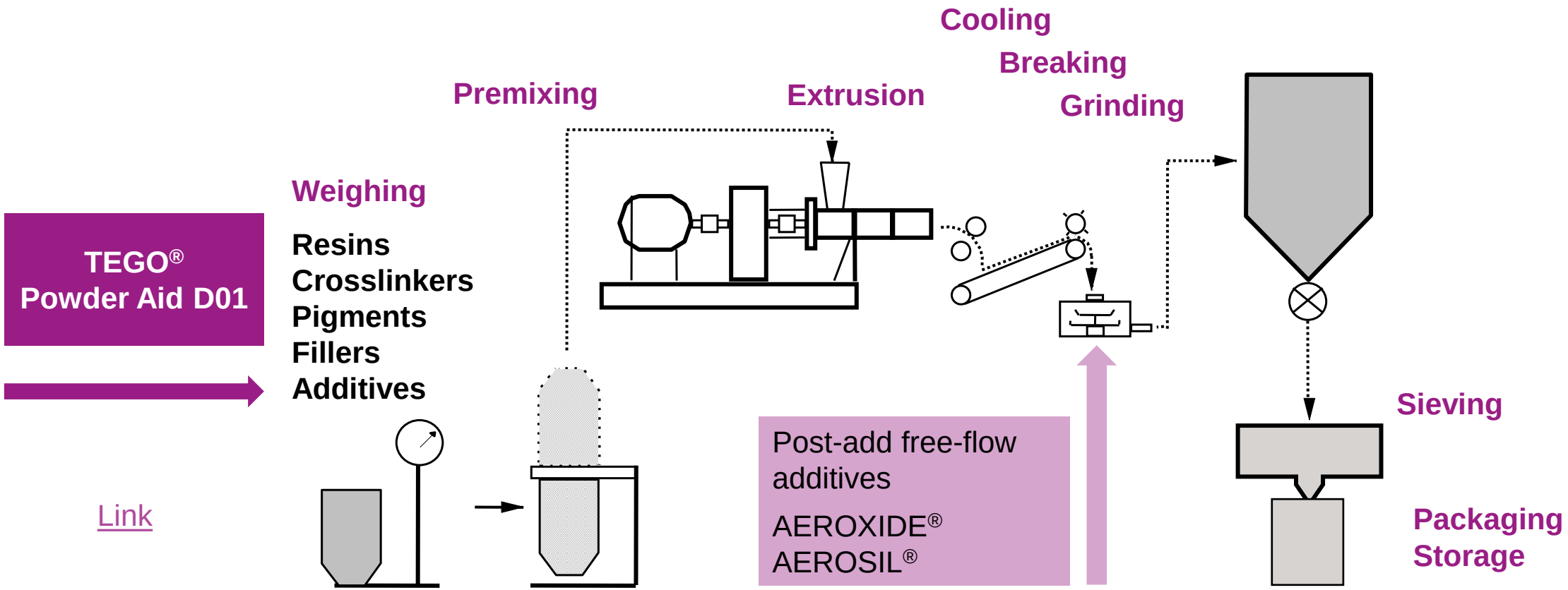
Manufacturing Process of Powder Coatings



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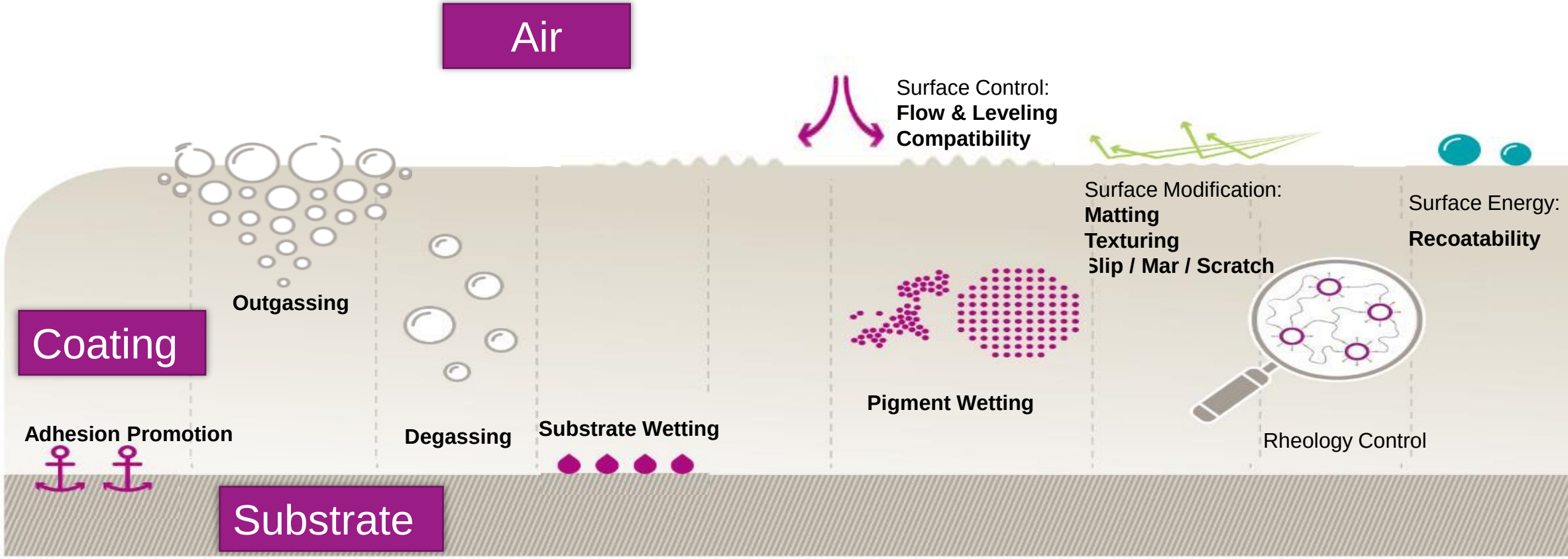
Powder Coating Additives – Key Functional Properties



