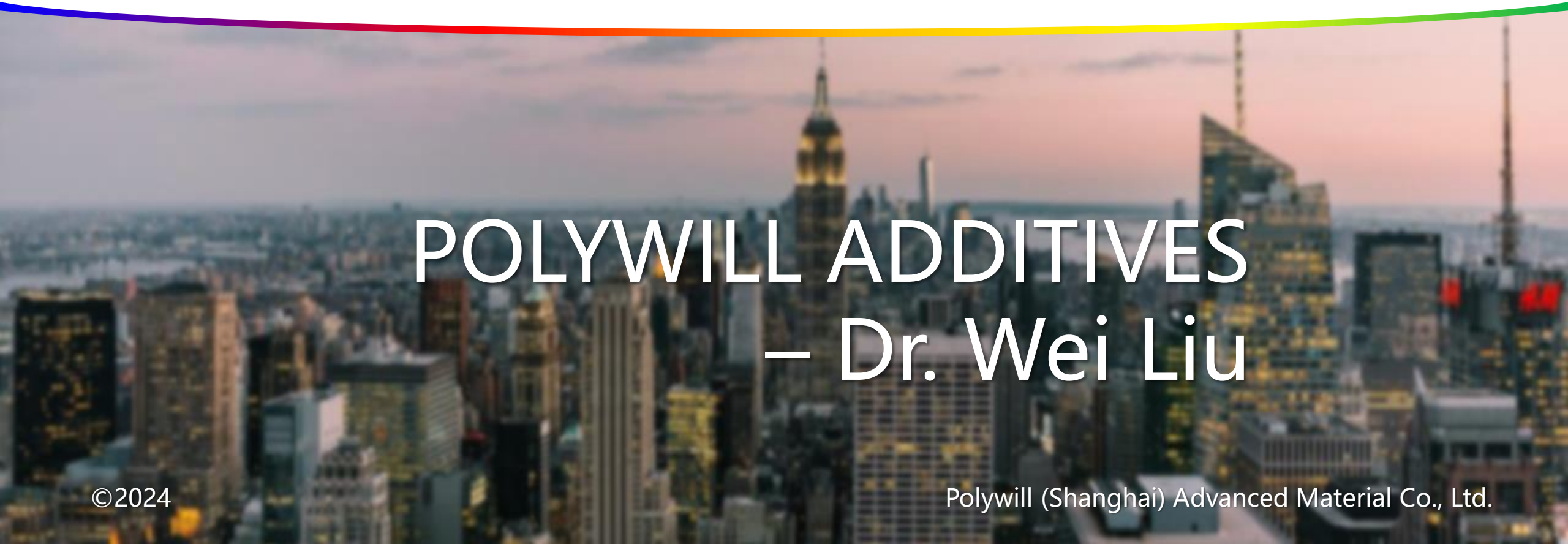
POLYWILL ADDITIVES

Driven By Your Challenges



POLYWILL ADDITIVES – Dr. Wei Liu

Content

01 Company Introduction

02 Additives for Architecture Coating

03 Additives for Solvent-borne Industrial Coating

04 Additives for Solvent-borne Floor Coating

Core Team

CTO

- Doctor of the **Chinese Academy of Science**
- Ex-Asian Pacific core R&D Director of **Valspar**
- Ex-Chief Scientist of **Dow Chemical** (Coating Dept.)
- **30+** patents

General Manager

- Ex-Greater China Business Director of **Dow Chemical** (Coating dept.)
- Ex-General manager of joint venture of **Dow & Sinopec**
- Board member of **LOGOS Packaging Co. Ltd**

R&D+ Tech. Service

- Doctor of University of Pennsylvania, Imperial College London and etc.
- R&D Director of **Solvay China**
- R&D Manager from **AkzoNobel** (Coating Dept.)
- R&D Manager from **Kansai Paint**

Manufacture & Supply Chain

- Plant manager of **Dow Chemical Shanghai** (Coating Dept.)
- Ex-process director of **Axalta** (Coating Dept.)
- Ex-Logistics Manager of **Rohm and Haas**

- Headquartered in Shanghai
- with over 2,000m² of R&D center

Analytical Lab

Synthesis Lab

Application Lab

Manufacturing Plant

- Two manufacturing plants based in East China and North China.
- Both equipped with application lab
- High-Standard Manufacturing Systems

DCS Control System

Advanced Manufacturing Equipment

Supply Chain Management

Shanghai R&D Center Equipment

Agilent GPC System

Agilent GC/MS System

Thermo-Scientific IR

Minor Water Content Analyzer

Spectrophotometer

Brookhaven Nano-Particle Size Analyzer

AMETEK Oxygen Permeation Analyzer

Shanghai R&D Center Equipment

Tensile Strength Analyzer

Precision Balance

Flash Point Tester

Surface Tension Analyzer

MFFT Tester

Heat Seal Analyzer

Centrifugal Machine

Application Laboratory Equipment

Brookfield Viscometer

Stormer Viscometer

ICI Viscometer

GRACO Airless Spraying

Rotary Abrazer

X-rite
Colorimeter

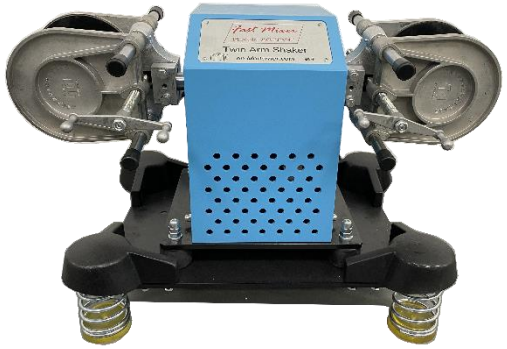
Glossmeter

Application Laboratory Equipment

Temperature Cycling Test Device

Salt Spray Resistance Testing Device

Weathering Testing Device



Shaking Disperser

Scrub Resistance

Our Clients

POLYWILL ADDITIVES

SHERWIN WILLIAMS

NIPPON PAINT

AkzoNobel
Tomorrow`s Answers Today

BASF
We create chemistry

KANSAI PAINT

DOW

Flint Group

Marie's

东方雨虹
ORIENTAL YUHONG

musashi paint

Color & Comfort

CARPOLY
嘉宝莉

BADESE 巴德士漆

JOINTAS 集泰股份

富思特
涂料保温一体化

DAIHO 大宝漆

HAOLISEN
浩力森

展辰新材

紫荆花漆
BAUHINIA PAINTS

BBMG
北京金隅股份有限公司
BBMG CORPORATION

三棵树

Kinte

湘江漆

Product Application Industry

POLYWILL ADDITIVES

Architectural paint & Water-proof

Pigment & Colorant

Wood Paint & Furniture

Metal Protection

Leather & Textile

3C & UV

Additive Product Line

Dispersants

- Wetting & Dispersing of pigments and fillers

Defoamers

- Foam control,
  Eliminate adverse effect from foam

Surface Additives
(Wetting & Leveling)

- Improve the wetting and spreading on metal surfaces
- Improve leveling, gloss and scratch resistance

Rheology Modifier

- Improve production,
  storage and application stability

Corrosion & Rust Inhibitors

- Prevent corrosion from moistures
- Improved salt-spray resistance

Functional additives

- Adhesion promoters
- Freeze-thaw resistance
- Aluminum orientation control
- Formaldehyde abating agent

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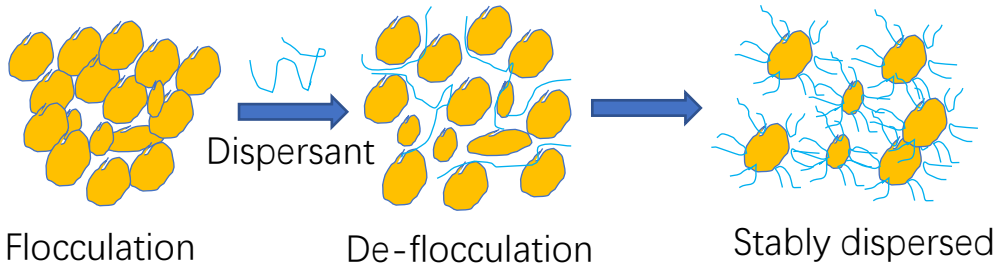
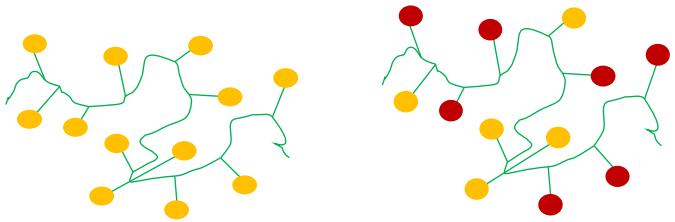
Dispersant

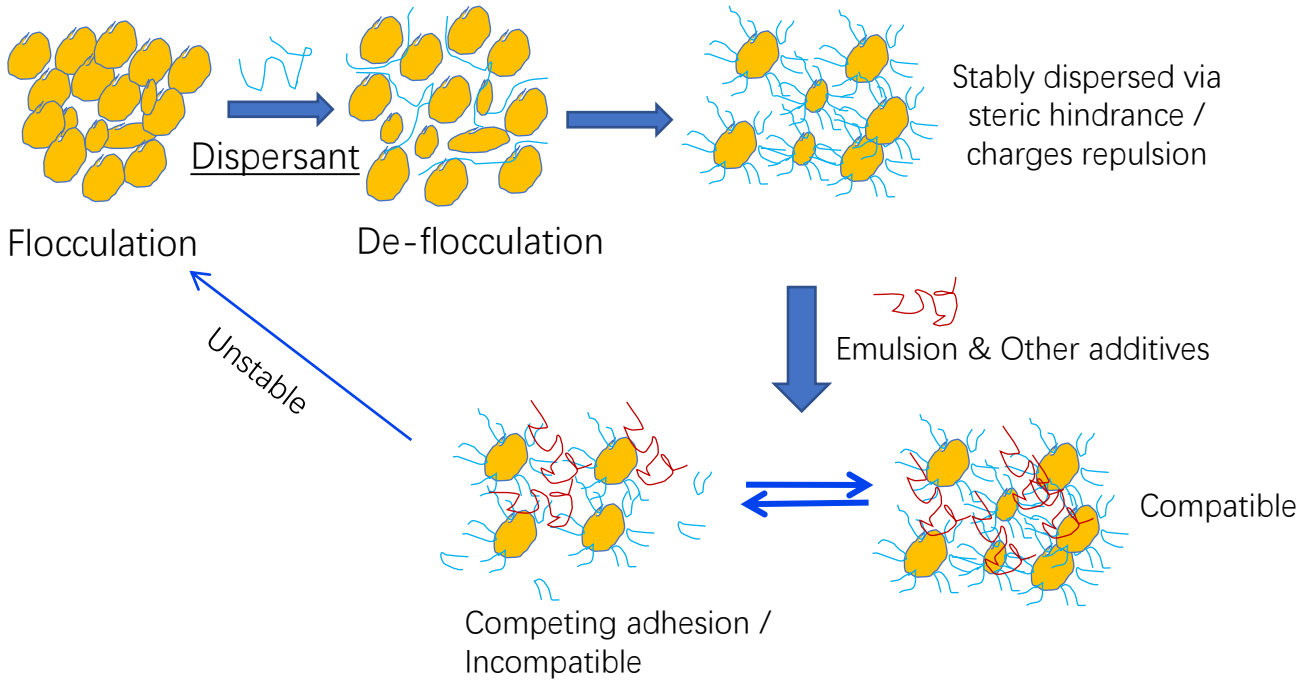
Dispersing of fillers/pigments：



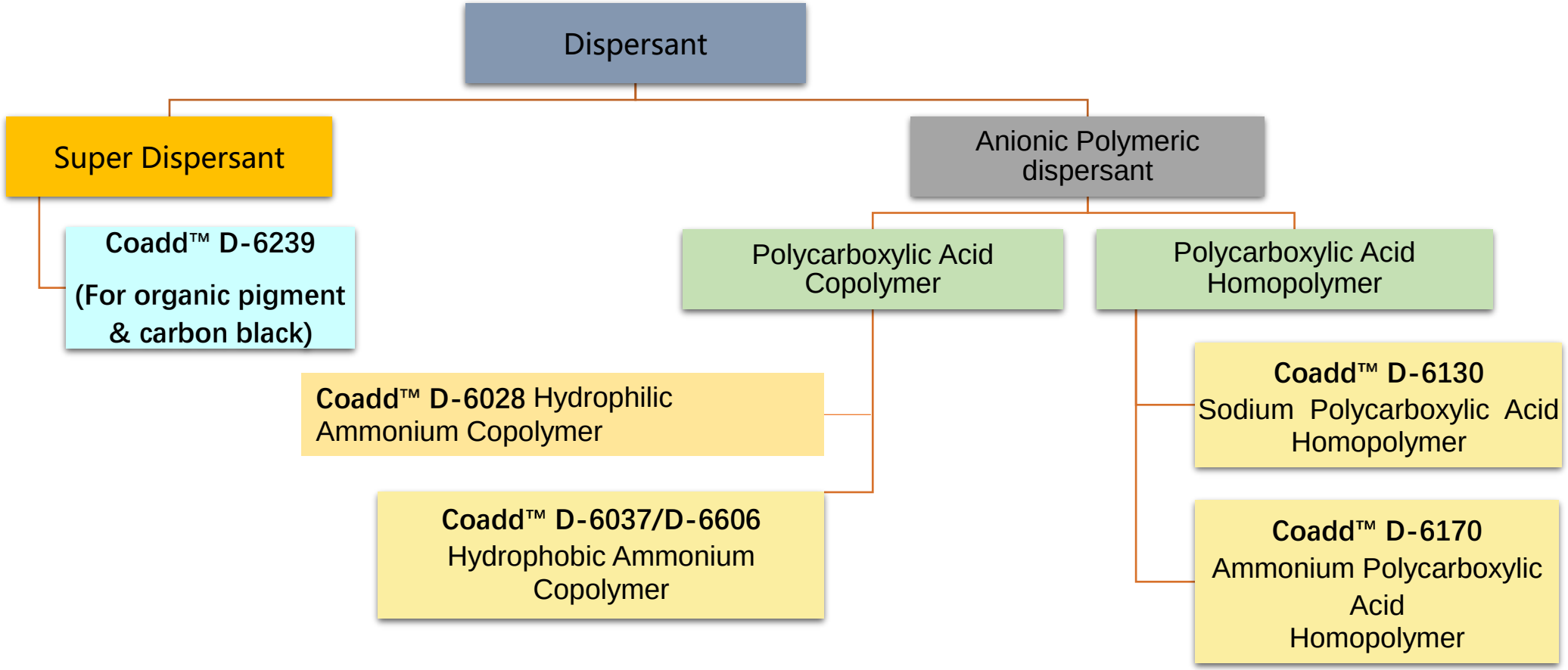


Functional groups: ions, nonionic, chelation group, association group, hydrophobic, hydrophilic

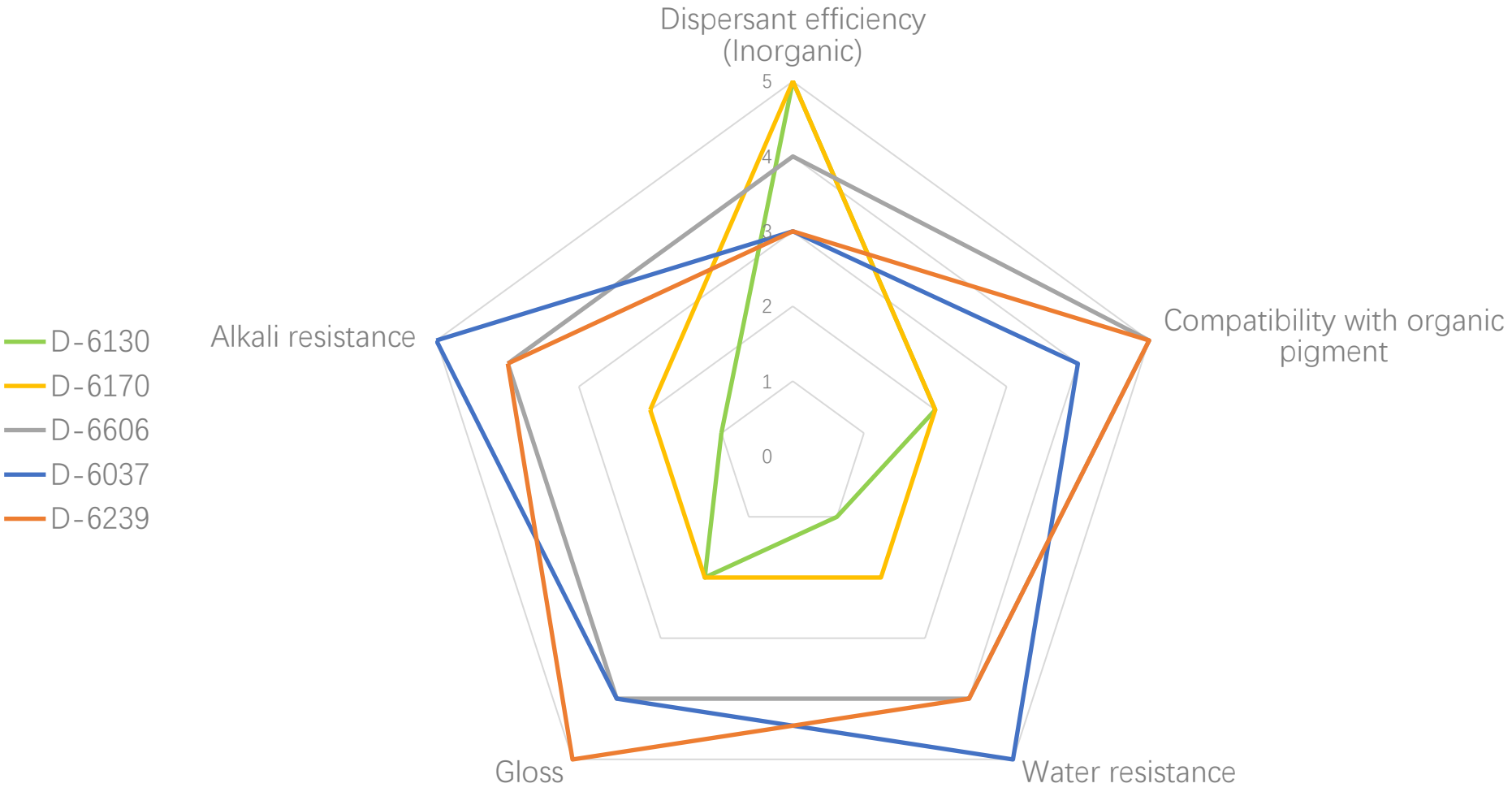
Stabling effect of dispersants in system：



Polywill Dispersants - Introduction



Dispersant – Product Performance



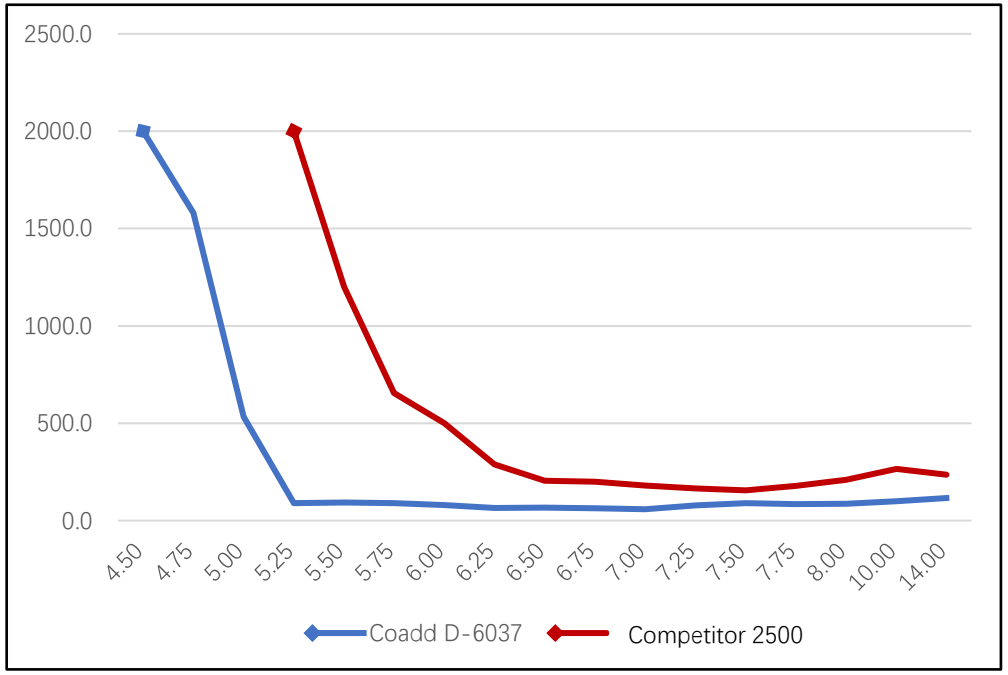
Coadd D-6037 Introduction

Coadd D-6037 has excellent early stage water resistance and early stage scrub resistance. Also the product has good rain imprint resistance, and high dispersing efficiency and compatibility compared to current market popular product.

