Coatings Trends & Technologies SUMMIT

The Pigment Selection Process: Balancing the MUSTs, WANTs and the NICE TO HAVEs

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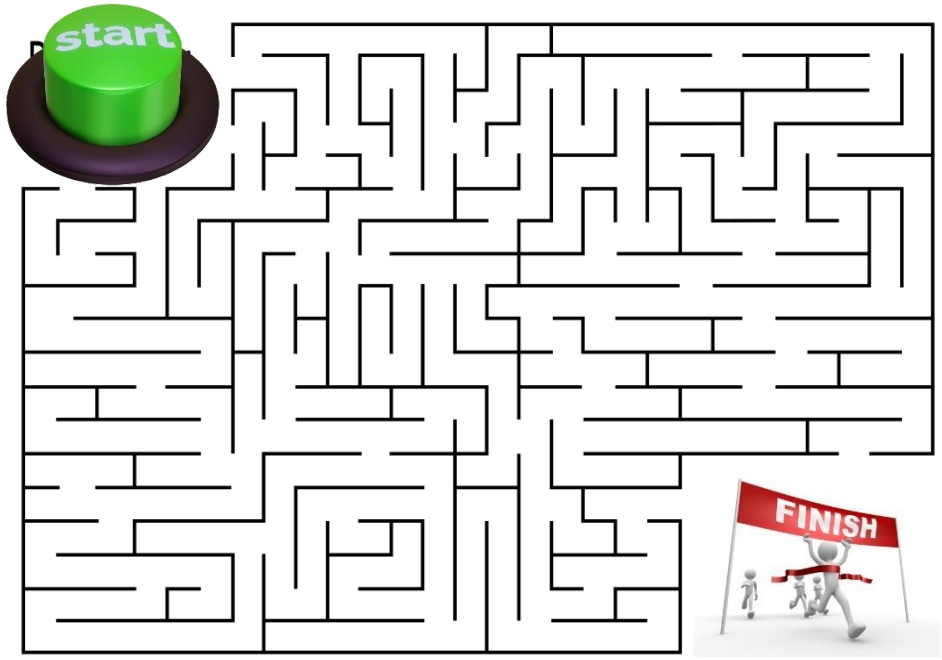
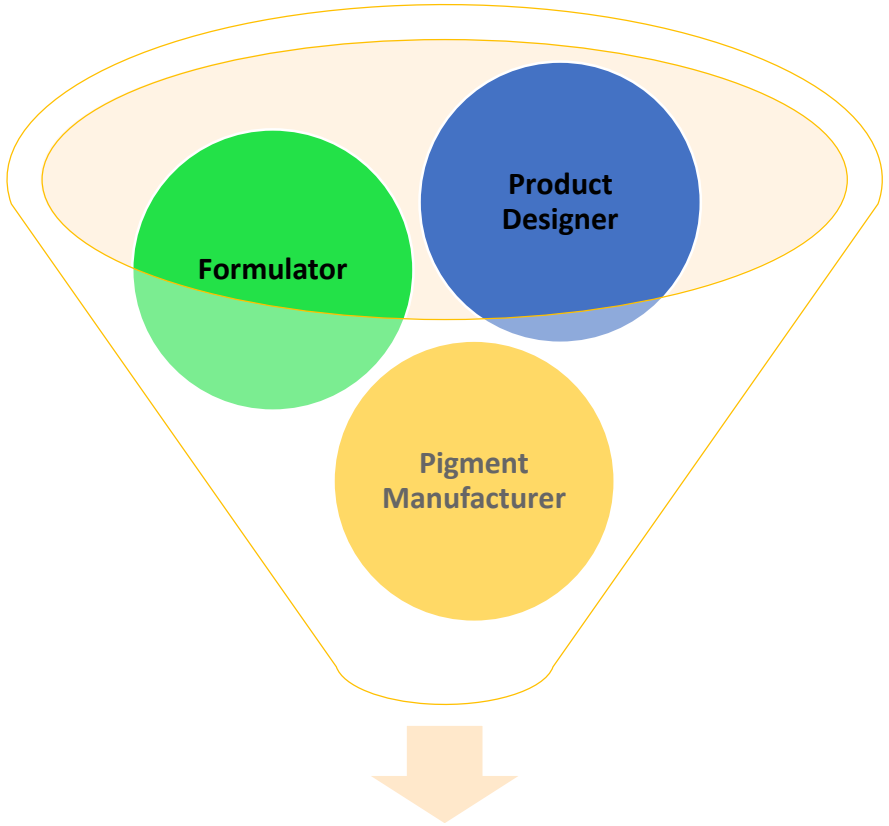
Colorant Selection Process



Colorant Selection Process



Successful Product Introductions to the Market

Pigment suppliers have the deep knowledge and understanding of their technologies and are best positioned to recommend optimal pigment solutions for a given application.