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Powder Coating Additive Groups

Additive Group	Effect	Examples
Flow & Leveling Compatibility Surface Energy	Gloss / Orange Peel Defects control Recoatability	Polyacrylates (on silica carrier) Amide wax/polyether blends
Degassing & Outgassing	Pinholes Popping	Benzoin Wax blends (Polyamide)
Mar & Scratch Matting Wax Texturing	Surface slip Gloss reduction Fine / Coarse / Wrinkle	Polyethylene / Polypropylene, Fischer-Tropsch Castor wax, paraffin PTFE, CAB, reactive additives
Pigment wetting	Gloss / DOI Melt viscosity	Copolymers Modified Polyethylene and Amide waxes

TEGO© Powder Aid D01

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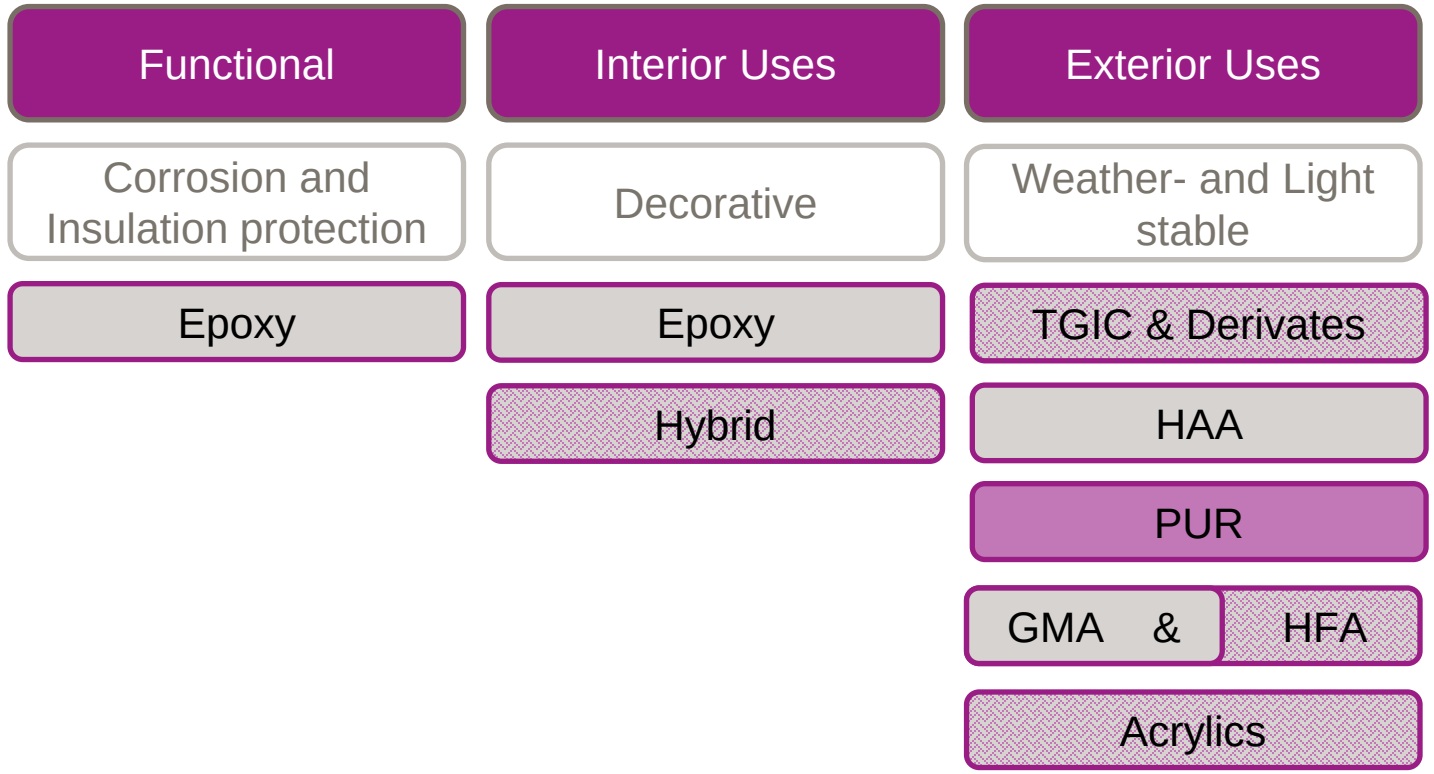
Suitable Across All Powder Coating Systems Used



System Name	Crosslinker / Resin
Epoxy	Polyamide or anhydride/ bisphenol-A-resin
Hybrid	Blend of bisphenol-A-resin and COOH-polyester
TGIC	Triglycidyl isocyanurate/ COOH-polyester
TGIC derivatives	Glycidylester/ COOH-polyester
HAA	ß-Hydroxyalkylamide/ COOH-polyester
PUR	Polyisocyanate/ OH-polyester ⇨ Polyurethane
Acrylics	Dodecanedioic acid/ glycidyl methacrylate ⇨(**GMA**) Polyisocyanate/ OH-acrylics ⇨ (**HFA**)

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TEGO® Powder Aid D01

NEW

Versatile pigment disperant additive for powder coatings with many benefits

Reduction of melt viscosity

Enhanced flow & leveling

Better gloss and DOI

100% active matter; solid

Good pigment & filler wetting

Optimal degassing properties

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TEGO® Powder Aid D01

NEW

At a glance

Universal usage

- Suitable for all pigmented and highly-filled formulations
- Compatible with any binder system at low dosage