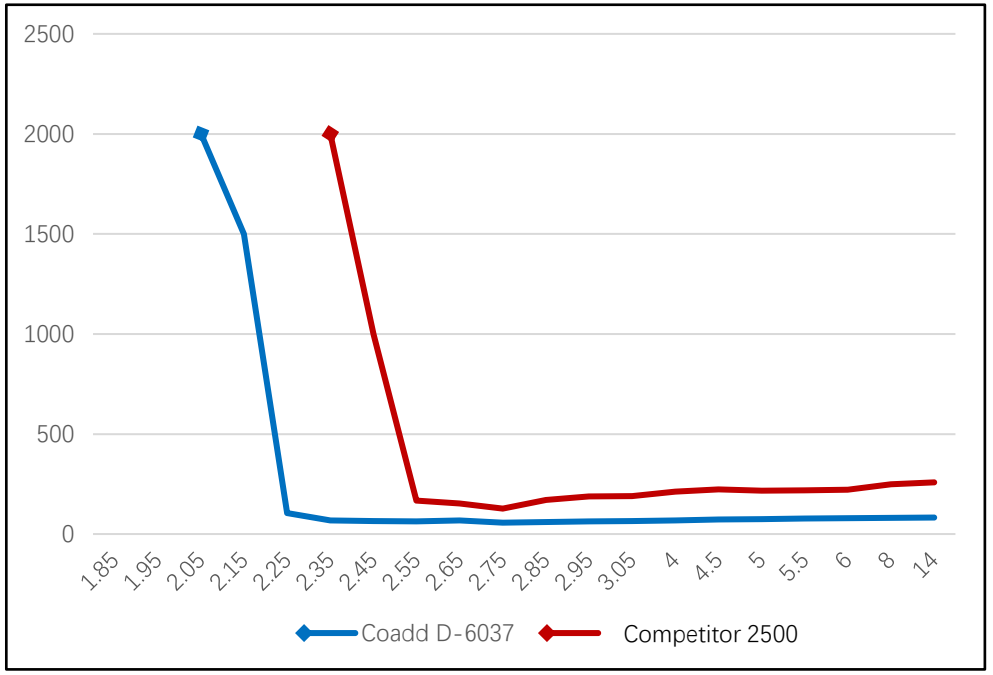
D-6037 Competitor

Coadd D-6037 – Provides high dispersing efficiency

TiO_2 Dispersing curve



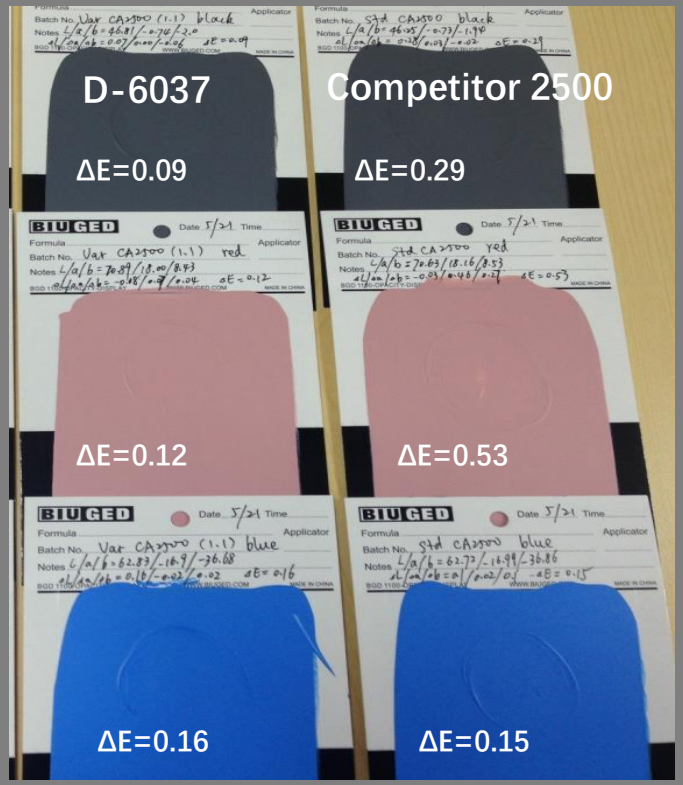
$CaCO_3$ Dispersing curve



Competitor 2500 is a popular market product similar to **Coadd D-6037**

Conclusion: Dispersing efficiency wise, **Coadd D-6037 > Competitor 2500**。

Coadd D-6037 & Competitor 2500 - Color Development & Acceptance



Rub-out test straight after let-down

Rub-out test after 30D heat age

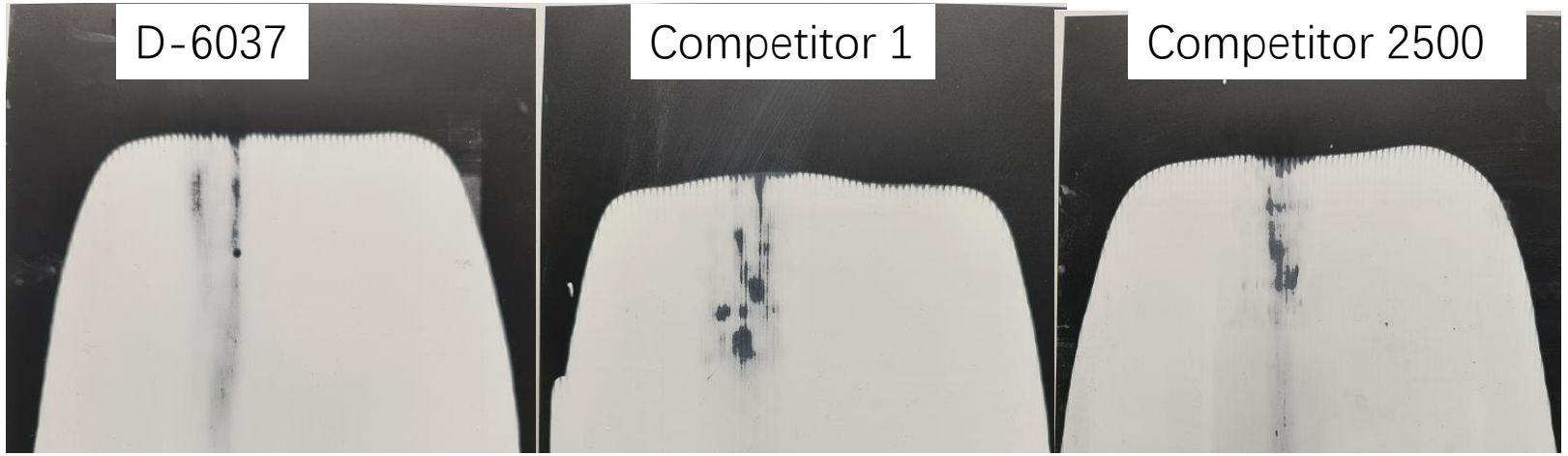
Coadd D-6037 has similar performance as Competitor 2500

Conclusion:

Coadd D-6037 has similar color development & acceptance as competitor 2500

Test result

Early-stage scrub-resistance



Early-stage water-resistance

From the test result, Coadd D-6037 has good early stage scrub resistance and early stage water-resistance compared with competitor products

Defoamer

Defoamer effects:

Foam inhibiting, foam releasing, foam breaking

Types of defoamers:

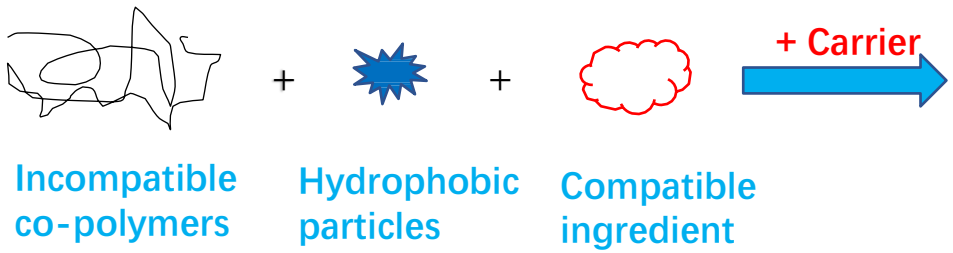
Mineral oil, Polysiloxane, Polymers

Mineral oil: DF-6136, DF-6139, DF-6035, DF-6801

Polysiloxane: DF-6022, DF-6602, DF-6050, DF-6633, DF-6821, DF-6860

Polymers: DF-6012, DF-6202

Components in defoamers:

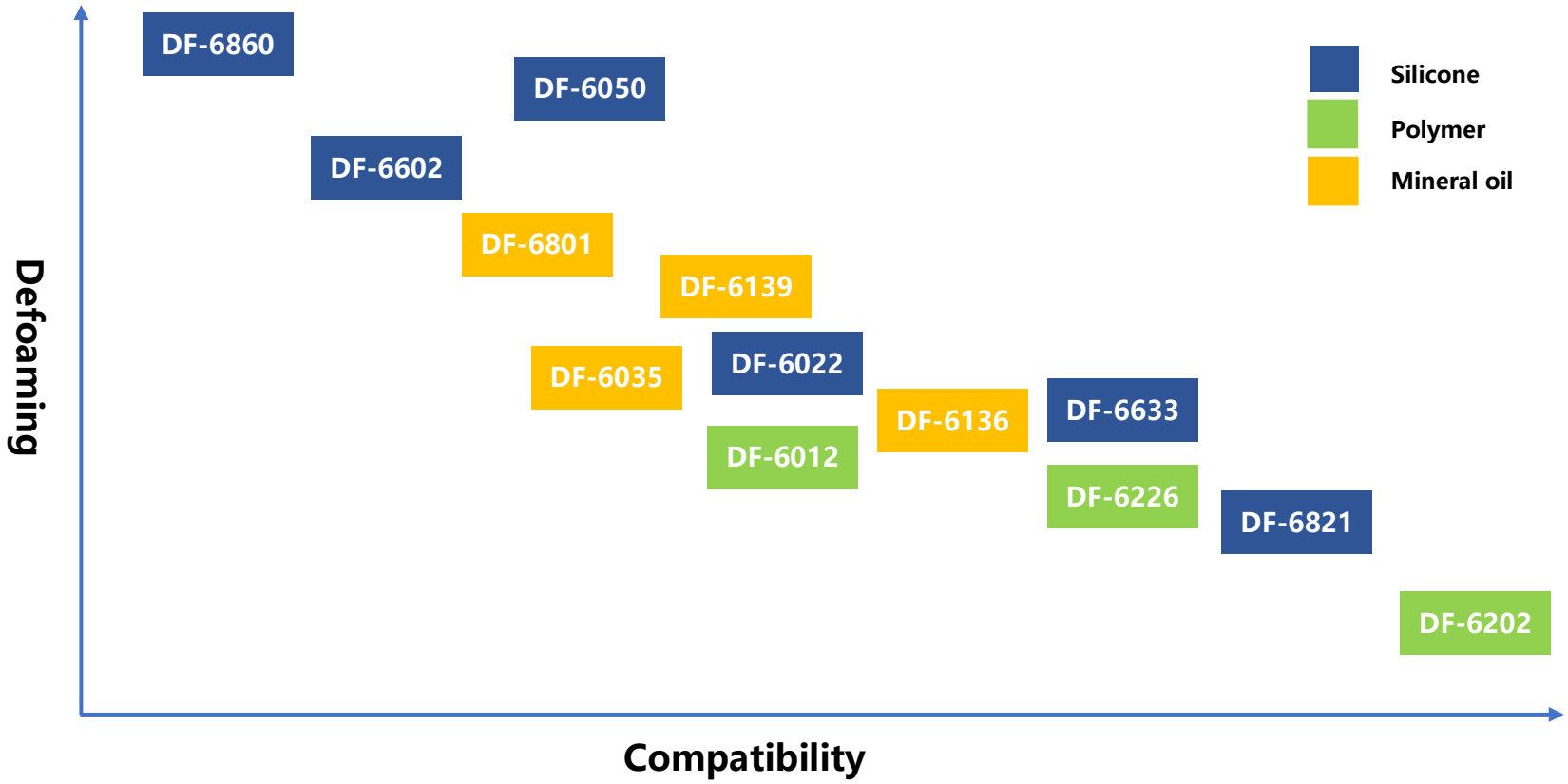


Balanced defoaming performance and compatibility

Good compatibility, but bad defoaming performance

Bad compatibility, but good defoaming performance

Defoamer - Comparison



Coadd D-6050 is a dispersion of modified polysiloxane, and is suitable for water-borne architecture, industrial and water-proof coatings. This product is zero VOC, and versatile defoaming agent, has wide range of temperature and pH adaptability, also it is convenient to operate, and has strong dispersibility. It is characterized by its rapid foam-breaking, strong foam inhibition, and excellent performance in micro-foam breaking.

PHYSICAL PROPERTIES

Appearance	White milky liquid
Non-volatile content (150℃, 30mins)	21%
Density (g/ml)	1.0
Viscosity (25℃; mPas)	<5000

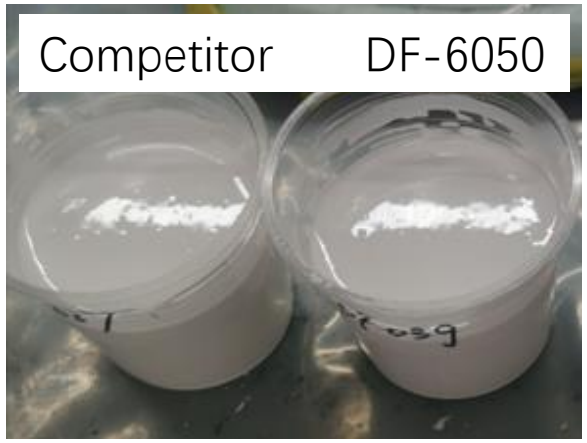
The suggested dosage is typically 0.1 – 1.0% based on total formulation.

Optimal dosage levels are determined through series of tests.