Colorant Selection Process

- A pigment is *only technically valuable to a customer if it performs in the correct manner required* for the application it is used for.

- Added functionality is an area of anticipated development but functionality differs from person to person or industry to industry.
  - ***Who is asking?***

- *The true cost of a raw material in context of the total formulation is the cost in use.*

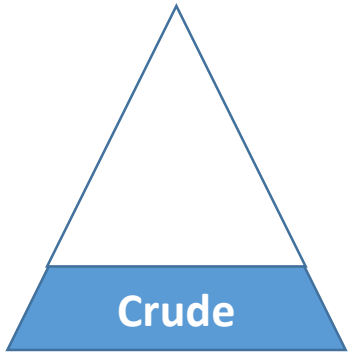
  ➔ This considers the price and amount of material needed to make the formulation meet the customers expectations.

Colorant Selection Process

- **Color and Effect**
  - Transparency/Opacity
  - Mica or aluminum
- **Application**
  - Type of substrate
  - Type of resin system
  - Interactions in formulations
  - Indoor / Outdoor Light / Weather
- **Compliance**
  - Food
  - Toy
  - Medical
- **Cost / Value**

- **Performance**
  - Transparency, Opacity
  - Flow, viscosity
  - Gloss
  - Acid and alkali resistance
  - Heat stability
  - Migration
  - Strength
  - Fineness of grind
  - And on
  - And on
  - And on