Performance

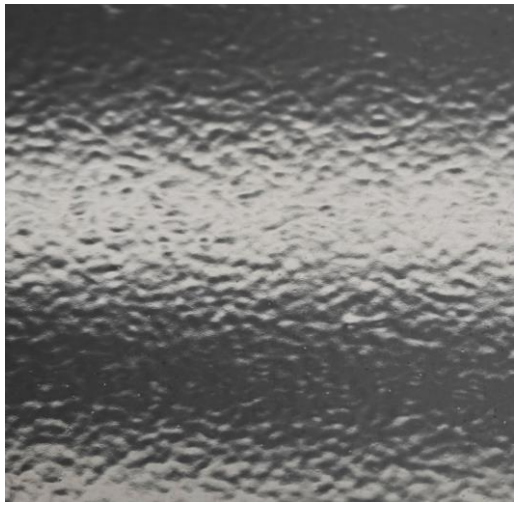
- Overbake resistant
- No effect on interfacial adhesion
- Equivalent storage stability

Easy to blend

- Full dispersion within polymer matrix
- Compatible with other additives

TEGO® Powder Aid D01 – Tested Formulations

All super durable HAA / Polyester systems with different compositions targeting a variety of use cases



Black

Higher filler and carbon black loading

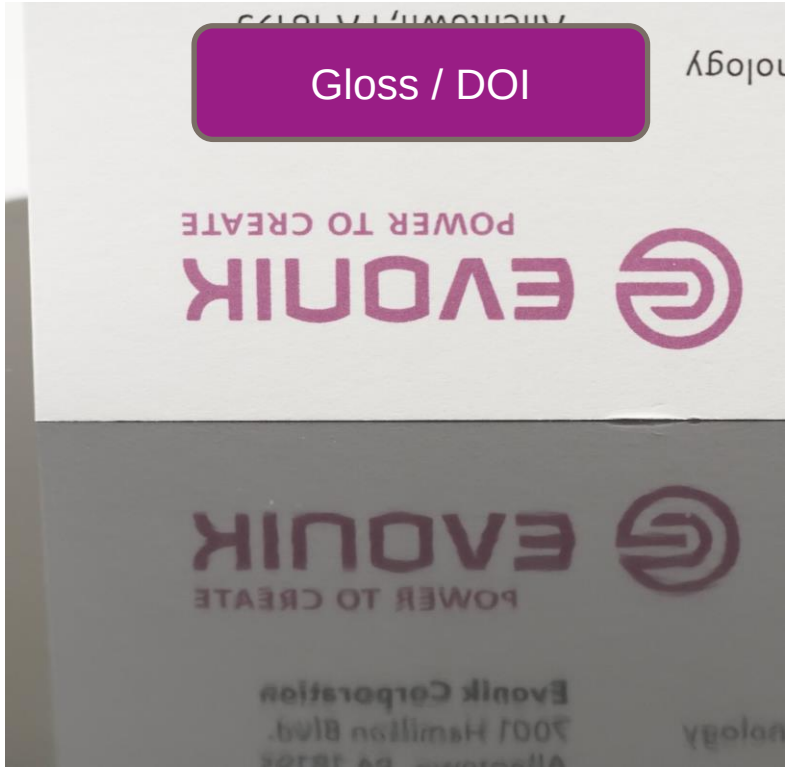
Gray

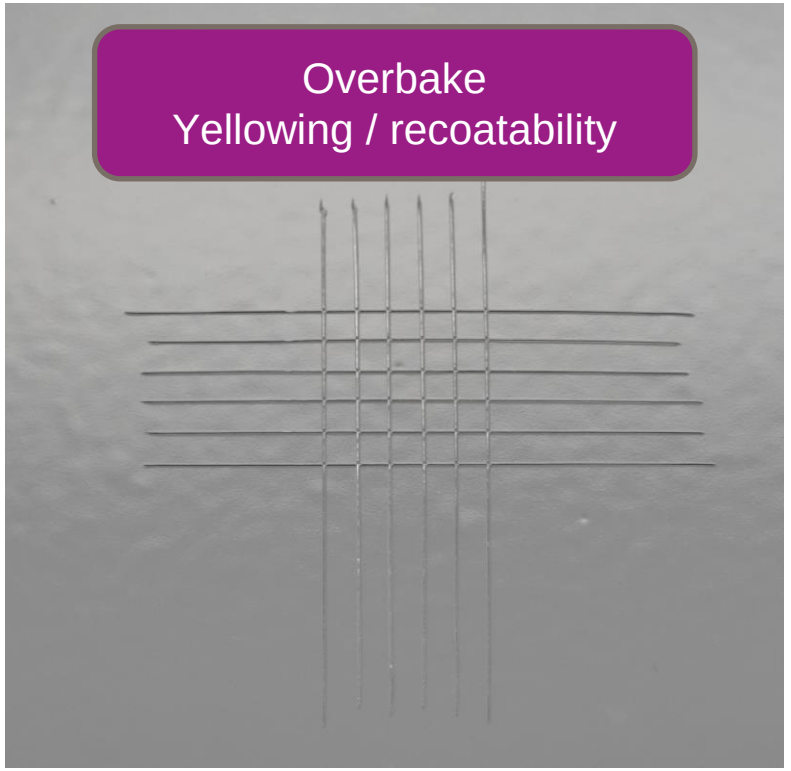
High loading level inorganic pigment and filler combination

Orange

Chromatic system using organic pigments, and low filler concentration

Test Protocol - Tested Properties





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Test Protocol - Tested Properties

Melt Viscosity

Rheometer - Temperature sweep

Pill-flow

Powder Coating Formulation
Black HAA Super Durable – Carbon Black & Filler

Main Formulation	
CRYLCOAT® 4659-0	68.4
Primid® XL-552	3.6
Leveling agent	1.0
Benzoin	0.5
MONARCH® 1300	1.5
Blanc Fixe Micro	25.0
Total	**100.0**
AEROXIDE® Alu C*	0.3