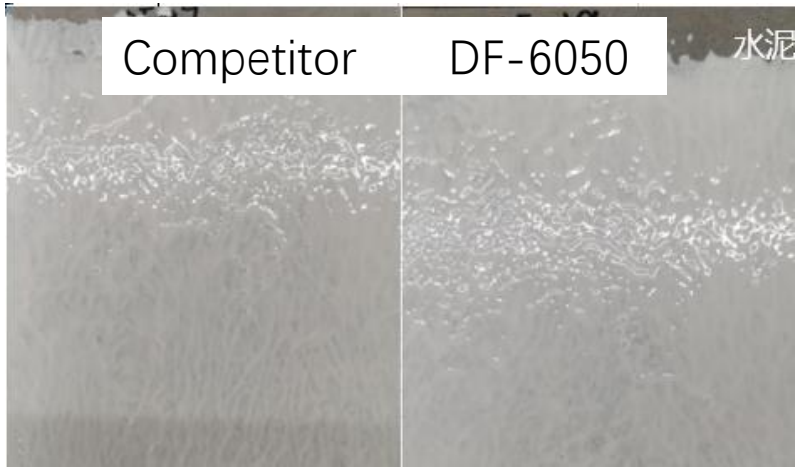
DF-6050 test result

Styrene-Acrylic system

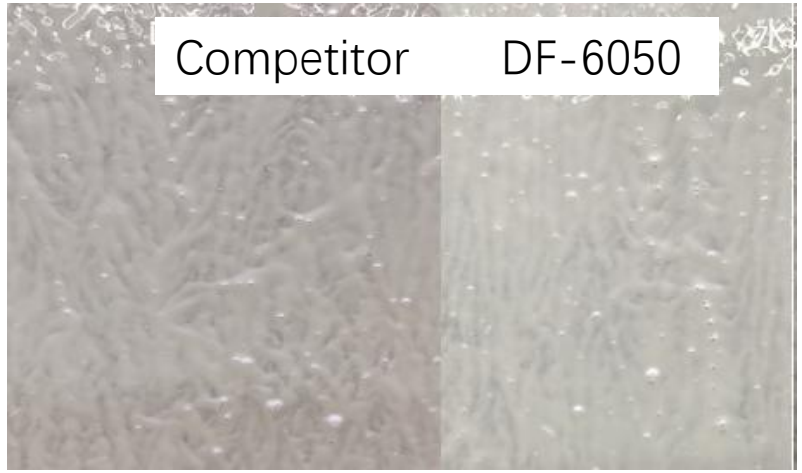
In-can status



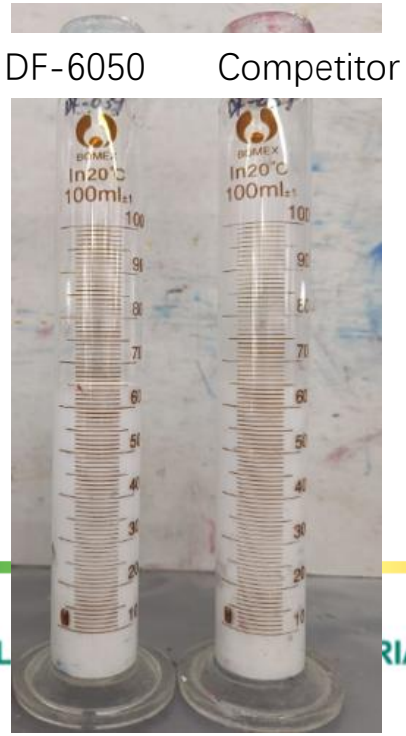
Coating results



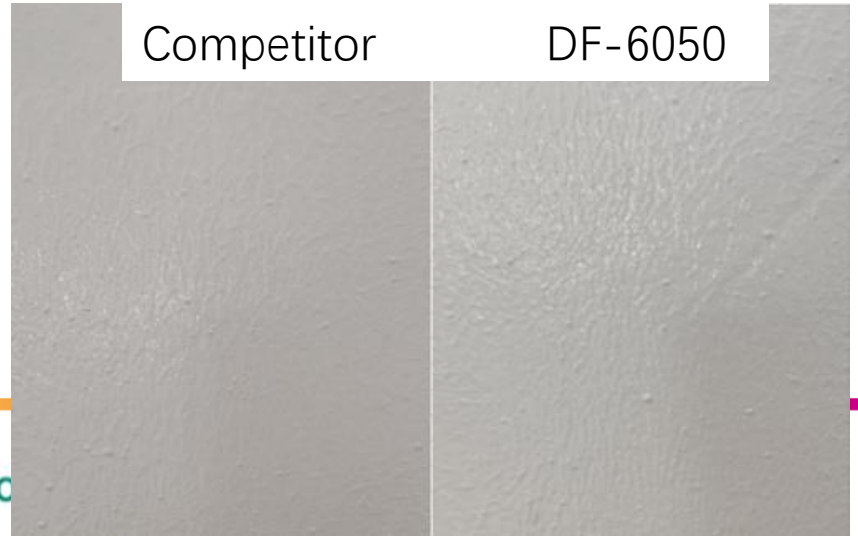
Coating results after 14D heat storage



VAE system



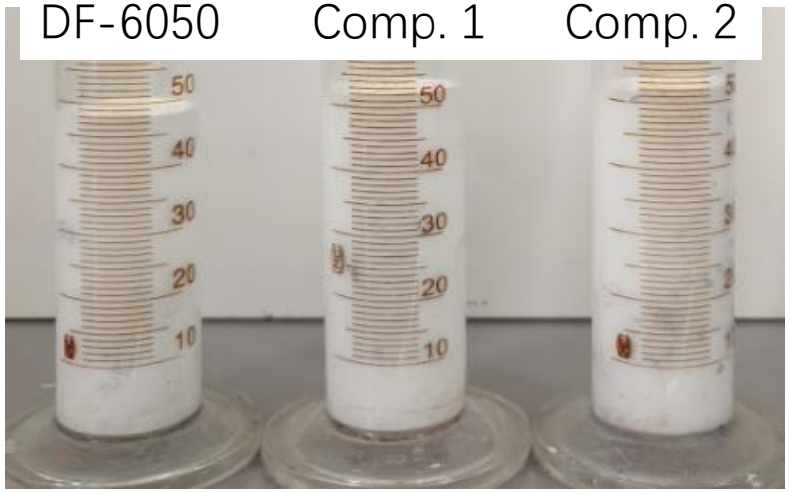
Coating results after 14D heat storage

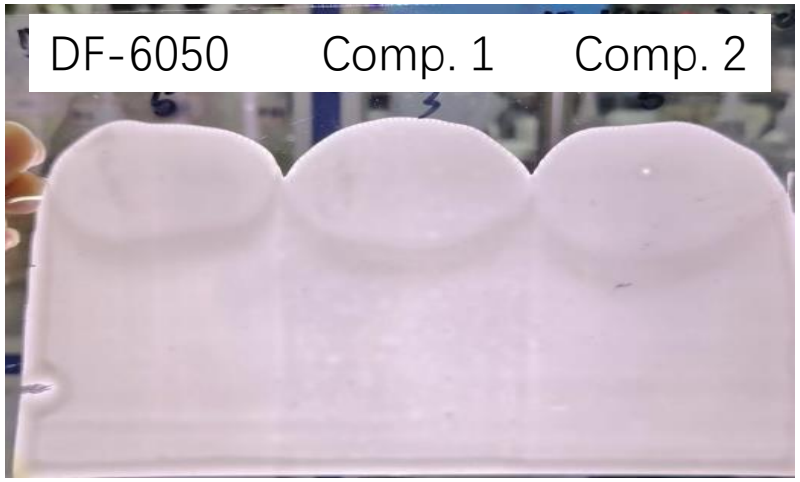


Conclusion: In here we have chosen the best general purpose product on market as competitor. From the test result, it shows that DF-6050 has similar performance compared with competitor product.

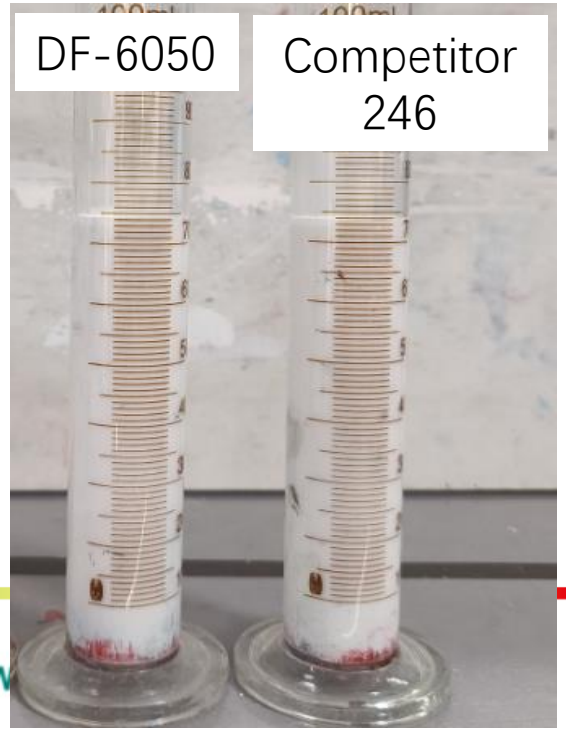
DF-6050 – Test result for different PVC

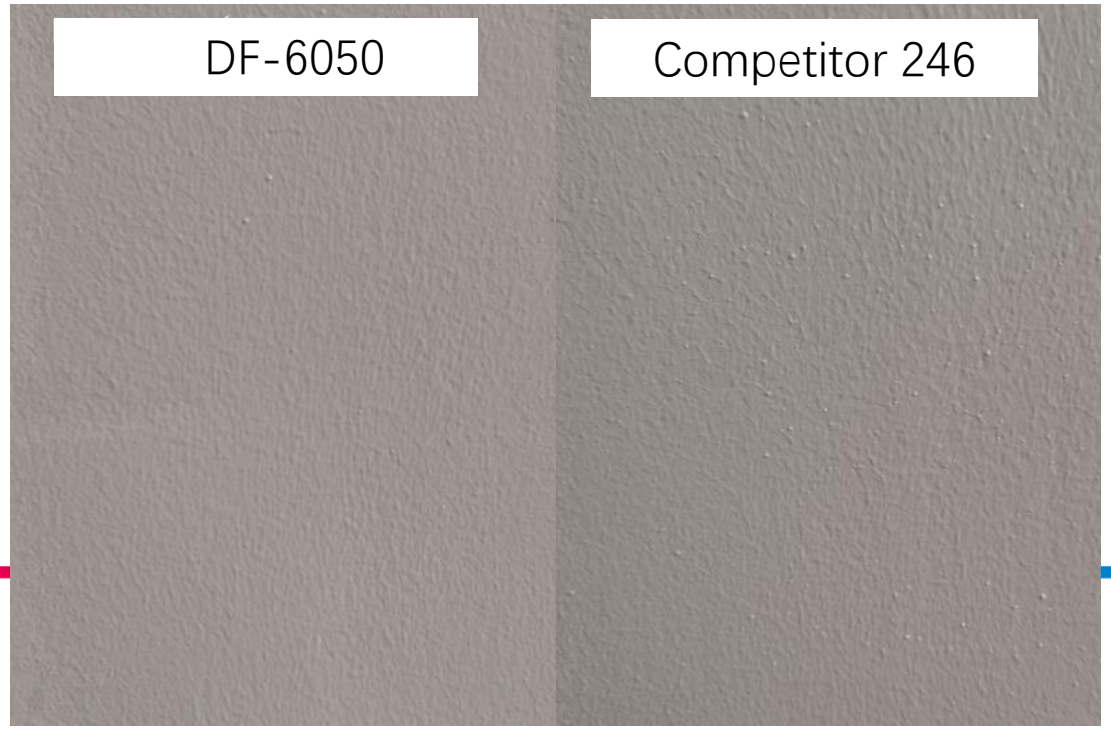
Low PVC system





High PVC system



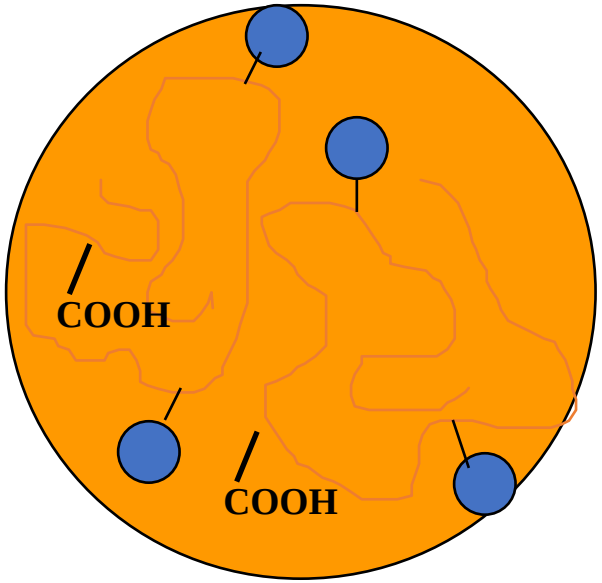


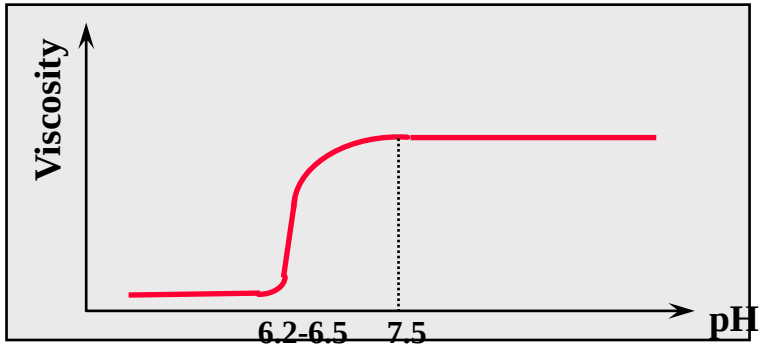
Test result - conclusion

- Better defoaming efficiency in most architecture coating compared with competitor product
- VOC free
- Similar heat storage stability compared with Competitor
- Excellent compatibility
- Universal & cost-efficient product for most systems

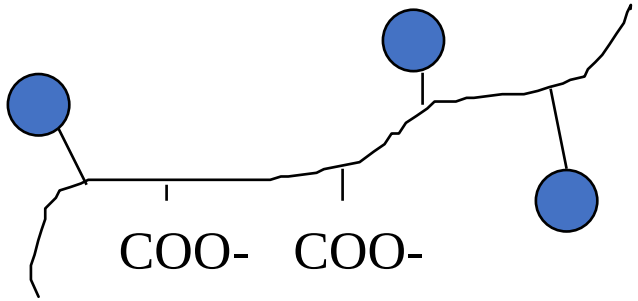
Rheology Modifier (Thickener)

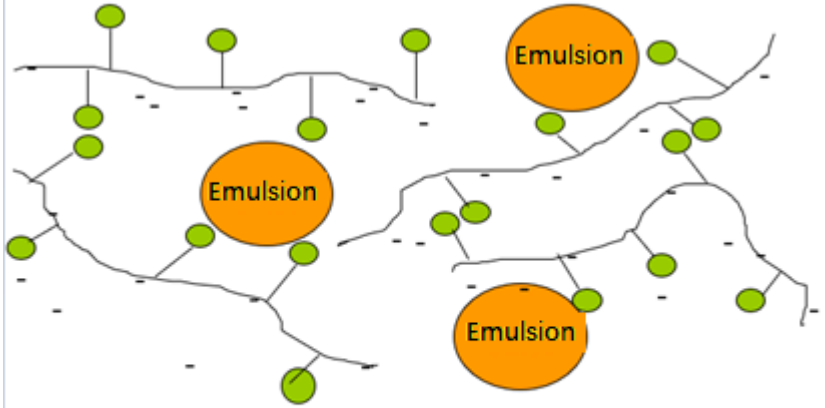
HASE thickener structure





Alkali condition



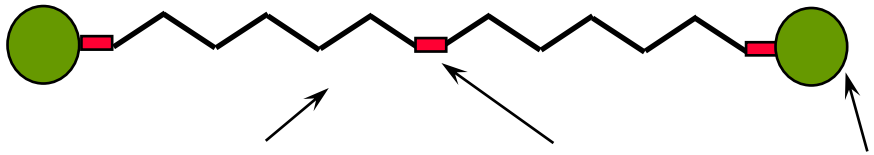


Thickens both water phase and emulsion phase

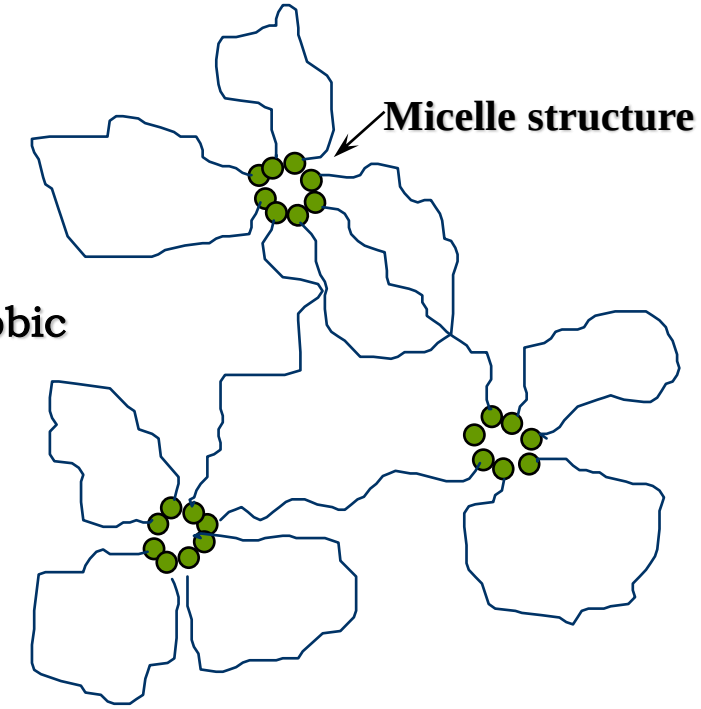
pH ~ 3-4

pH ~ 7-10

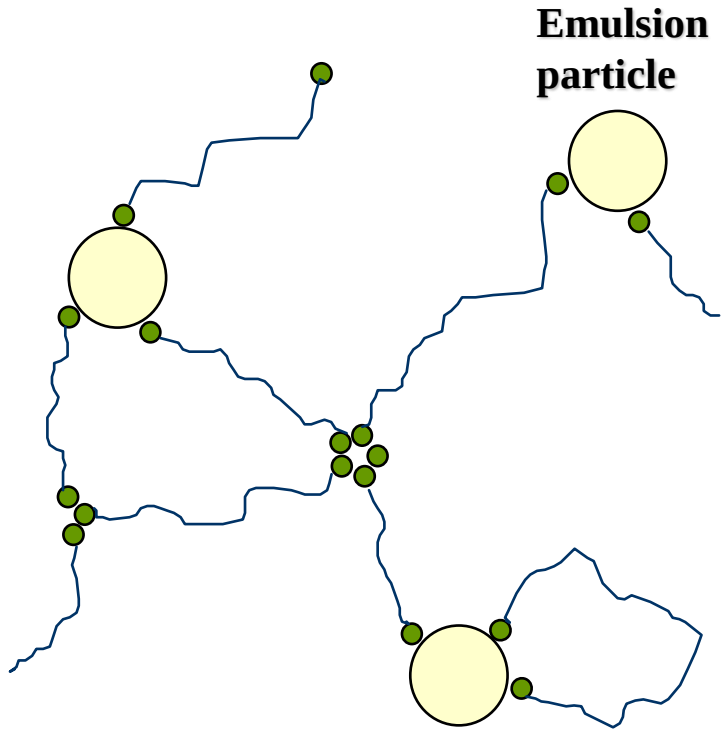
HEUR thickener structure



HEUR structure



Water-phase



Emulsion phase

Polywill Rheology Modifier

Low Shear Viscosity Thickener

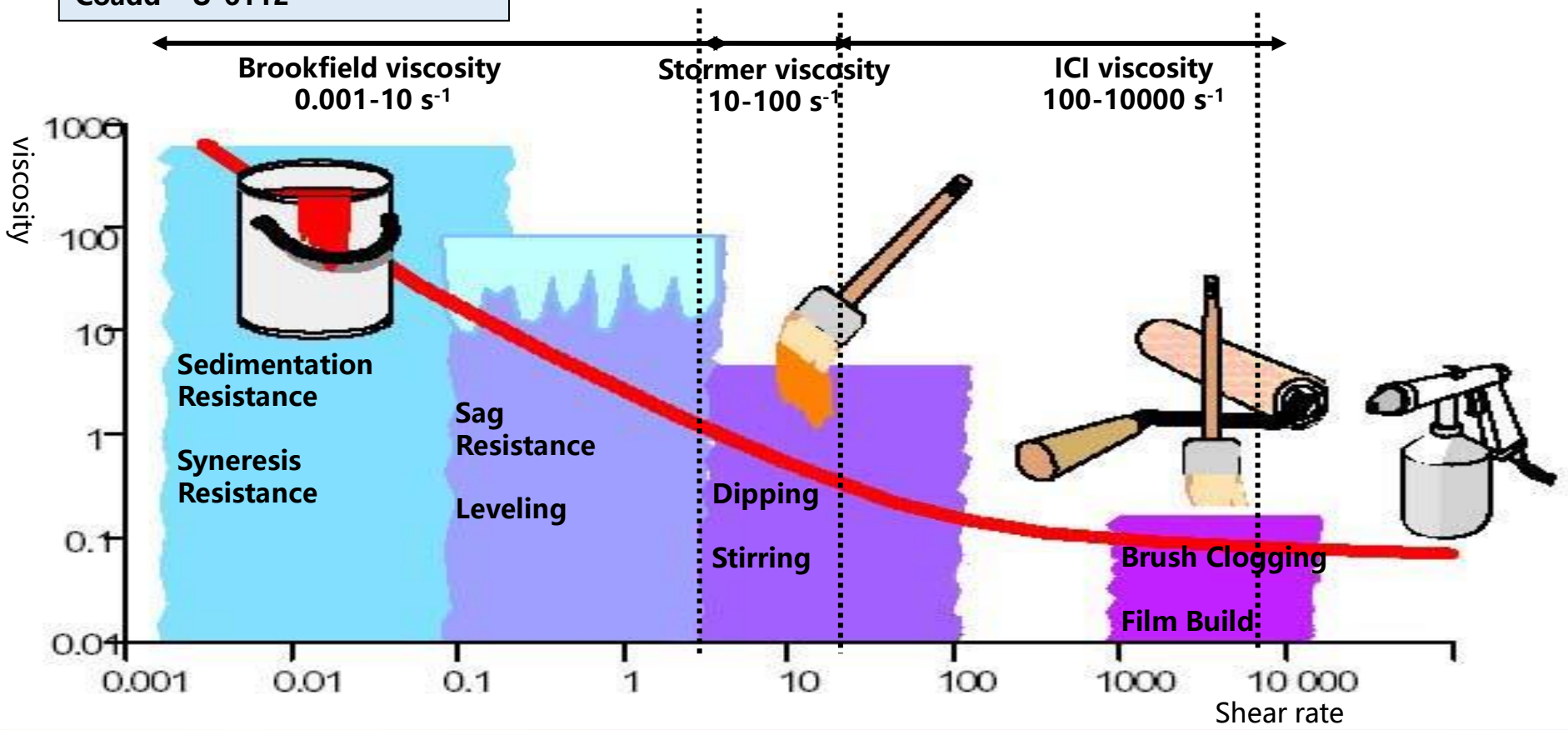
Coadd™ A-6016/H-6120/ H-6150
Coadd™ U-6112