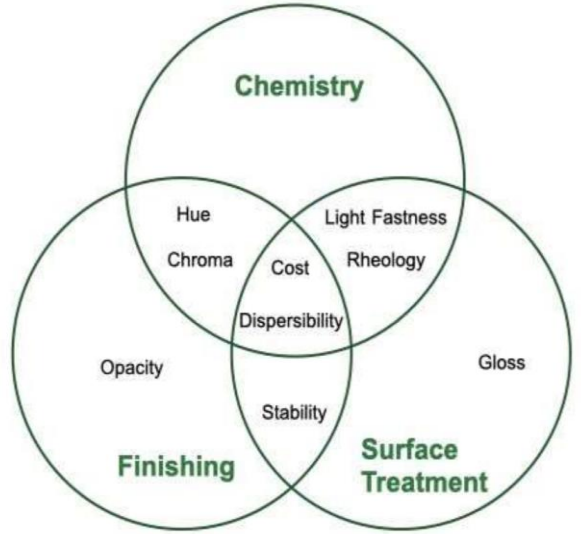
Synthesis



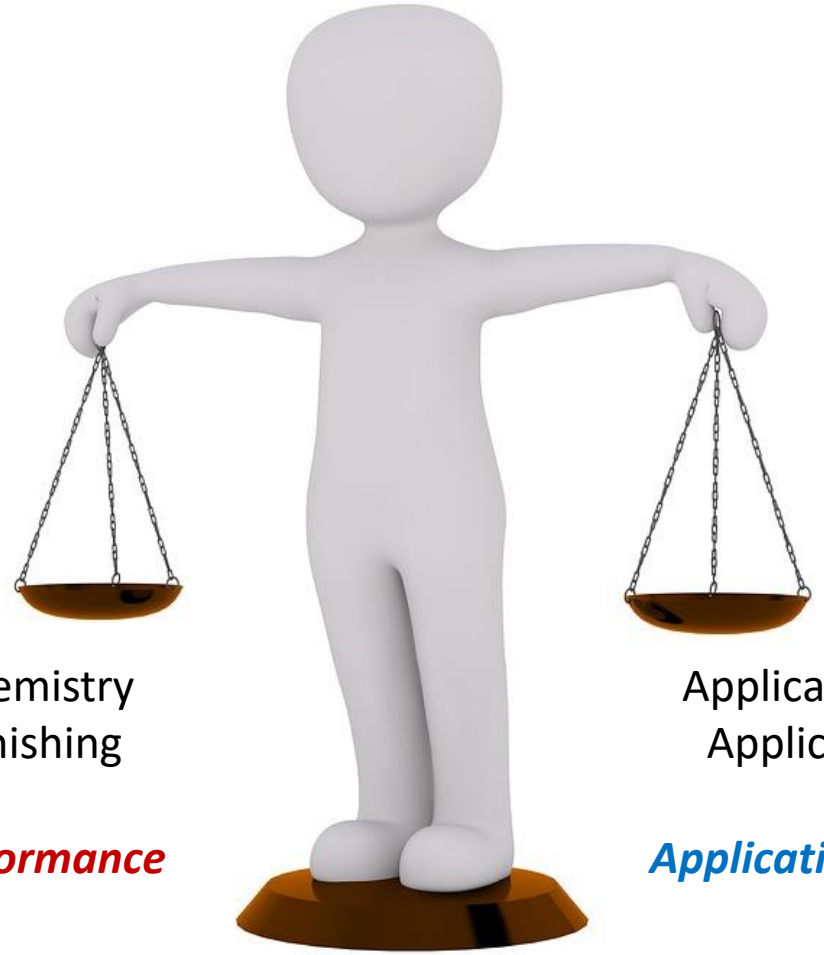
Crude is the base of the pigment

~75-80% of the pigment performance

- The first manufacturing step(s) determine the chemical identity of the pigment.
- Crude pigment is the end product of the synthesis.
- Finishing and surface treatment provide the end use properties.
  - Finishing ➔ primary particle size
  - Surface treatment ➔ dispersibility



It is a balance!