* Free-flow additive post-add at grinding

	Blank	TEGO® Powder Aid D01		Competitor A	
	B1	**B2**	**B3**	**B4**	**B5**
Main Formulation	100%	99.5%	99%	99.5%	99%
TEGO® Powder Aid D01	**-**	**0.5%**	**1%**	**-**	**-**
Competitor A	-	-	-	0.5%	1%

Gloss / Degassing
Black HAA Super Durable – Carbon Black & Filler

Curing condition:

204°C / 400°F – 10 min

	Blank	TEGO® Powder Aid D01		Competitor A	
	B1	**B2**	**B3**	**B4**	**B5**
Gloss Units (20°)	58	63	68	61	60
Gloss Units (60°)	90	92	94	92	94
Degassing threshold (µm)	51	71	74	66	66

✓ Better gloss development and improved degassing with TEGO® Powder Aid D01

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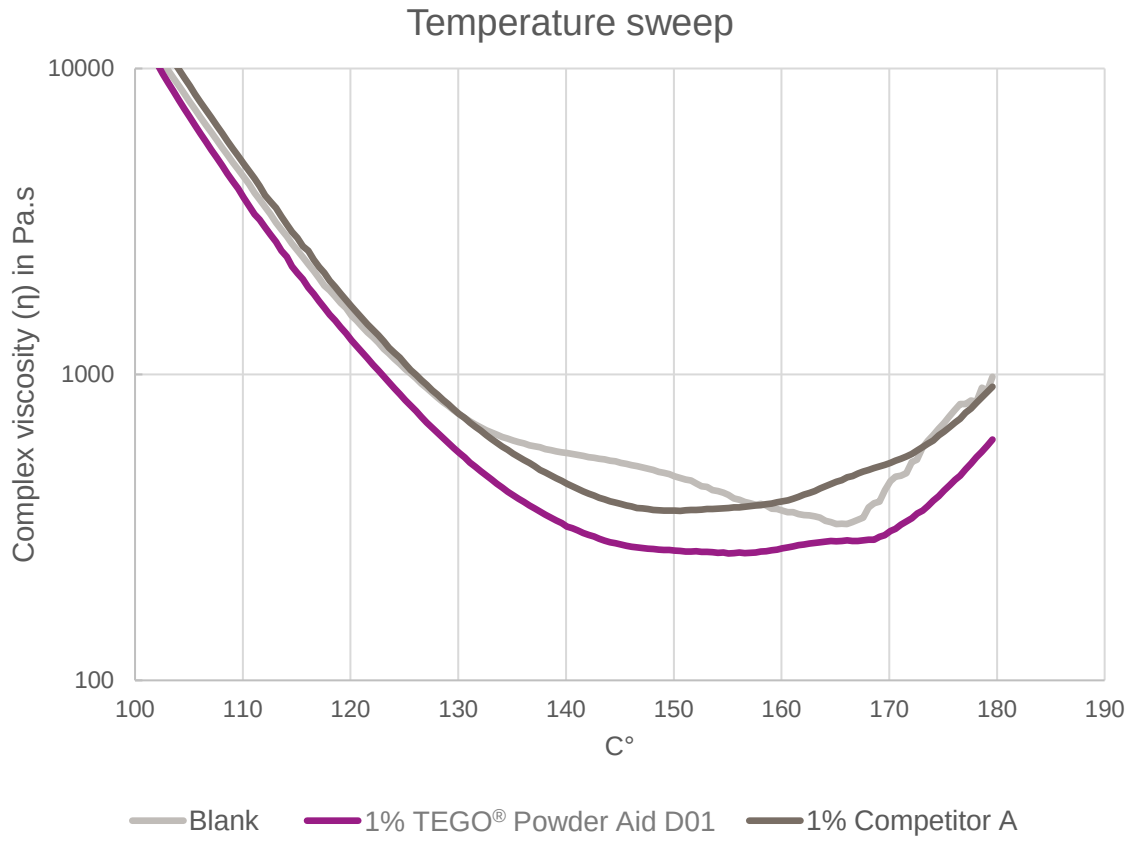
Melt Viscosity – Anton Paar & Pill Flow

Black HAA Super Durable – Carbon Black & Filler



Pill flow: 1g pill

Test conditions: 149°C / 300°F – 15 min

	Blank	TEGO® Powder Aid D01		Competitor A	
	B1	**B2**	**B3**	**B4**	**B5**
Pill Flow (mm)	39	44	46	38	39