Mid-Shear Viscosity Thickener

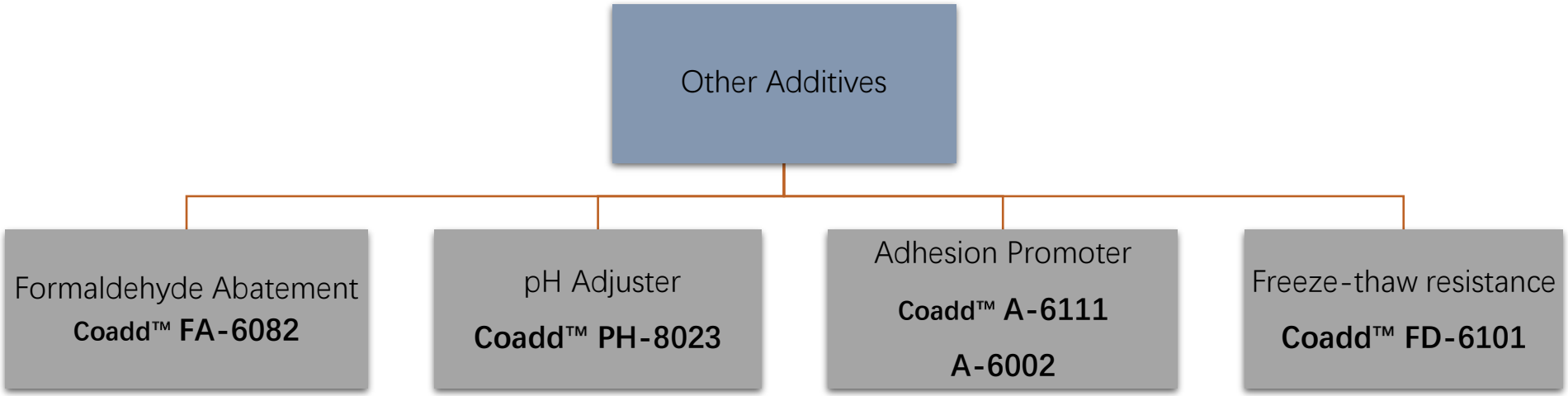
Coadd™ H-6350/H-6360
Coadd™ U-6508

High Shear Viscosity Thickener

Coadd™ U-6920



Polywill – Other Additives



Other Additives – Formaldehyde Abatement

Storage stability test

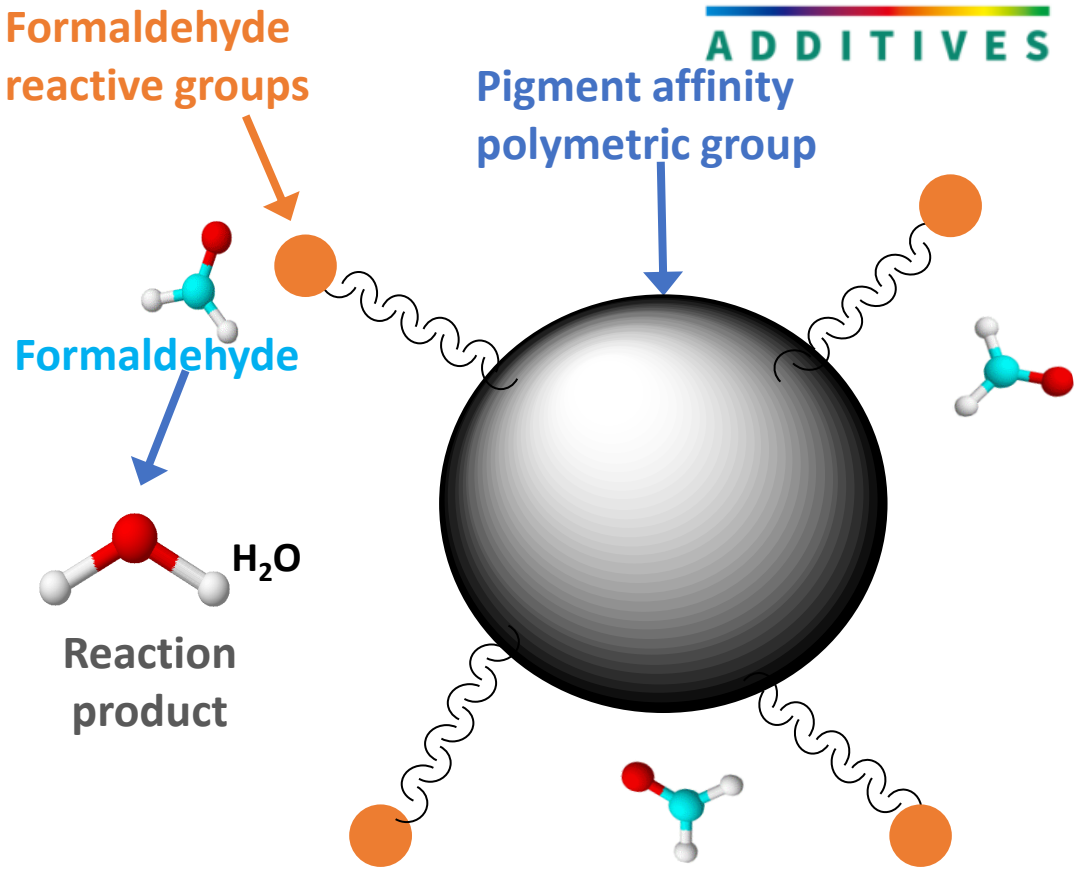
	pH		KU		Hiding power		Appearance	
	No FA-6082	2% FA-6082	No FA-6082	2% FA-6082	No FA-6082	2% FA-6082	No FA-6082	2% FA-6082
Initial	8.46	8.78	90.8	92.8	96.5	96.26	Uniform	Uniform
5 days	8.42	8.13	90.1	92.2	95.15	95.96	Uniform	Uniform
Change	-0.04	-0.65	-0.7	-0.6	-1.35	-0.3		
30 days	8.19	7.83	88.2	90.1	95.07	95.68	Uniform, slight yellow	Uniform, slight yellow
Change	-0.27	-0.95	-2.6	-2.7	-1.43	-0.58		

No VOC, almost no effect on system storage stability

Formaldehyde abating efficiency test

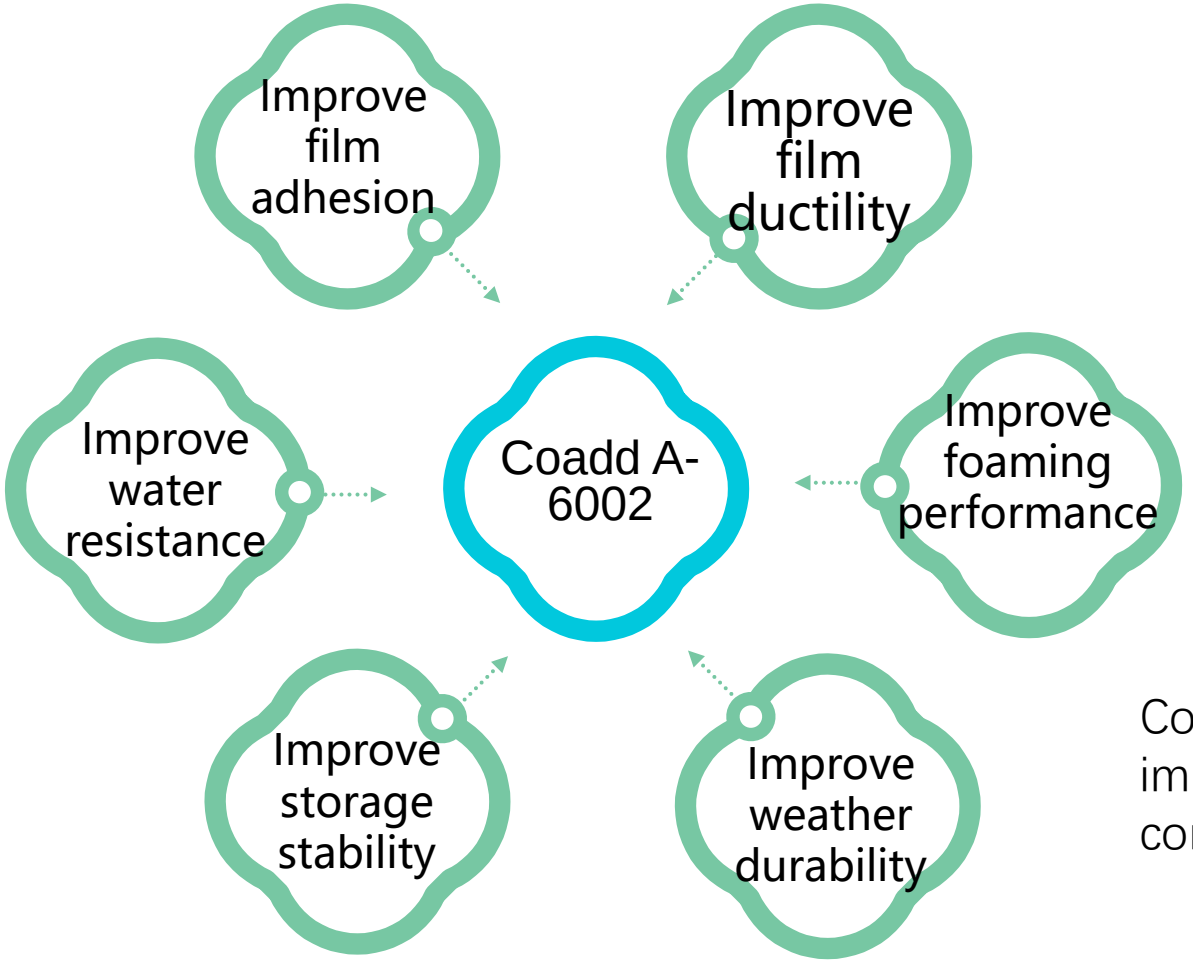
Detail	Formaldehyde reduction	Reduction persistency (1000h)
Blank (No FA-6082)	48%	40%
2% Coadd FA-6082	> 87%	>75%

Test carried out under JC/T1074-2008

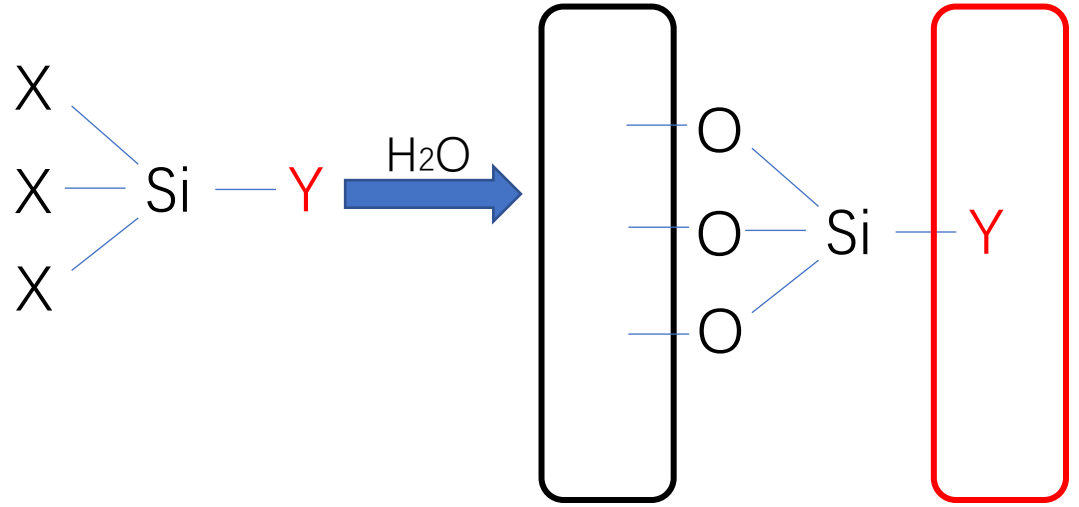


The Formaldehyde reactive groups are wrapped around the polymetric group with pigment affinity, improves the reactive surface area and efficiency. Also provides long lasting formaldehyde abating effect.

Other Additives – Adhesion Promoter



Product structure and mechanism:



Compared with A-6111, A-6002 has better adhesion, and improved hardness when incorporated in system. But compromised some compatibility

Coadd A-6002 is suitable for exterior tile adhesives and stone textured paints

- **FD-6101 Introduction:**

Appearance	Colorless to light yellow liquid
Active content (%)	>85
Density (g/ml)	1.12
Viscosity (25°C, mPa.s)	<5000

Product features:

•VOC free, by substitute EG and PG in formulation

•Improves freeze-thaw stability

•Enhances gloss

•Improve stain resistance

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Dispersant

Product	1K			2K PU	2K epoxy	Application	Characteristics
	Acrylic	PU	Alkyd				
Coadd DO-1202	△		△		△	Inorganic pigment, anti-corrosion pigment and fillers	Improve the system anti-sedimentation
Coadd DO-6311	△	△	△	△	△	Organic, inorganic and carbon black	Excellent in prevent floating and flooding, good viscosity reduction
Coadd DO-6269	△	△	△	△	△	Organic, inorganic and carbon black	Contains anchoring group for both organic and inorganic pigment, universal product
Coadd DO-6265	△	△	△	△	△	Inorganic pigment, fumed silica	Excellent color stability
Coadd DO-1051	△	△	△	△	△	Inorganic, especially titanium oxide and pigment co-grinding	Effective for floating and flooding, especially in epoxy system.
Coadd DO-1030	△	△	△	△	△	Inorganic pigment, fumed silica	Suitable for inorganic pigment and matting powder
Coadd DO-3150	△		△		△	Inorganic pigment, anti-corrosion pigment and fillers	Suitable for medium polarity system, especially corrosion resistance coatings. Can effectively improve sag-resistance and sedimentation
Coadd DO-3160	△		△		△	Inorganic pigment, anti-corrosion pigment and fillers	Suitable for non-polar system, similar performance to R-3150. Recommend for formulations with fumed silica.