Pigment Chemistry
Pigment Finishing
=
Pigment Performance

Application Chemistry
Application Process
=
Application Performance

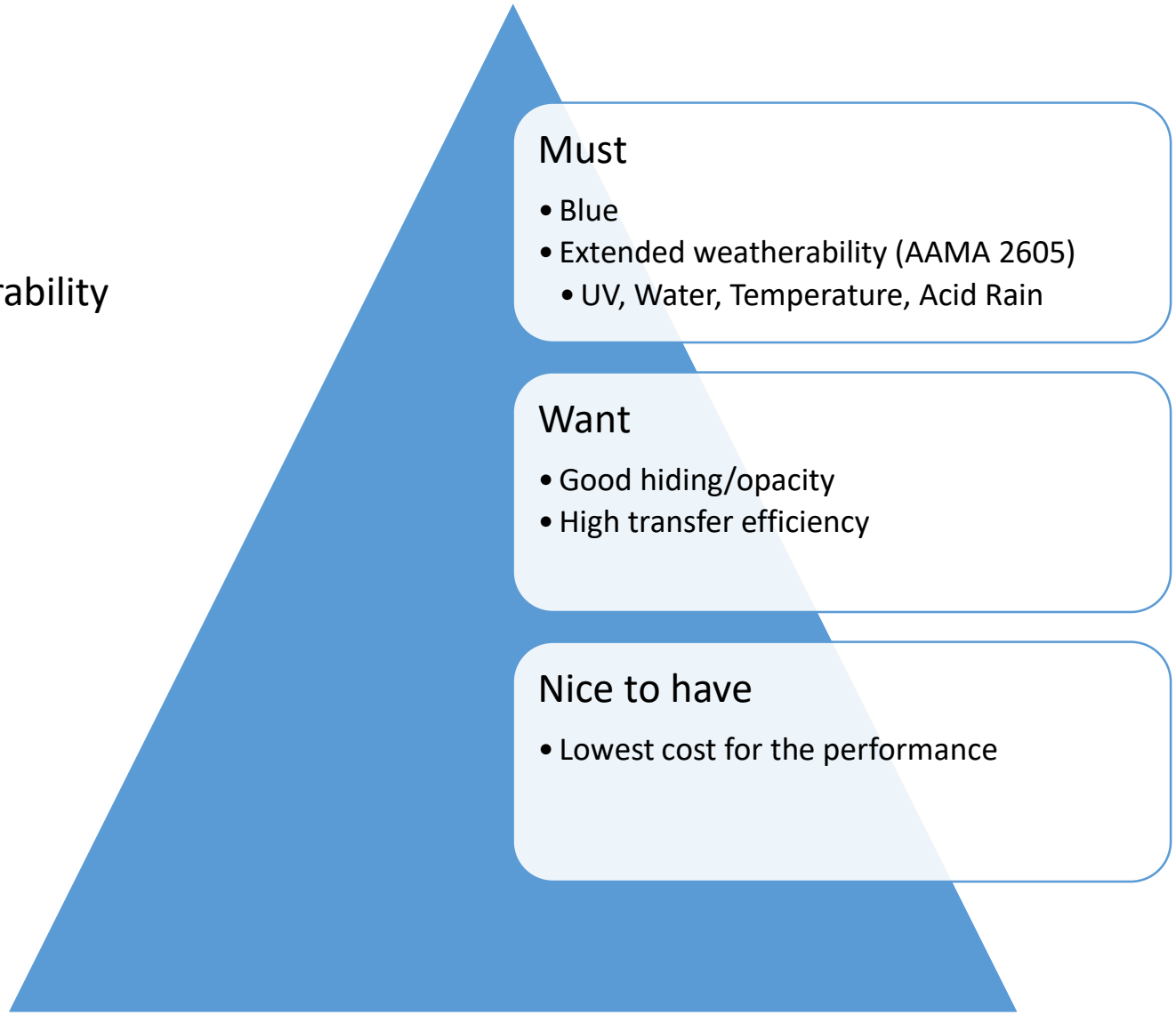
MUST’s

WANT’s

NICE TO HAVE’s

Example #1

- Powder Coating
- Blue color
- Exterior weatherability
- Good hiding



Fuming Nitric Acid Test

- The Fuming Nitric Acid test is used to simulate a pigment's response to acid rain resistance.
- This test was taken from the AAMA (American Architecture Manufacturing Association) standards – AAMA 2604-17a.
- These standards are typically used when the coating is required to have a long-term durability property like for buildings and other parts that are hard to reach and/or are repaired infrequently (many years).
- 50:50 TiO2 ratio is primarily used for the test.