✓ Reduced melt viscosity with TEGO® Powder Aid D01

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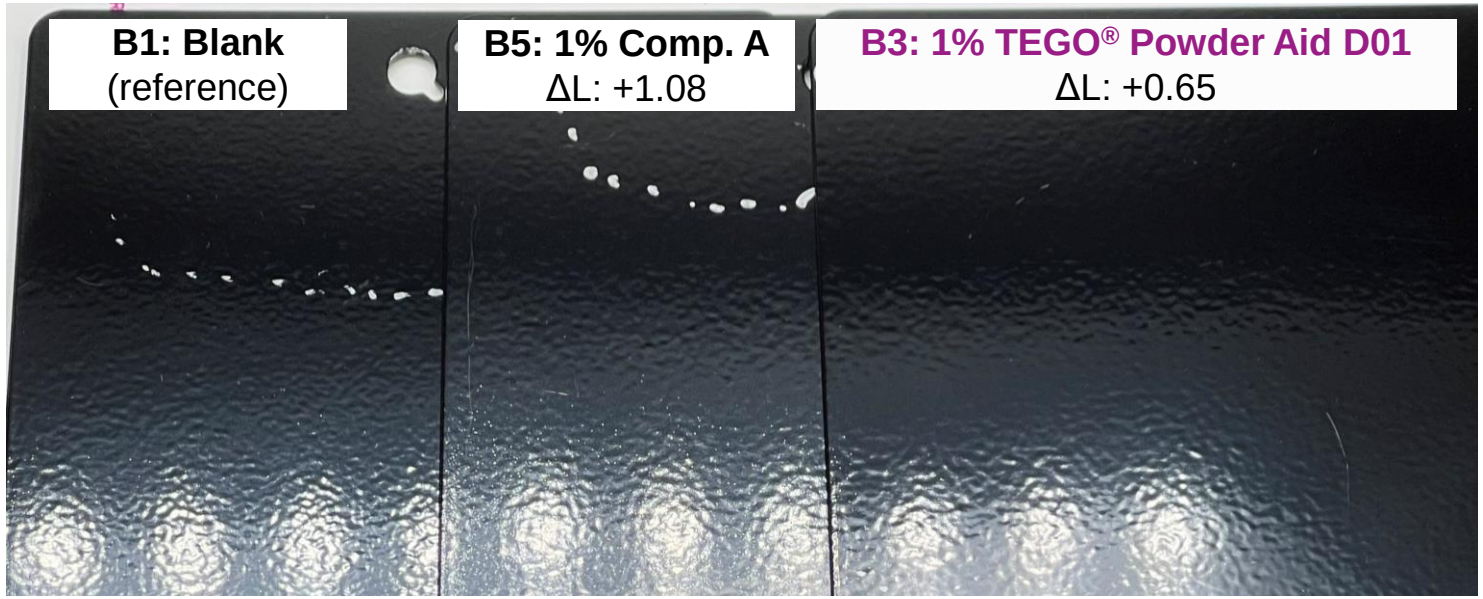
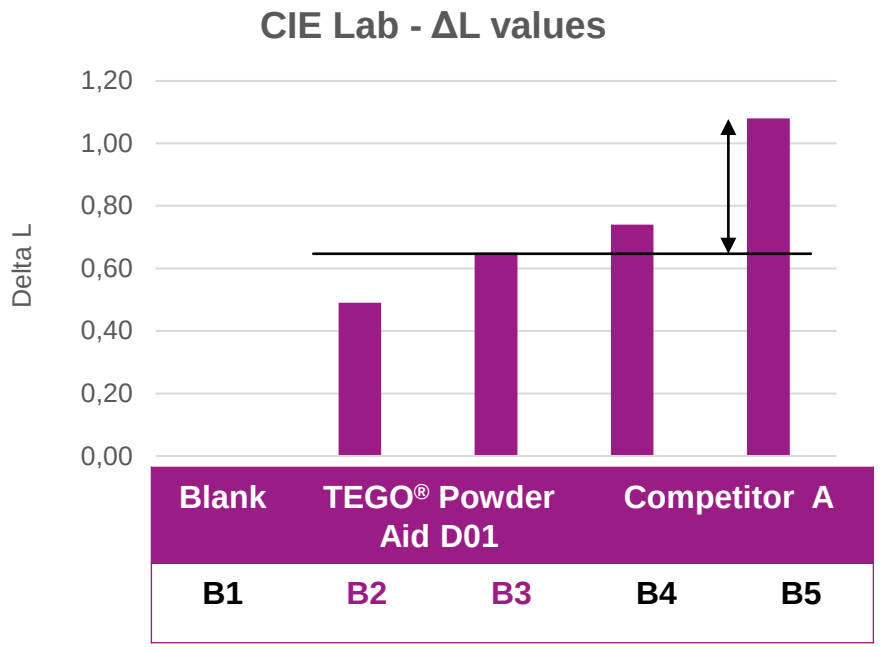
Appearance
Black HAA Super Durable – Carbon Black & Filler





- ✓ Difference in visual appearance can be quantified by spectrophotometer measurement of ΔL (CIE Lab Datacolor)
- ✓ TEGO® Powder Aid D01 outperforms the competitor

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Powder Coating Formulation

HAA Super Durable Light Gray - Highly Filled Inorganic

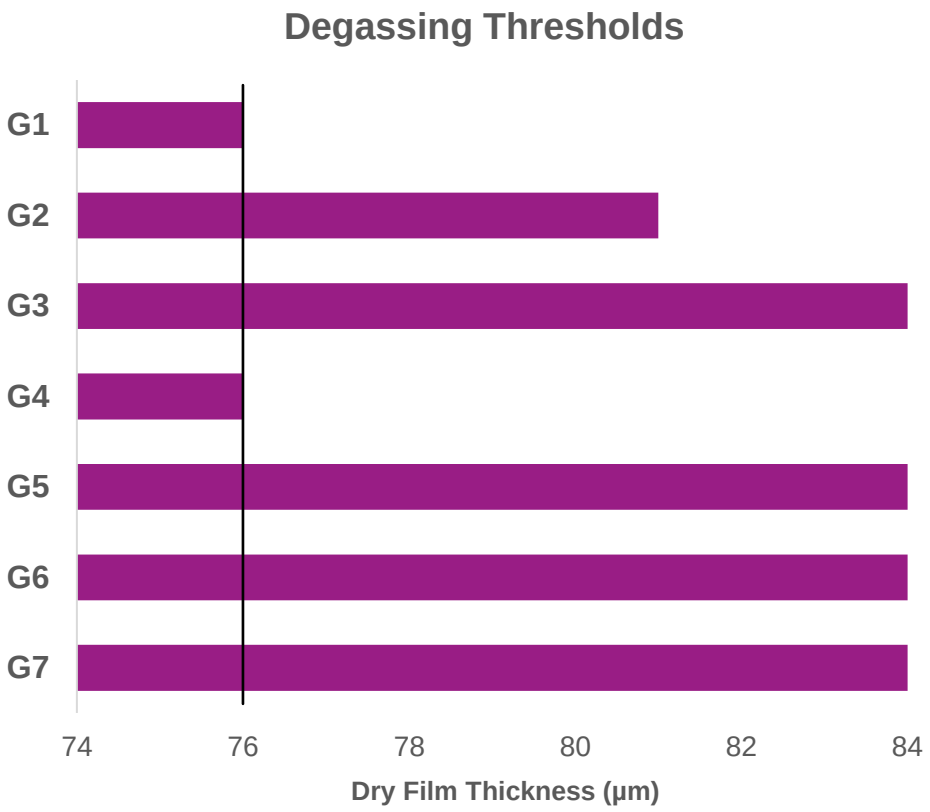
Main Formulation	
CRYLCOAT® 4659-0	50.6
Primid® XL-552	2.7
Leveling agent	1.0
Benzoin	0.5
BLACK PEARLS® 800	0.2
Ti-Pure™ R-960	35.0
Blanc Fixe Micro	10.0
Total	**100.0**
AEROXIDE® Alu C*	0.3