△ indicates recommended

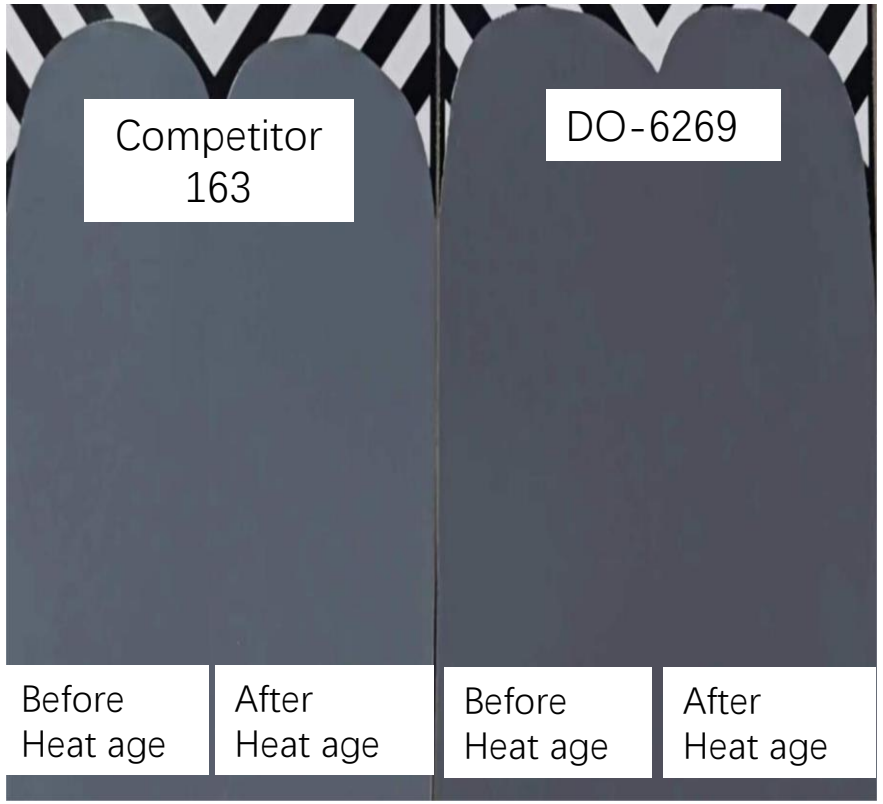
DO-6269 Test result – Hydroxyl acrylic system for carbon black

Test result for FW200 carbon black

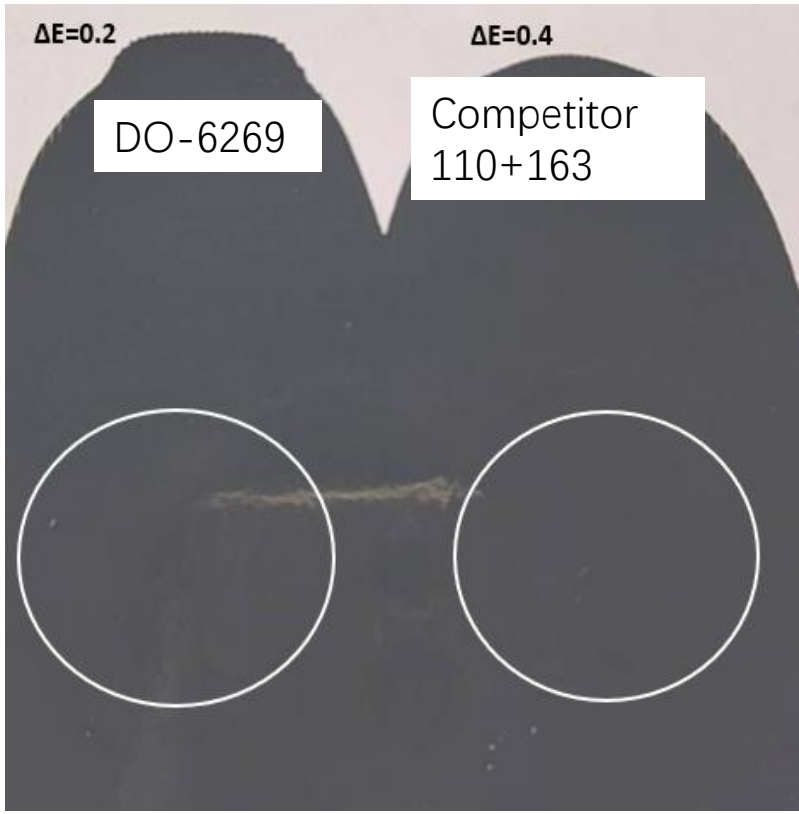
Test result

Test detail	DO-6269	Competitor 163
Fineness (um)	10	10
Color development	5	4
Hiding power	5	5
BF viscosity (4#60R)	2580	3000
Gloss	95/95	95/95
Tinted gloss	95/95	95/95

White reduction

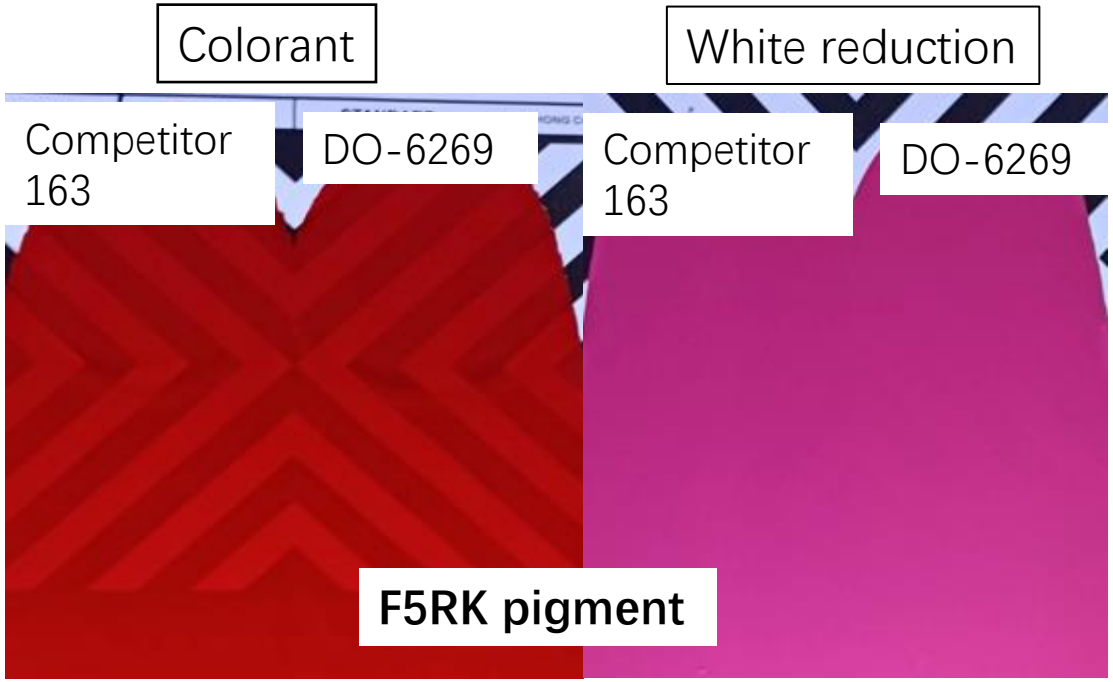


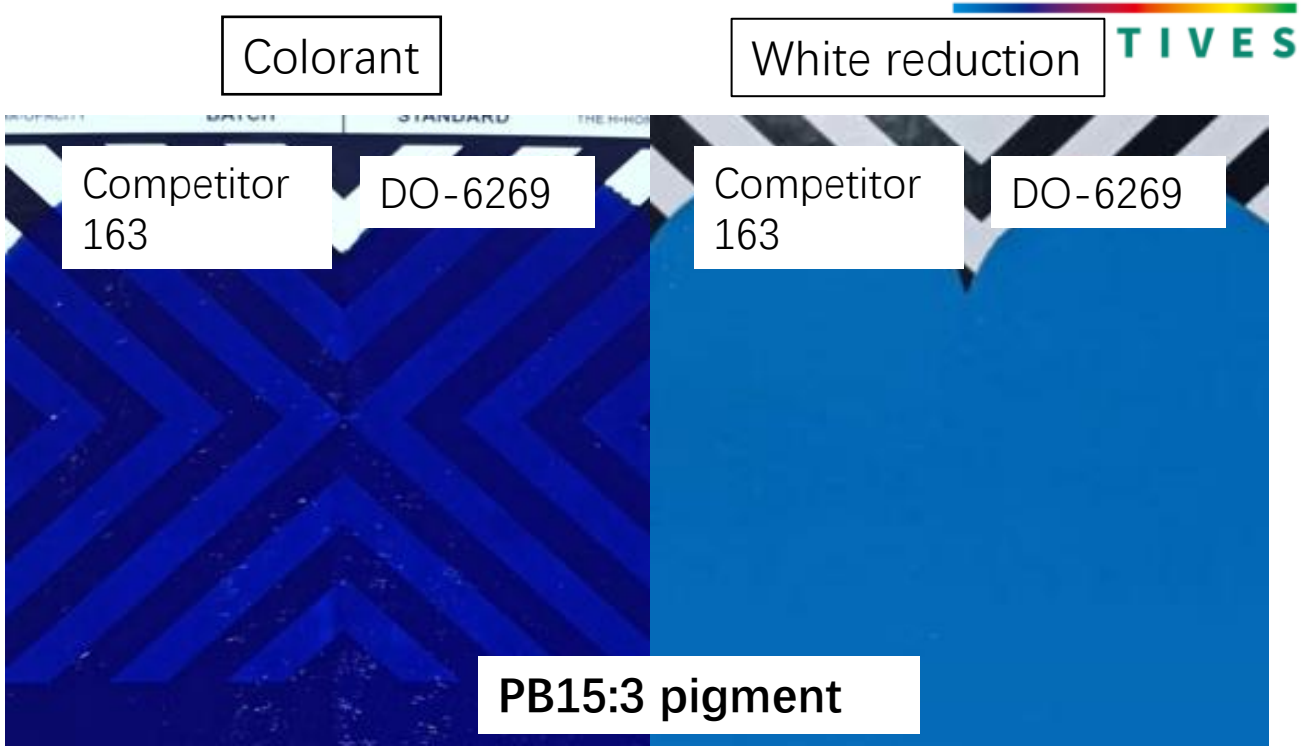
White reduction color floating test

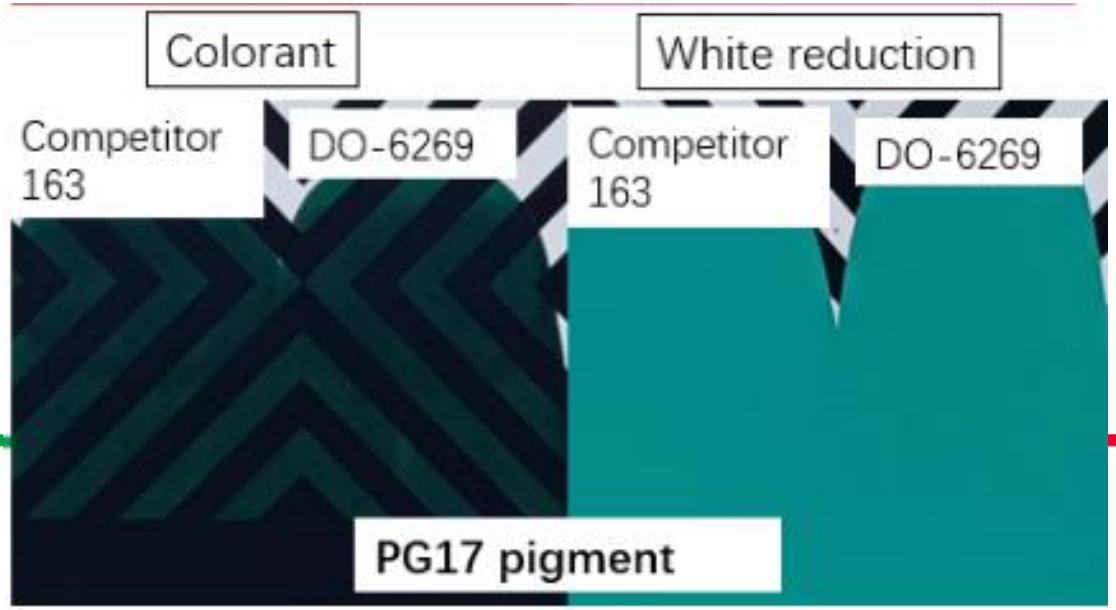


DO-6269 has good performance in grey color strength with FW200 carbon black, also can prevent color floating.

DO-6269 Test result – Pigment compatibility



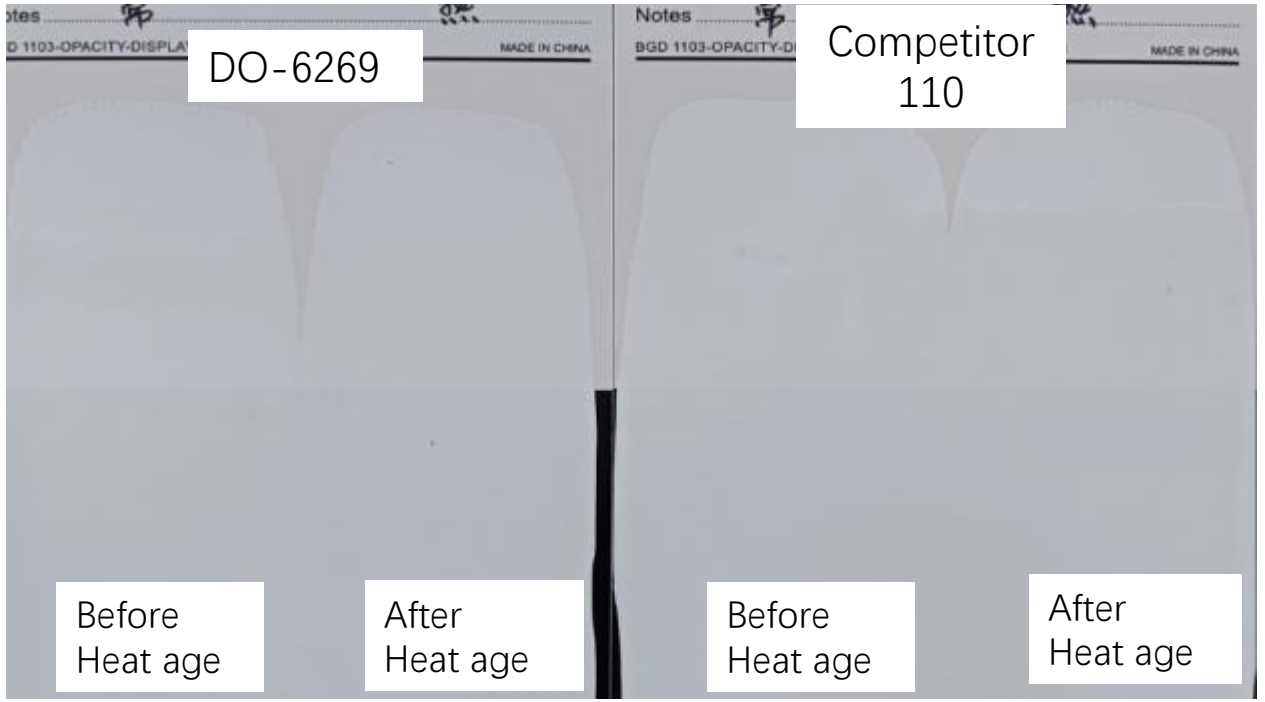




Coadd DO-6269 shows good dispersing efficiency for organic pigments. Better performance when used for transparent pigment

DO-6269 Test result – Inorganic pigment

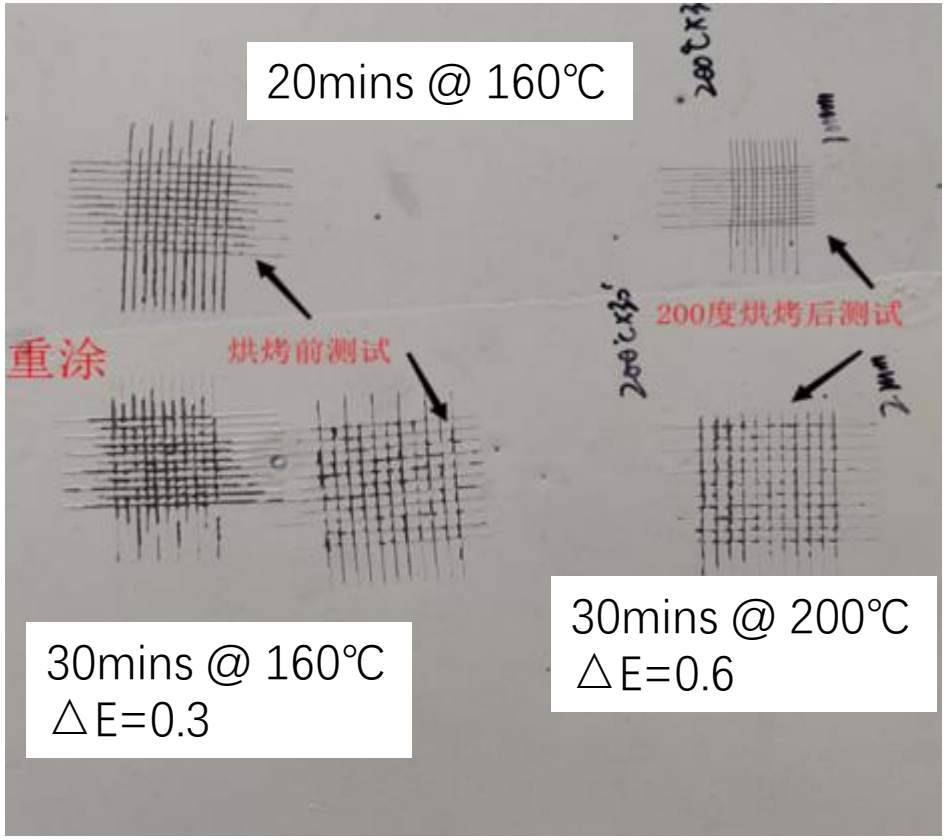
Test detail		Competitor 110	DO-6269
Viscosity (mPas)		341.5	297.5
Ford cup 4# (s)		142	120
150um roller coat	Gloss 20/60	79.8/89.3	79/87.2
	Contrast	0.924	0.934
	Hiding power	92.51	94.35
	Whiteness	87.87	90.01
Heat storage 50℃ 35D		Layering, no sedimentation	No layer or sedimentation



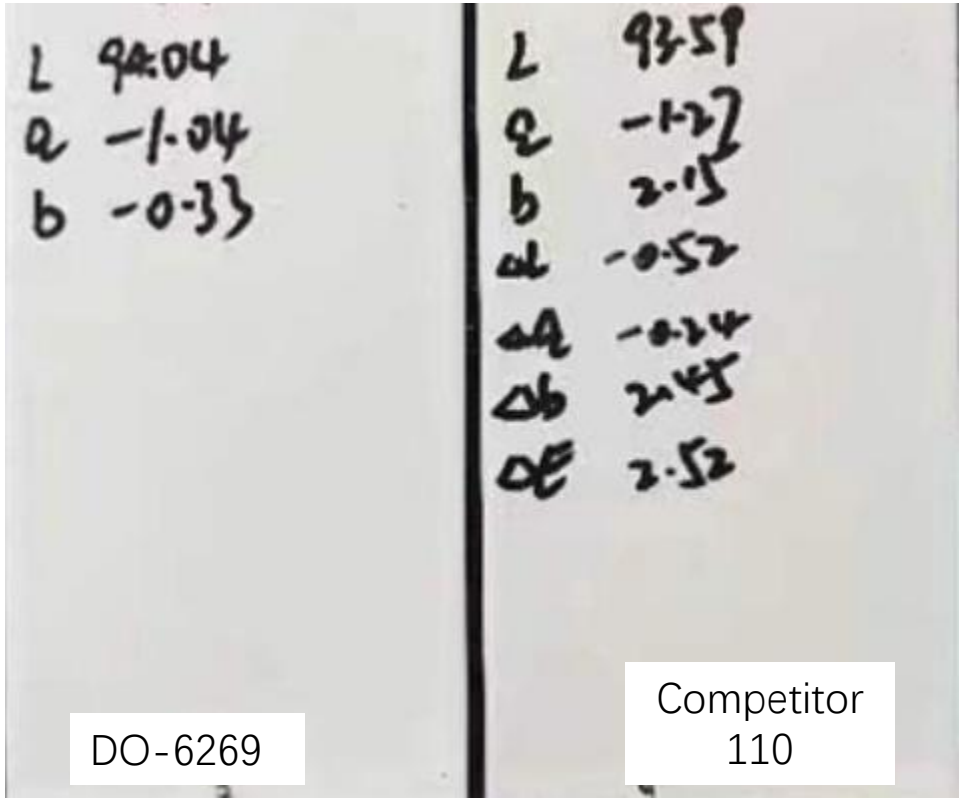
For inorganic pigment such as titanium oxide, DO-6269 shows good whiteness and hiding power properties compared with competitor 163.

DO-6269 Test result – Automotive baking coating

Acrylic thermal curing adhesion test



Yellowing stability test



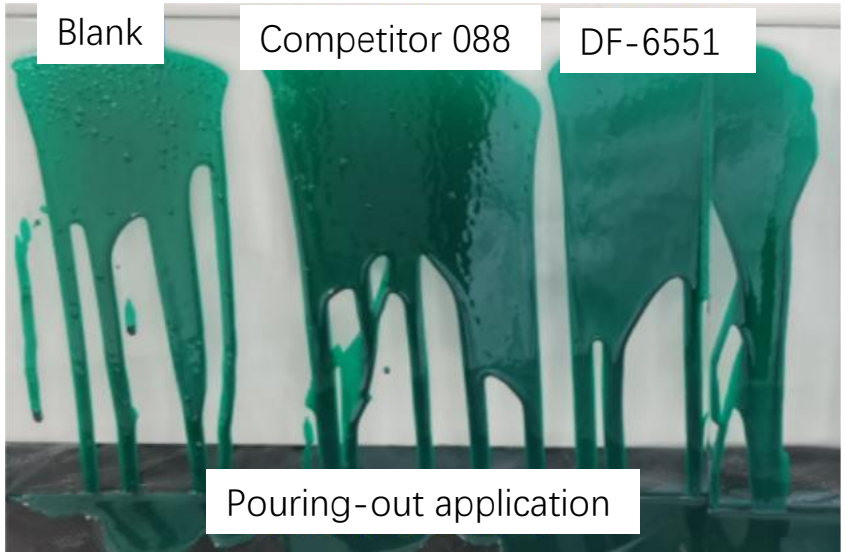
Normally for automotive baking coating system, inter-layer adhesion and yellowing problem is very common.

DO-6269 shows excellent inter-layer adhesion and no yellowing problem. Whiteness performance better than competitor 110

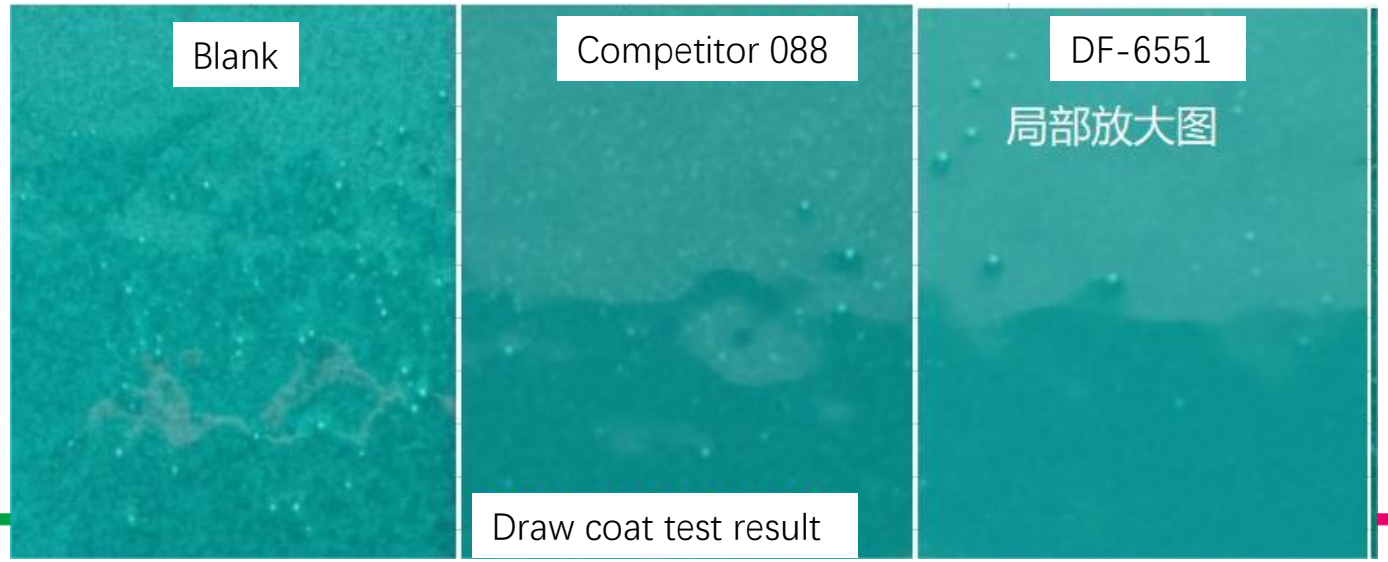
Defoamer

Product	Type	Characteristics
Coadd DF-6066	Modified polysiloxane	Standard universal defoamer for various systems. Good balance between defoaming efficiency and compatibility, especially suitable for epoxy system
Coadd DF-5206	Polyether	Excellent foam inhibition property, no adverse effect on re-coat
Coadd DF-6056	Polyolefin	Recommended for both solvent-borne and solvent-free application, especially for solvent-free PU and epoxy floor coating.
Coadd DF-6088	Modified polysiloxane	Excellent performance in various solvent & solvent-free system.
Coadd DF-6551	Polysiloxane with hydrophobic solids	Excellent foam inhibition, good defoaming effect at low dosage. Recommended for systems contains pigments or matting powders.

Coadd DF-6551: 2K epoxy primer coating test result

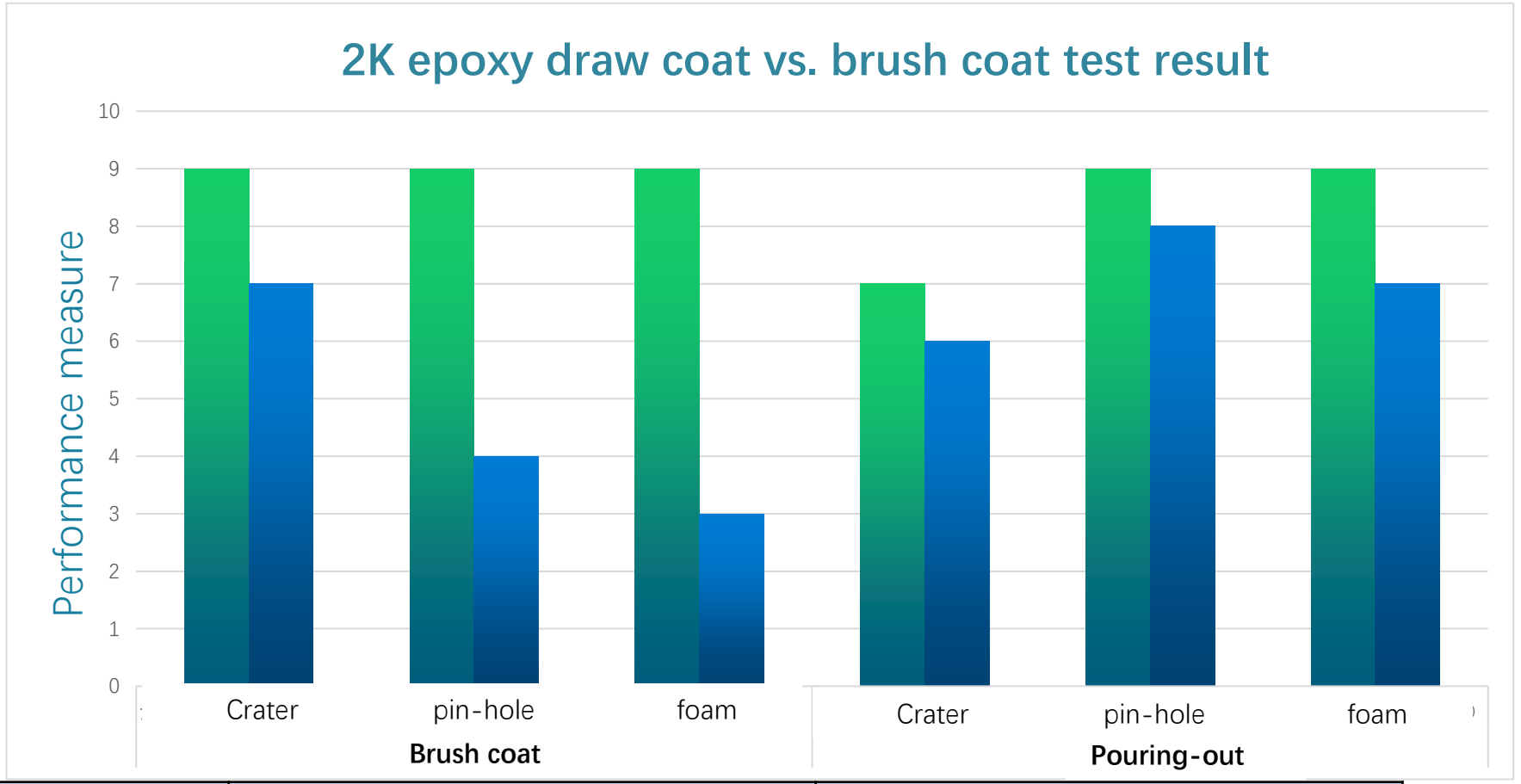


Test detail	Competitor 088	Coadd DF-6551
Fineness	＜20μm	＜20μm
Adhesion	Level 0	Level 0
Hardness	≤2H	≤2H
Gloss，60°	97.7	97.3



From the test result, it shows Coadd DF-6551 has better performance than competitor 088 during application.

Coadd DF-6551: 2K epoxy system test result



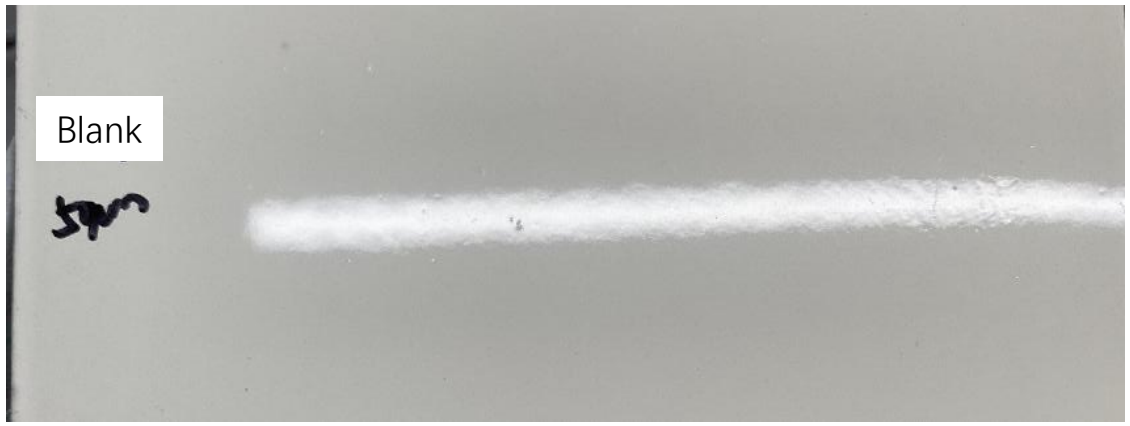
From the test result, DF-6551 has better defoaming performance compared with competitor product. Also the dosage is 30% less than competitor.

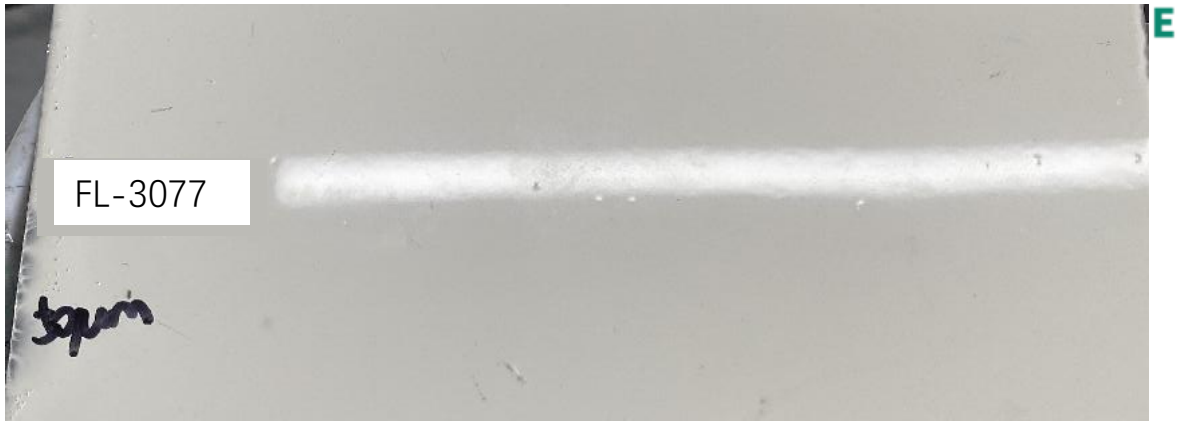
Product	Brush coat			Pouring		
	Cratering	Pin hole	foaming	Cratering	Pin hole	foaming
0.6% DF-6551	9	9	9	7	9	9
0.8% Competitor	7	4	3	6	8	7

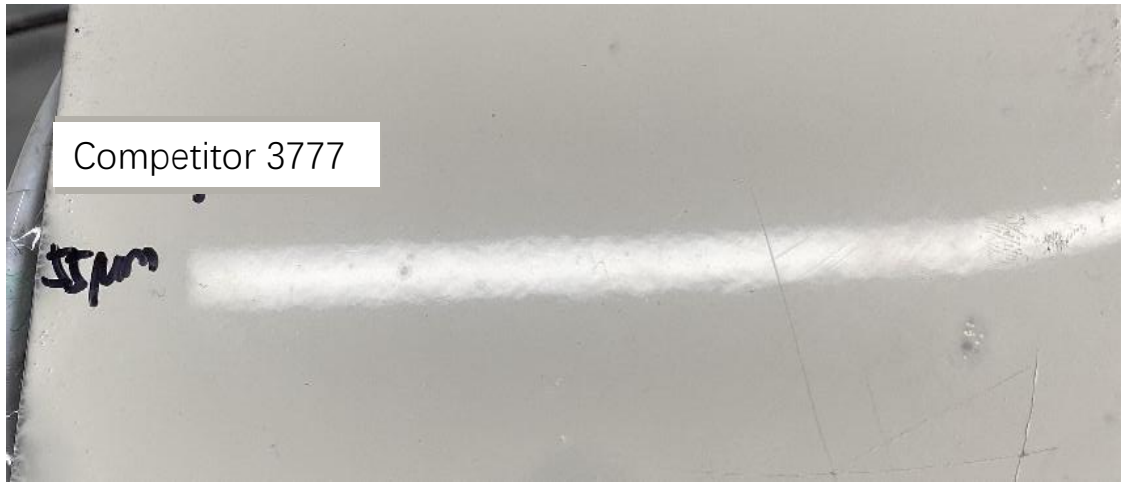
Leveling Agent

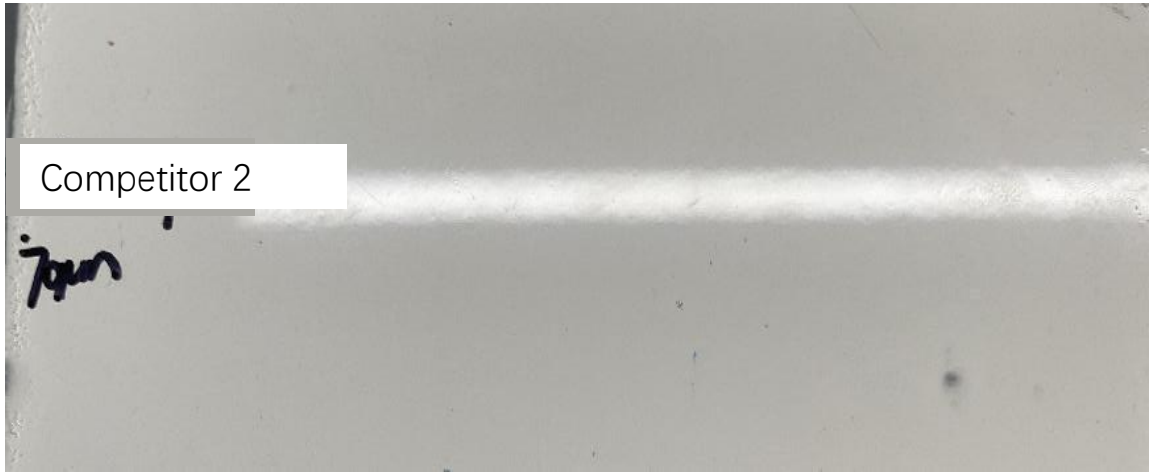
Product	Type	Characteristics
FL-6358	Modified polyacrylics & polysiloxane copolymer	Improve the film leveling and gloss, provide long-wave leveling and prevent cratering. No adverse effect on re-coat
FL-3060	Polyether modified polysiloxane	Strong surface reduction properties and increase substrate wetting. Prevent cratering and improve film gloss and smoothness.
FL-6310	Polyether modified polysiloxane	Strongly reduce surface tension and substrate wetting, prevent cratering.
FL-6633	Polyether modified polysiloxane	Strongly reduce surface tension, prevent cratering and improve film gloss and smoothness.
FL-3077	Modified polyacrylate	Non-silicone leveling agent, with defoam properties. Excellent leveling, no adverse effect on re-coat.