* Free-flow additive post-add at grinding

	Blank	TEGO® Powder Aid D01		Competitor B		Competitor C	
	G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**
Main Formulation	100%	99.5%	99%	99.5%	99%	99.5%	99%
TEGO® Powder Aid D01	**-**	**0.5%**	**1%**	**-**	**-**	**-**	**-**
Competitor B	-	-	-	0.5%	1%	-	-
Competitor C	-	-	-	-	-	0.5%	1%

Degassing & Gloss Values

HAA Super Durable Light Gray - Highly Filled Inorganic



Curing condition:

204°C / 400°F – 10 min

	Blank	TEGO® Powder Aid D01		Competitor B		Competitor C	
	G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**
Gloss Units (20°)	54	59	64	59	63	49	52
Gloss Units (60°)	87	89	90	89	90	86	86
Degassing threshold (µm)	76	81	84	76	84	84	84

✓ Better gloss development and improved degassing with TEGO® Powder Aid D01

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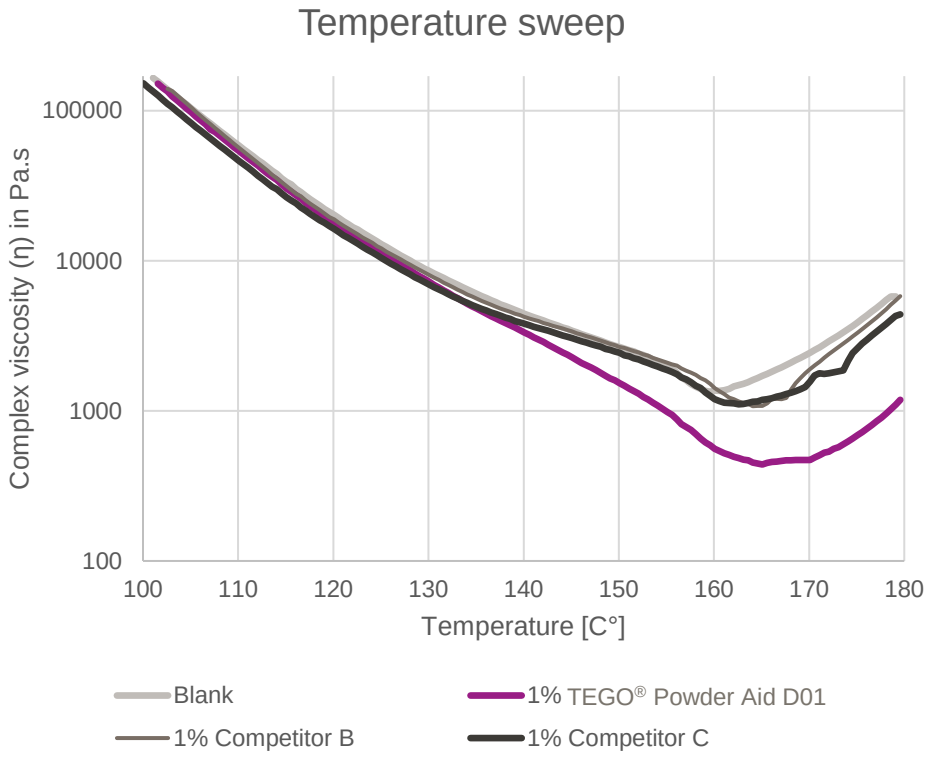
Melt Viscosity – Anton Paar & Pill Flow

HAA Super Durable Light Gray - Highly Filled Inorganic



Pill flow: 1g pill

Test conditions: 149°C / 300°F – 15 min

	Blank	TEGO® Powder Aid D01		Competitor B		Competitor C	
	G1	G2	G3	G4	G5	G6	G7
Pill flow (mm)	40	52	55	39	40	41	42

✓ Reduced melt viscosity with TEGO® Powder Aid D01

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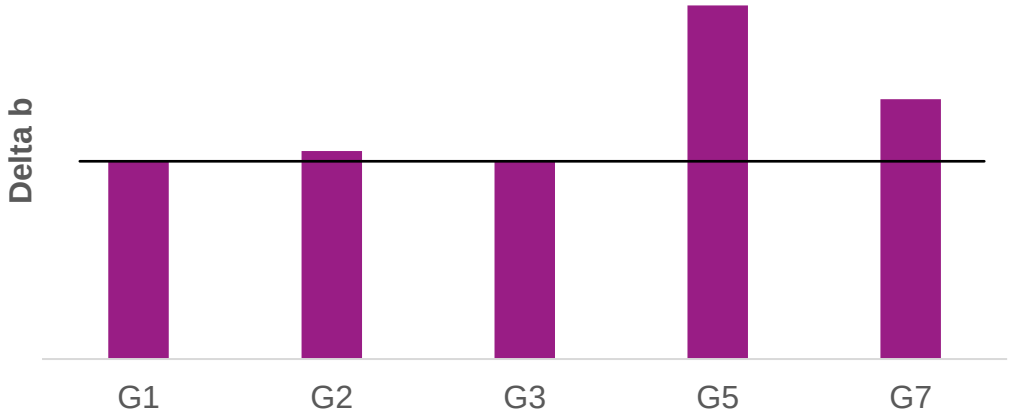
Overbake Yellowing