Coadd FL-3077 – Non silicone. 2K PU system test result





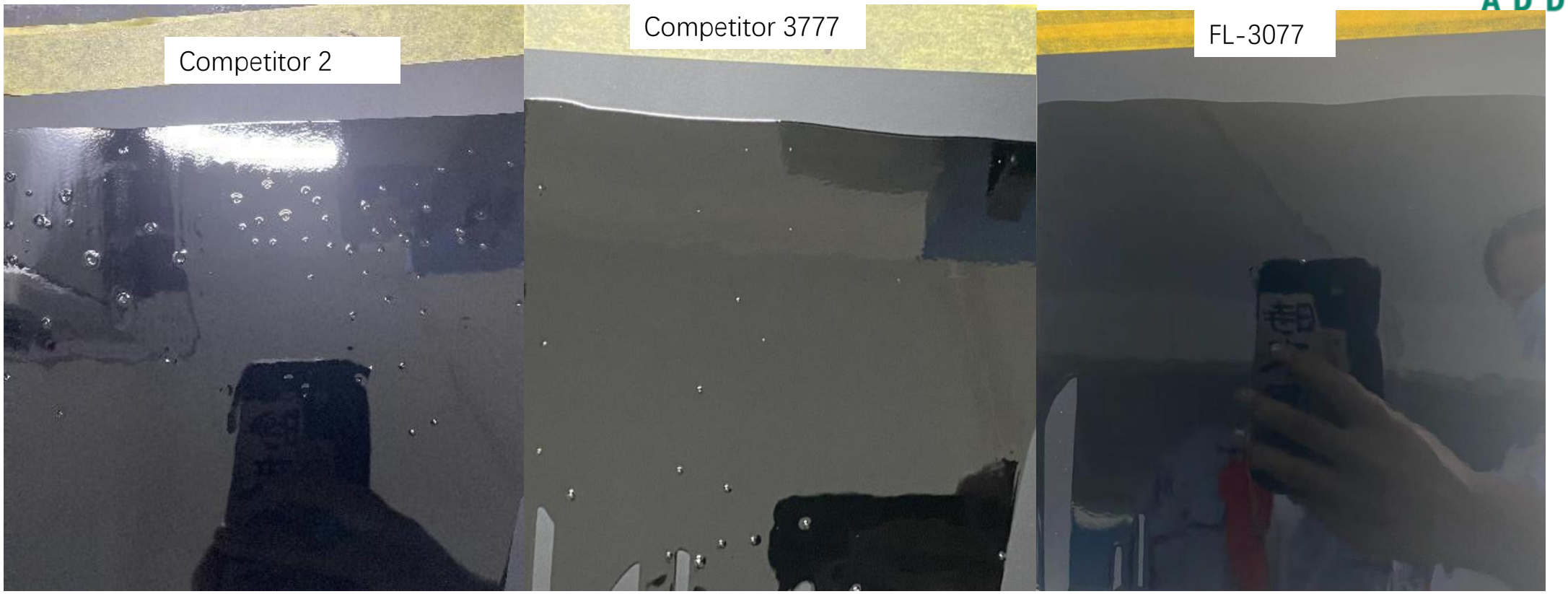




From the test result, the leveling performance is ranked as:

Coadd FL-3077 > Competitor 2 > Competitor 3777 > Blank

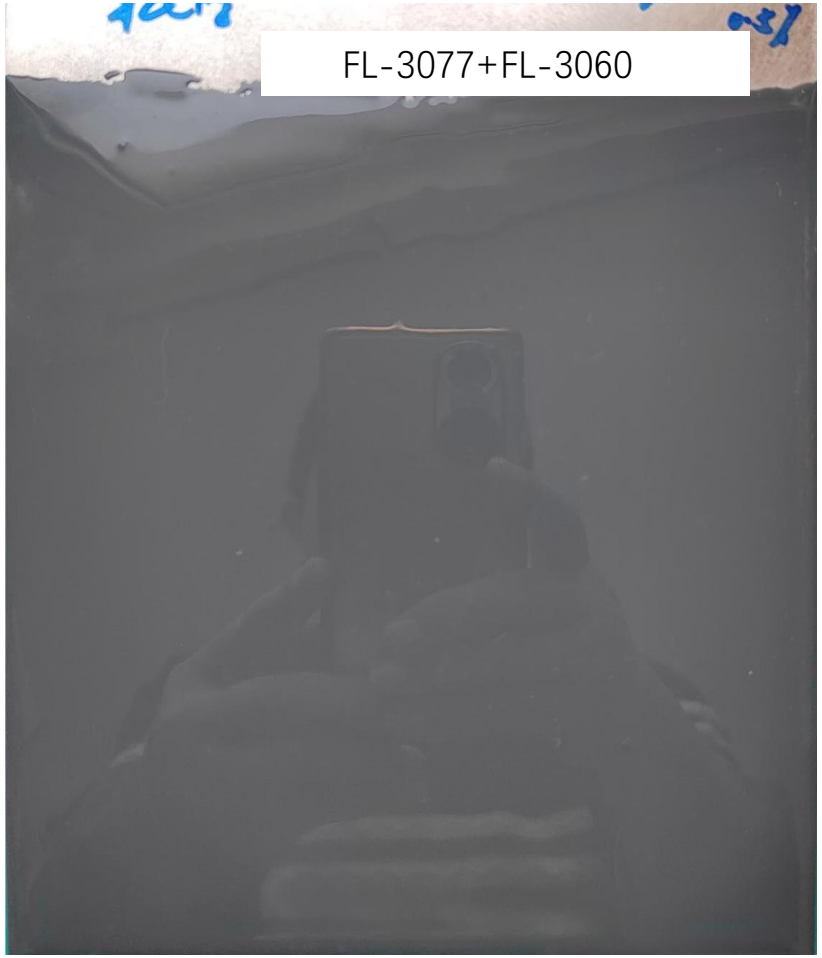
Coadd FL-3077 – Foam control. 2K PU system test result

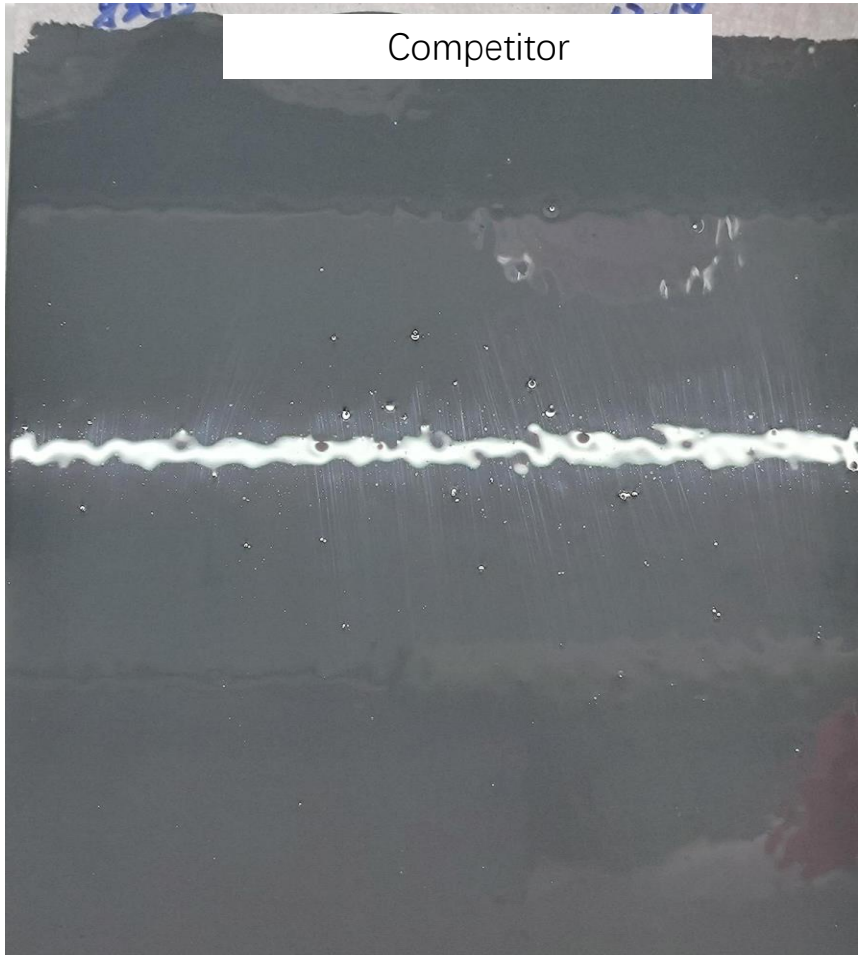


From the test result, the leveling performance is ranked as:

Coadd FL-3077 > Competitor 3777 > Competitor 2

Coadd FL-3077: 2K EP system test result





From the test result, FL-3077 with FL-3060 gives a good balance between leveling and foaming performance

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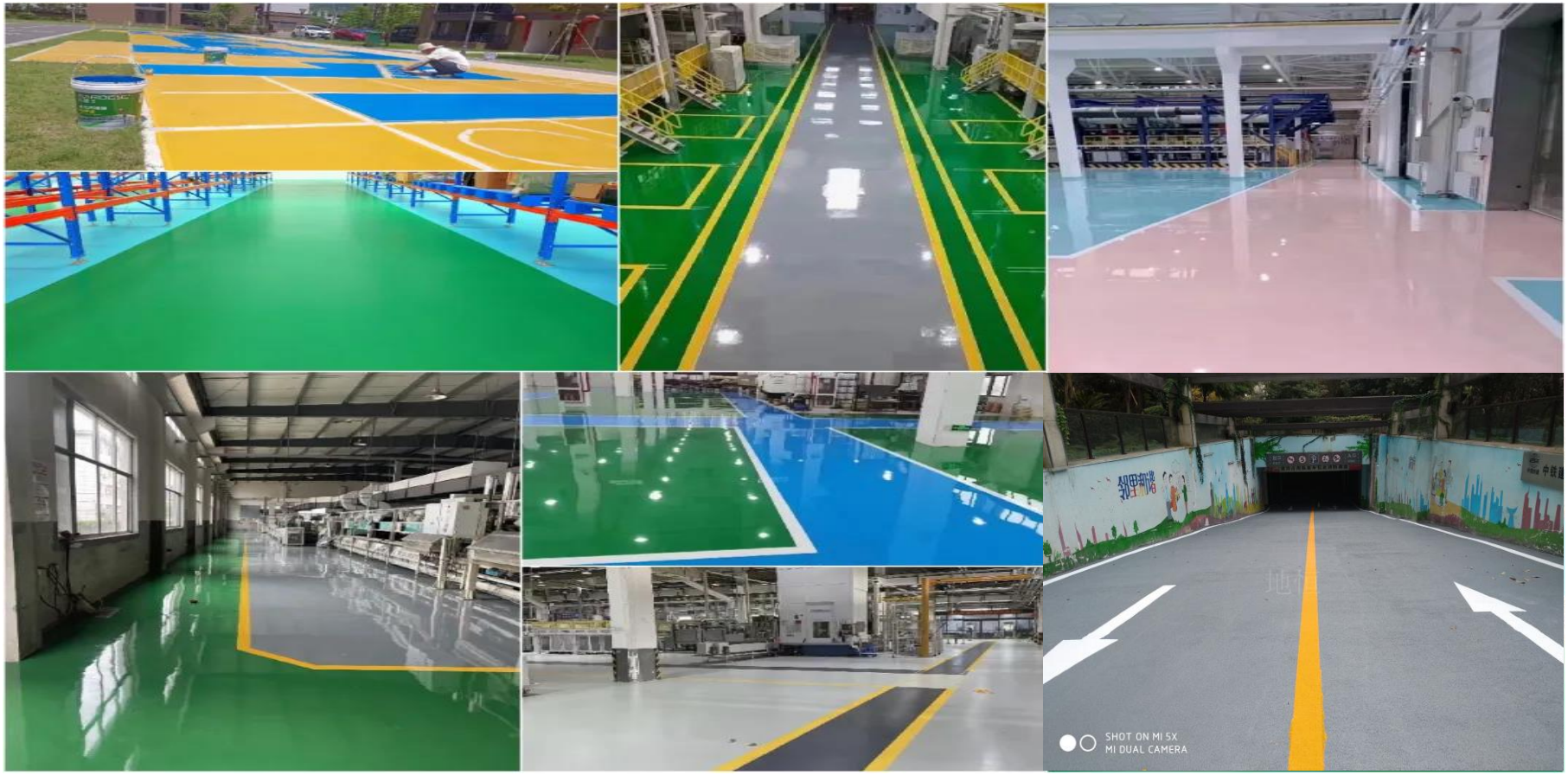
04 Additives for Solvent-borne Floor Coating

Solvent-borne floor coating - Introduction

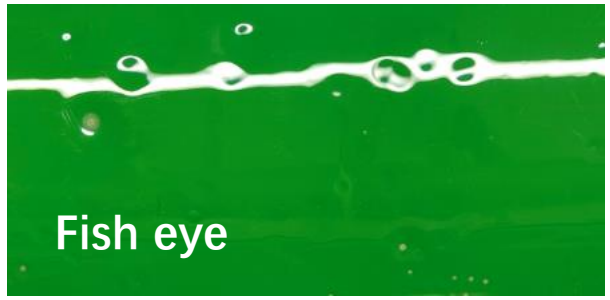


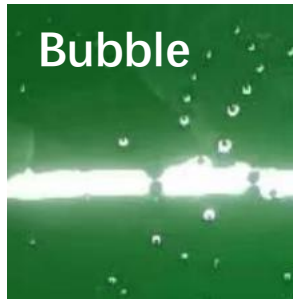
Solvent-borne floor coating - Introduction

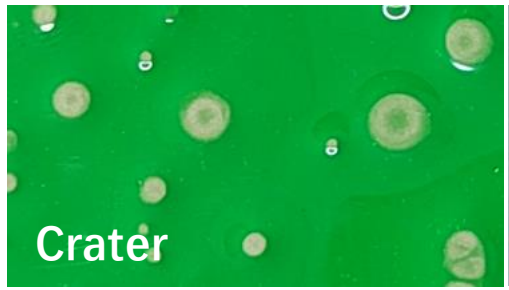
Over 85% of floor coating uses epoxy

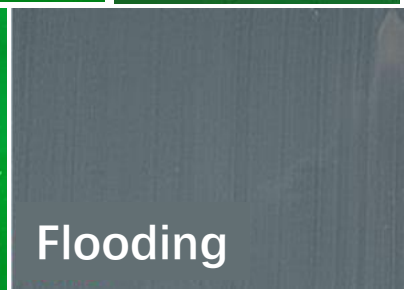
Floor coating types

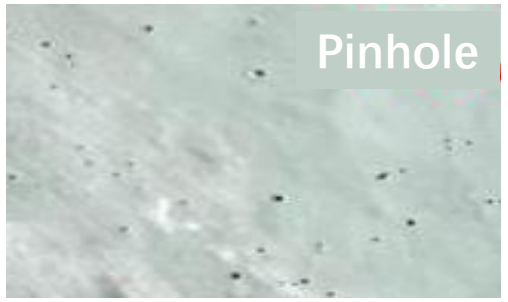
- Alkyd
- CPE
- **Epoxy**
- Acrylics
- PU
- Polyurea
- Vinyl ester
- Inorganic

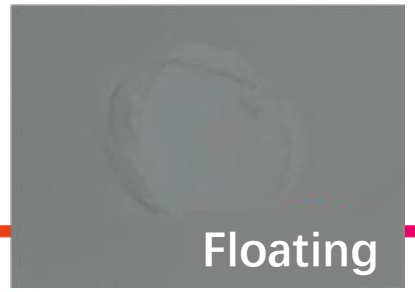












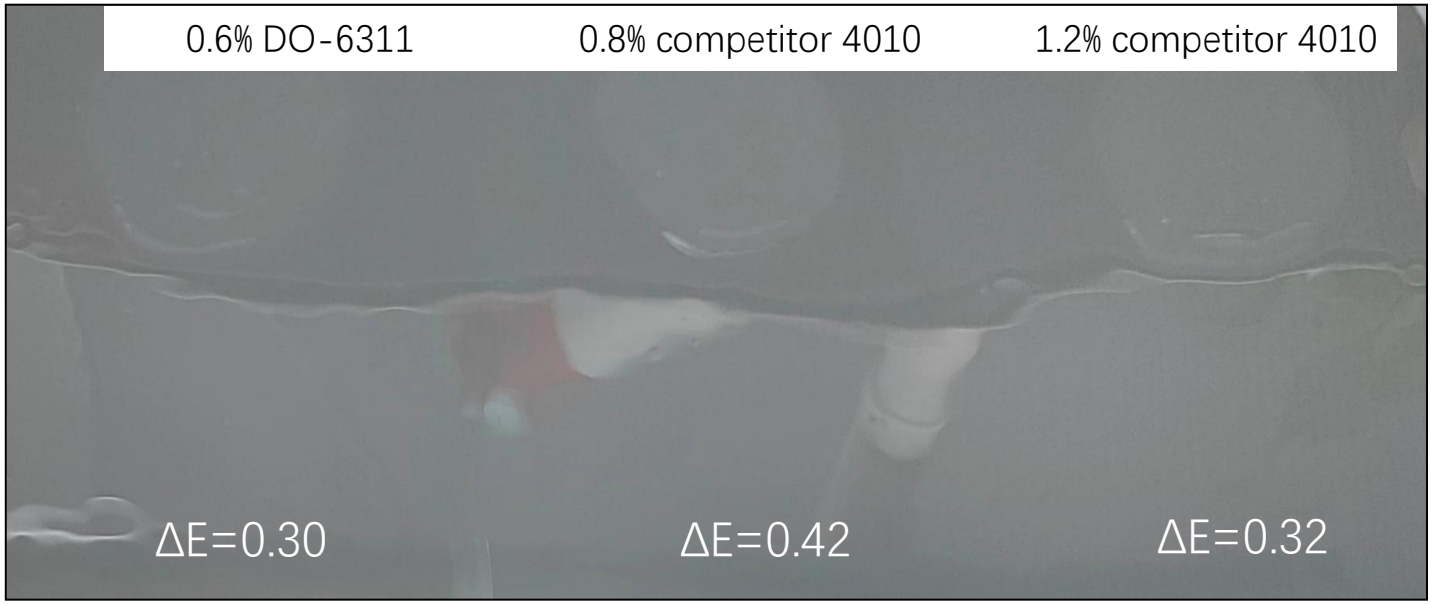
Solvent-borne floor coating – Product introduction

Type	Product	Active content	Dosage (%)	Characteristics
Dispersant	Coadd ™ DO-6311	100%	Inorganic pigment: 2-3 Organic: 20-40 Carbon black: 40-50	High cost-effective universal dispersant for organic and inorganic pigments, featuring excellent color development and viscosity reduction effects. Particularly suitable for medium to low polarity solvent-borne and solvent-free systems.
	Coadd ™ DO-6265	52%	Inorganic: 2-8	Acid-modified polymer dispersant, suitable for solvent-borne and solvent-free systems for dispersing inorganic pigments and fillers. It exhibits excellent viscosity reduction, effectively improving the flow of floor coatings. It ensuring long-term color stability of dispersed pastes, provides high gloss and low haze films.
	Coadd ™ DO-1051	50%	0.3-1.0	Effectively prevent floating and flooding, especially in epoxy system. Do no stable foaming, excellent application properties.
Defoamer	Coadd ™ DF-6551	100%	0.05-0.3	Modified silicone-based defoamer, excellent foam inhibition, defoaming effects, and compatibility. Offers a broad dosage range and avoid cratering. Suitable for general solvent-based coatings, high-solids, solvent-free epoxy, and polyurethane coating systems. Recommended to dilute to 25% with xylene if added in let-down stage.
Leveling	Coadd ™ FL-3077	52%	0.1-1.0	High Mw leveling agent which improves the leveling and gloss of paint films, providing long-wave leveling and reducing cratering. It also has defoaming properties. When used in combination with Coadd™ FL-3060, it enhances anti-cratering effects.
	Coadd ™ FL-3060	12%	0.03-0.2	Silicone type leveling agent, strong reduce of surface tension and improves substrate wetting, effectively prevents cratering and provides excellent leveling and smoothness. Suitable for floor coatings, coil coatings, general industrial coatings, and wood coatings. Recommended to dilute to 20% with xylene before adding.

Coadd DO-6311: Medium grey color epoxy floor coating test result

Application test is carried out with different dispersant. By applying 150um film on PE film, and compare the color development and color difference.

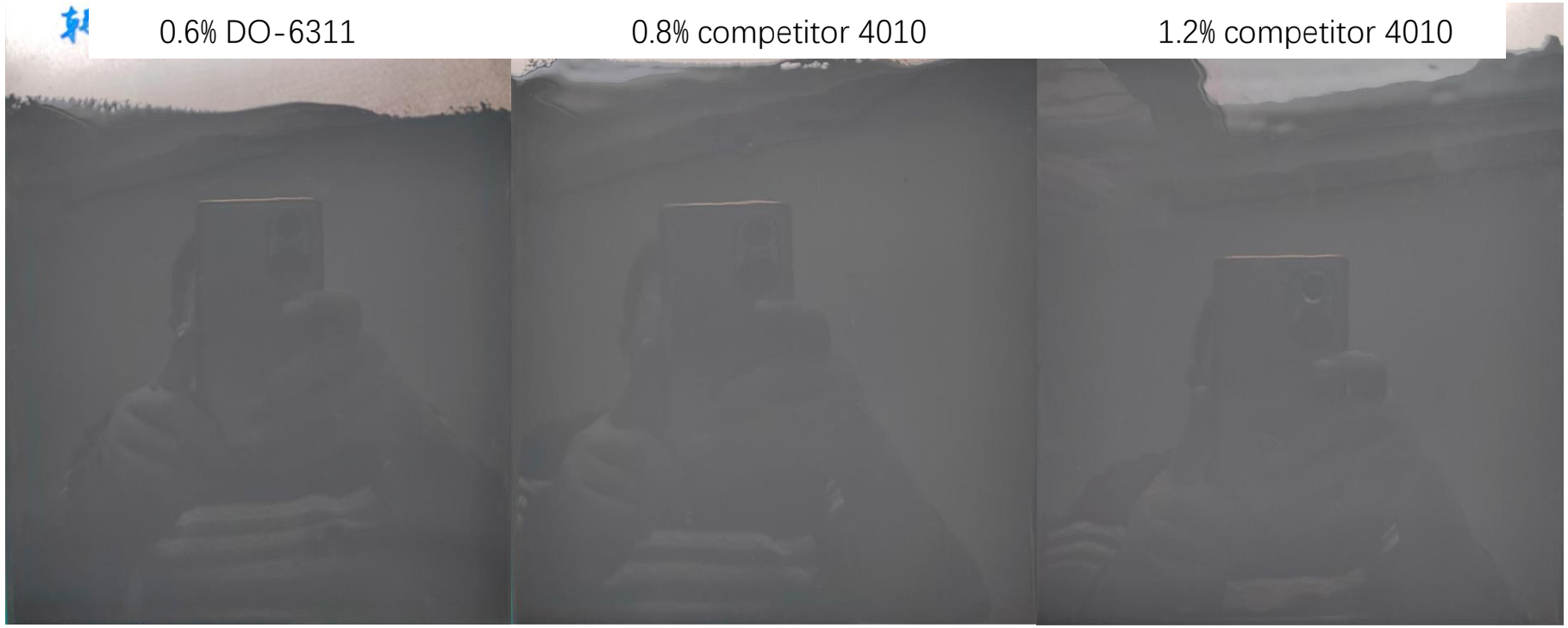
Test detail	Coadd DO-6311			Competitor 4010		
Dosage	**0.4%**	**0.6%**	**0.8%**	**0.8%**	**1%**	**1.2%**
Viscosity mPas	676	650	500	1058	1046	596
ΔE	0.41	0.30	0.24	0.42	0.38	0.32
Gloss (20°)	95.5	96.7	94.7	94.0	94.5	94.3



From the test result, it shows that DO-6311 has similar performance in color differenced when compared with competitor 4010, while the dosage for DO-6311 is less.

Coadd DO-6311: Medium grey color epoxy floor coating test result

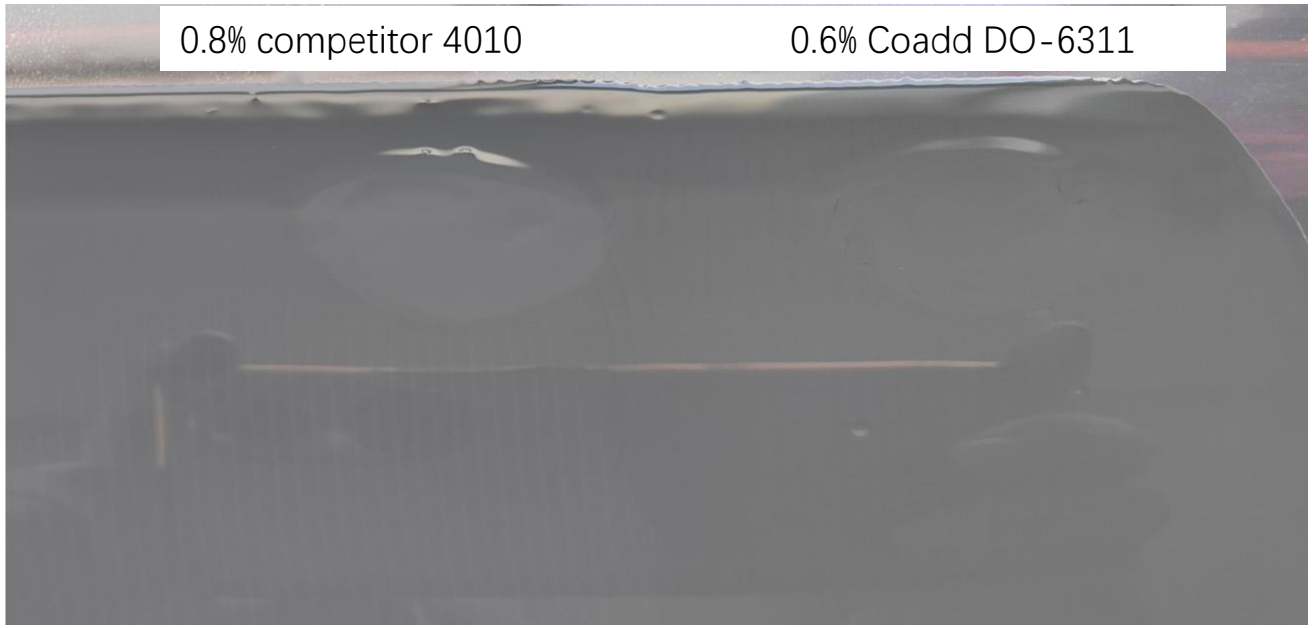
Further test has been carried out by applying 150um film on concrete substrate, to compare the coating appearance.

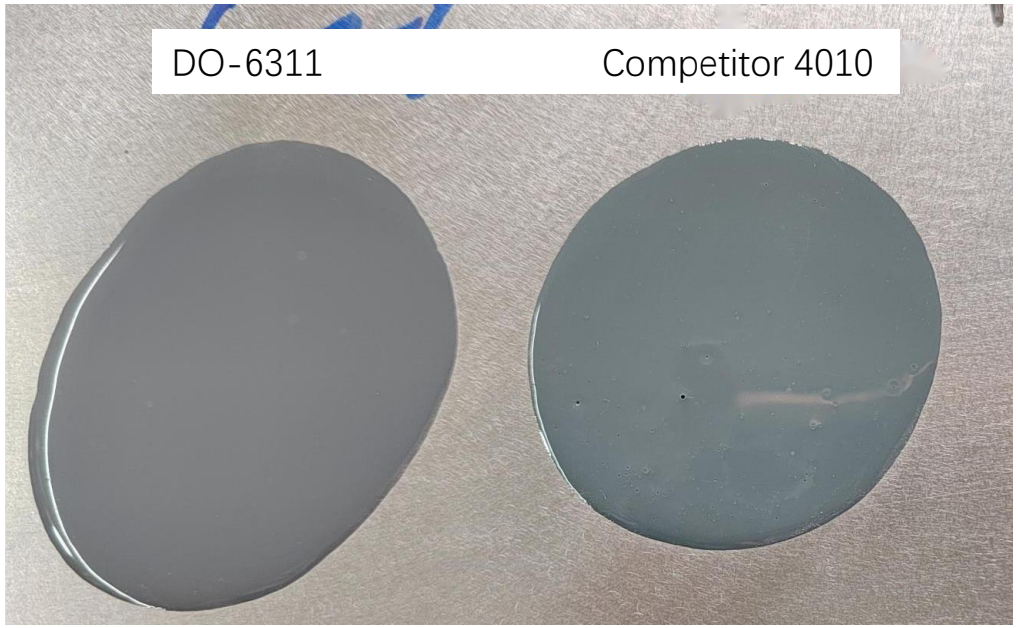


From the test result, all samples shows good film appearance, with no bubbles or craters, and good leveling performance.

Coadd DO-6311: Medium grey color epoxy self-leveling coating test result

Also application test has been carried out by applying 200um film, to assess the self-leveling coating compatibility by carrying out rub-out test and check the color difference (Left). Also test are carried out with same weight of coatings dropped on metal substrate, to determine the self-leveling area.

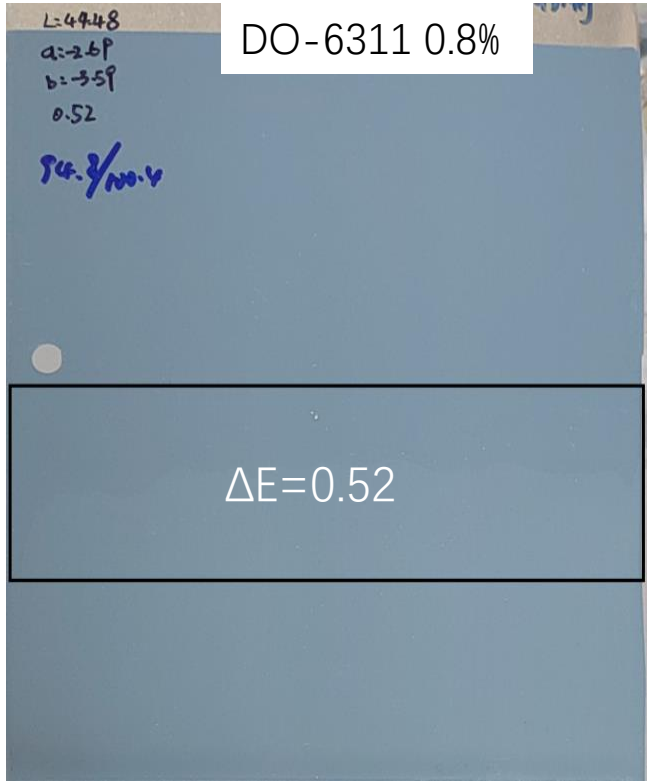


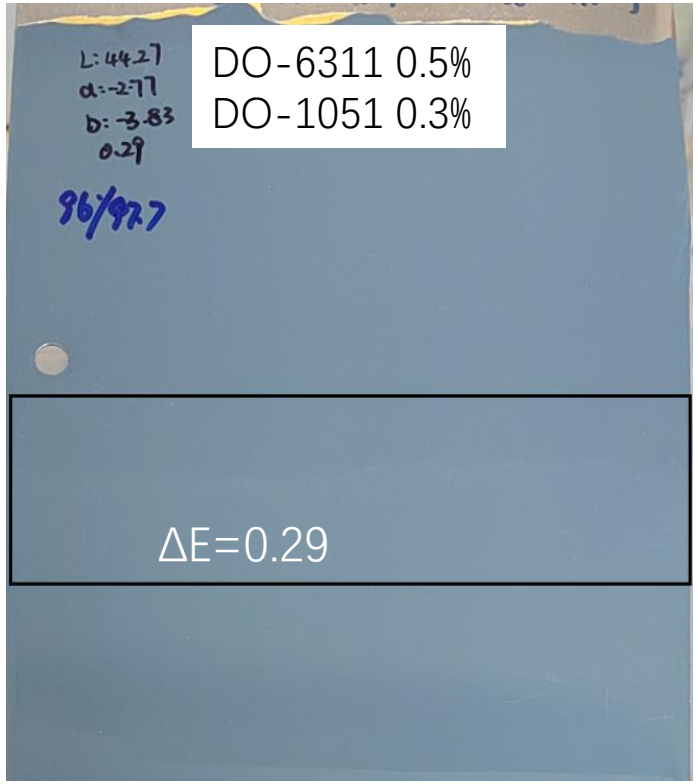


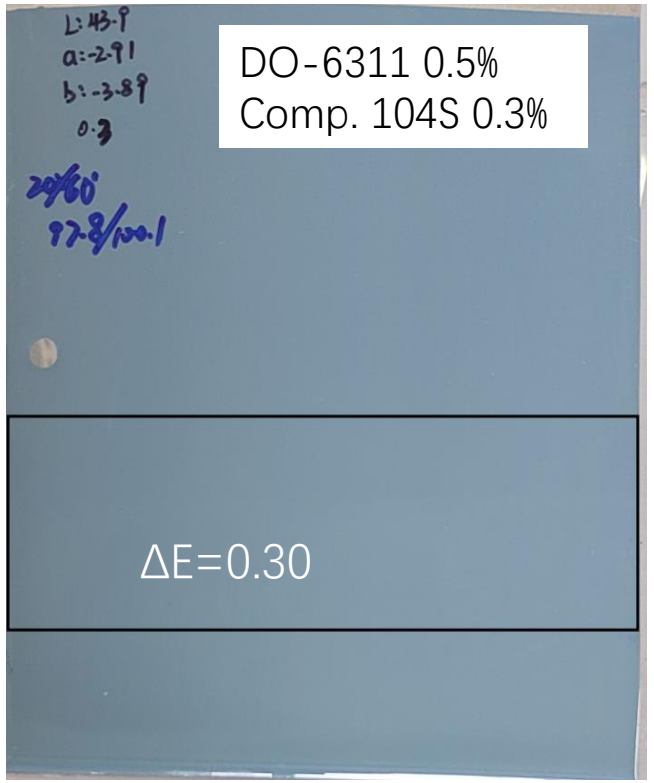
From the test result, DO-6311 shows better performance in rub-out test compared with competitor 4010. Also note dosage for DO-6311 is 30% less than competitor 4010. Also DO-6311 has larger self-leveling area, indicating a better viscosity reduction performance, and also better flow performance.

Coadd DO-1051+DO-6311： Solving lapping mark test result

Test has been carried out to assess the lapping marks, between DO-6311, DO-6311+DO-1051, and with competitor 104S. The two layers are applied with 15mins interval.







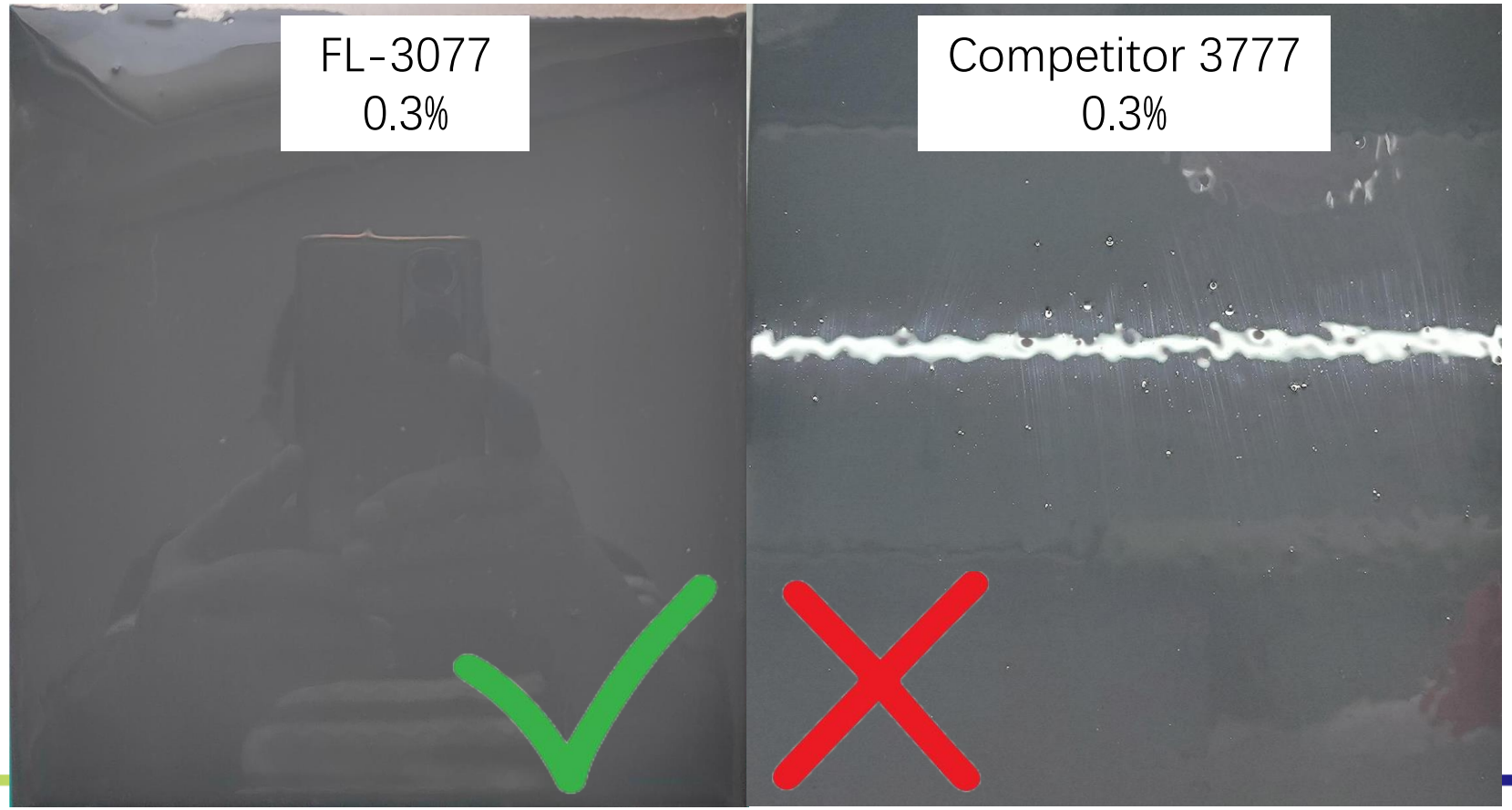
From the test result, DO-6311+DO-1051 has very similar lap mark performance compared with competitor 104S

Coadd DF-6551: Medium grey color epoxy floor coating test result

Different application method has been tested with D-6551 to see the coating performance. From the test result, all tested application method shows good appearance, indicating good foam elimination and foam inhibition properties.

Coadd FL-3077: Medium grey color epoxy floor coating test result

Application test has been carried out for the leveling performance of FL-3077. From the test result, FL-3077 shows good long-wave leveling properties. Also the foaming performance is better than competitor 3777.



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If you have any product inquiry

Please email: liuwei@polywill.com