HAA Super Durable Light Gray - Highly Filled Inorganic

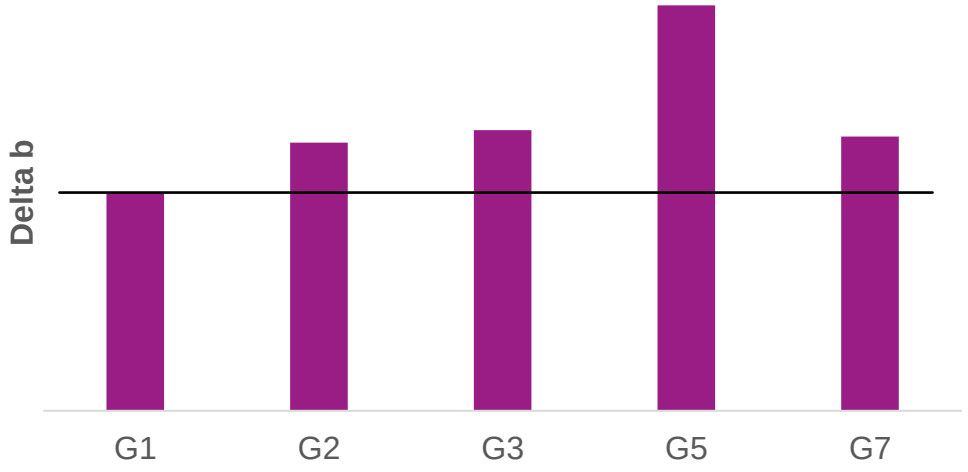
Overbake yellowing at 204 °C / 400 °F – 30 min*

* Electric oven



	Blank	TEGO® Powder Aid D01		Comp. B	Comp. C
	G1	G2	G3	G5	G7
Δb	0.19	0.20	0.19	0.34	0.25

Overbake yellowing at 230 °C / 450 °F – 10 min*



	Blank	TEGO® Powder Aid D01		Comp. B	Comp. C
	G1	G2	G3	G5	G7
Δb	0.35	0.43	0.45	0.65	0.44

- ✓ Minimal effect on overbake yellowing with TEGO® Powder Aid D01
- ✓ Note: All systems had full recoatability adhesion (Crosshatch 5B / GT0)

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Powder Coating Formulation

HAA Super Durable Orange – Organic Pigments

Main Formulation	
CRYLCOAT® 4659-0	68
Primid® XL-552	3.6
Leveling agent	1.0
Benzoin	0.5
Novoperm® Yellow M2R70	8.0
Novoperm® Red F5RK	3.0
COLORTHERM® Yellow 10	1.0
Ti-Pure™ R-960	5.0
Blanc Fixe Micro	10.0
Total	**100.0**
AEROXIDE® Alu C *	0.3

	Blank	TEGO® Powder Aid D01		Competitor B		Competitor C	
	O1	**O2**	**O3**	**O4**	**O5**	**O6**	**O7**
Main Formulation	100%	99.5%	99%	99.5%	99%	99.5%	99%
TEGO® Powder Aid D01	**-**	**0.5%**	**1%**	**-**	**-**	**-**	**-**
Competitor B	-	-	-	0.5%	1%	-	-
Competitor C	-	-	-	-	-	0.5%	1%

* Free-flow additive post-add at grinding

Gloss & Pill Flow

HAA Super Durable Orange – Organic Pigments

Curing condition:

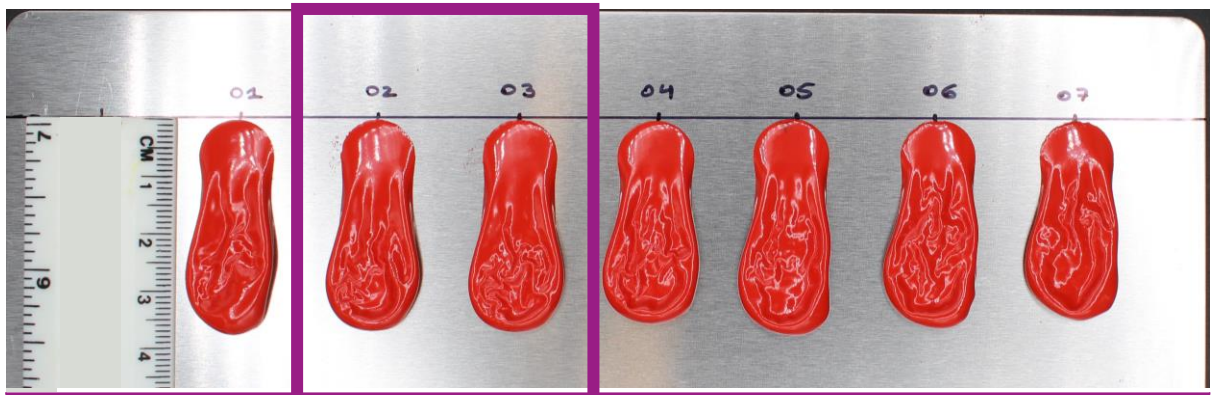
204°C / 400°F – 10 min

	Blank	TEGO® Powder Aid D01		Competitor B			Competitor C
	O1	O2	O3	O4	O5	O6	O7
Gloss Units (20°)	46	51	53	46	46	47	45
Gloss Units (60°)	82	85	86	85	85	85	84
Degassing threshold (µm)	71	76	79	76	79	76	79

- ✓ Better gloss development and with TEGO® Powder Aid D01 with similar effect on melt viscosity.
- ✓ Note: increased concentrations of pigment dispersants have marginal effect on gloss and melt viscosity

Pill flow: 1g pill

Test conditions: 149°C / 300°F – 15 min



	Blank	TEGO® Powder Aid D01		Competitor B			Competitor C
	O1	O2	O3	O4	O5	O6	O7
Pill flow (mm)	37	37	37	35	37	36	35

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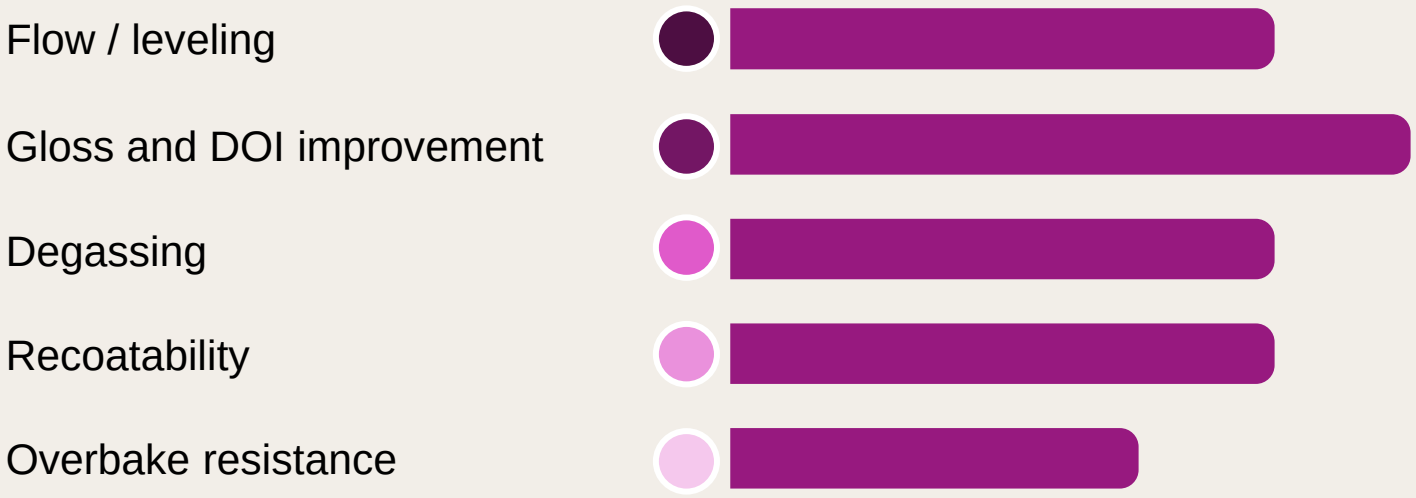
TEGO® Powder Aid D01
Flow & Leveling + Pigment wetting

Powder Coatings

High molecular weight polymer

- 100 % active pellets
- Generates higher DOI and color strength with organic pigments
- Excellent viscosity reduction for flow/leveling during melt phase
- Especially for powder coatings



Technical information

Appearance	**Pellets**
Active matter content	**100 %**
Melting point	**51-52 °C**

Recommended addition level

0.5 up to 2.0 % calculated on total formulation

Processing Instructions

Incorporation with the raw material pre-mix and processing through extrusion.

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Full Set of Product Data Sheets & Additional Promotional Literature available

Additives for powder coatings

TEGO® Powder Aid D01

DESCRIPTION

TEGO® Powder Aid D01 is a solid multifunctional polymeric additive for powder coatings. It provides pigment wetting, reduced melt viscosity, improved gloss, and leveling.

KEY BENEFITS

- effective with high inorganic filler and pigment content
- particularly for carbon black and other organic pigments
- suitable for low temperature curing systems

EFFECT

Flow/leveling

Gloss and DOI improvement

Degassing

Recoatability

Overbake resistance

SUITABILITY

acrylic	epoxy
●	●
epoxy/polyester	**fluoropolymer**
●	●
polyester	**polyurethane**
●	●

○ not suitable ◐ partly suitable ● suitable

TYPICAL APPLICATIONS

Powder coatings

TECHNICAL DATA

active matter content	100 %
appearance	waxy solid
chemical description	high molecular weight polymer
delivery form	pellets

RECOMMENDED ADDITION LEVEL

As supplied calculated on total formulation: 0.5 - 2 wt-%

PROCESSING INSTRUCTIONS

Incorporation within the raw material pre-mix and processing through extrusion.

HANDLING & STORAGE

When stored in original unopened packaging, the product has a shelf life of 24 months from the date of manufacture.

TEGO® Powder Aid D01

Country of Origin		Germany
Packaging	Pail	15 kg
	Sample	1 L Can
Shelf-Life		24 months
Sampling		Essen

ADDITIVES FOR POWDER COATINGS

TEGO® Powder Aid D01

Multifunctional polymeric additive for powder coatings

NEW

Description

TEGO® Powder Aid D01 is a multifunctional polymeric additive for powder coatings and consists of 100 % active matter pellets.

It provides optimum leveling & degassing properties, reduce melt viscosity, and improve pigment wetting. When added to powder coating formulations, this effective additive reduce melt viscosity which leads to improved degassing effect.

TEGO® Powder Aid D01 improves pigment wetting and provides better dispersion during extrusion. It contributes significantly the increase in gloss and DOI. The new additive imparts these positive properties to powder coating formulations without containing surface-active waxes. As a result, overcoating is also possible without any problems.

TEGO® Powder Aid D01– At a Glance

Universal usage	• Suitable for all pigmented and highly-filled formulations • Convenient in any binder system with low dosage
Performance	• Overbake resistant • No effect on interfacial adhesion • Equivalent storage stability
Easy to blend	• Full disperson within polymer matrix • Compatible with other additives

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