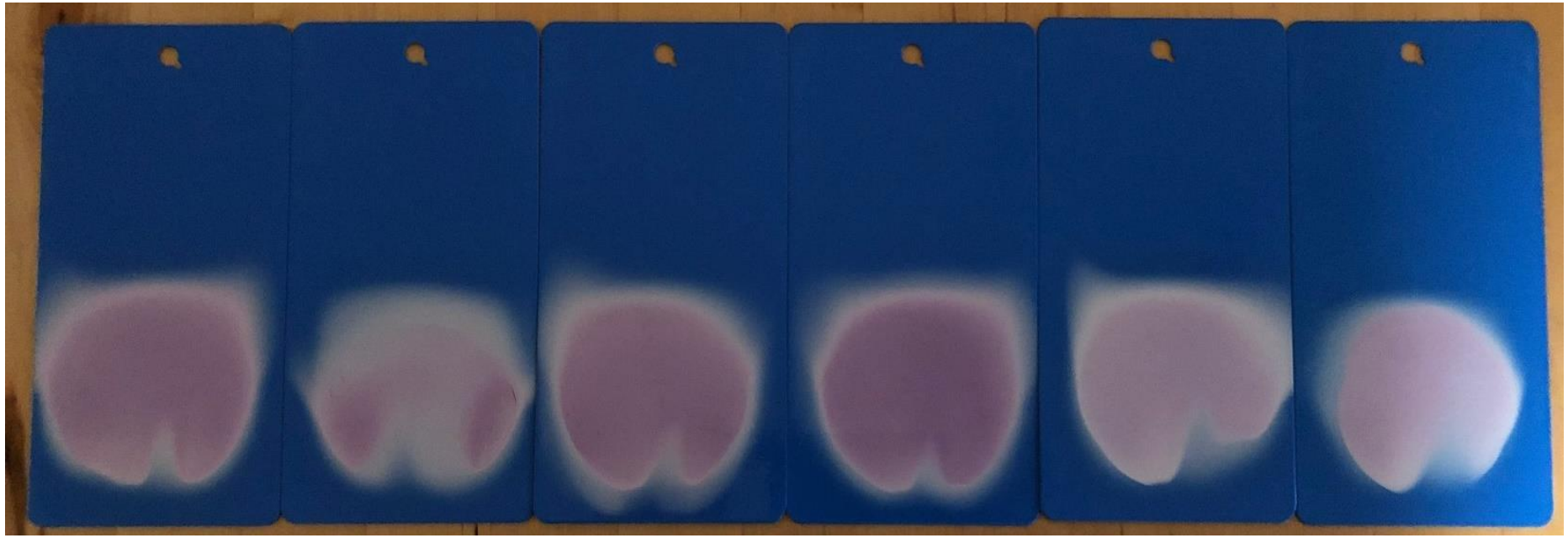
Fuming Nitric Acid Test

PB15:1 A	PB15:1 B	PB15:1 C	PB15:1 D	PB15:1 E	PB15:1 F
dE = 24.81	dE = 24.41	dE = 24.02	dE= 22.66	dE= 24.15	dE = 20.63

susceptible to ozone oxidation especially under TiO_2 catalysis

50:50 TiO2 blend

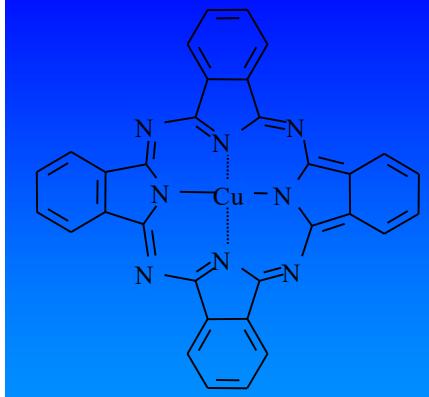
Fuming Nitric Acid Test



PB15:1 A	PB15:1 B	PB15:1 C	PB15:1 D	PB15:1 E	PB15:1 F
dE = 24.81	dE = 24.41	dE = 24.02	dE= 22.66	dE= 24.15	dE = 20.63

susceptible to ozone oxidation especially under TiO_2 catalysis

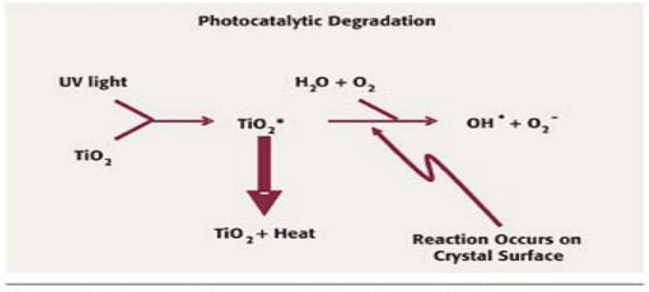
10:90 TiO2 blend

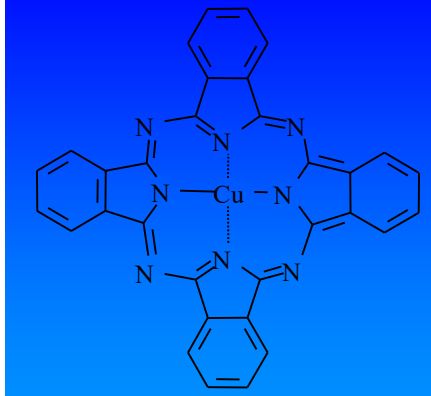


Copper Phthalocyanine

+ O = Ti = O

Severe acid rain impact:
dE coatings ~20-25

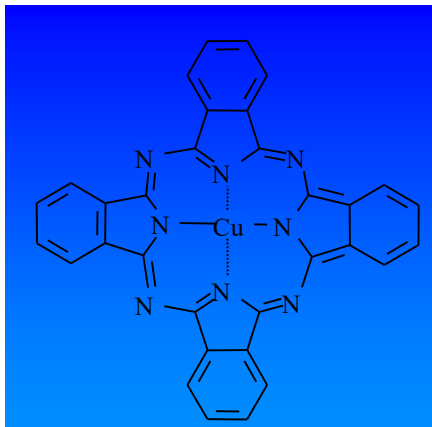




Copper Phthalocyanine

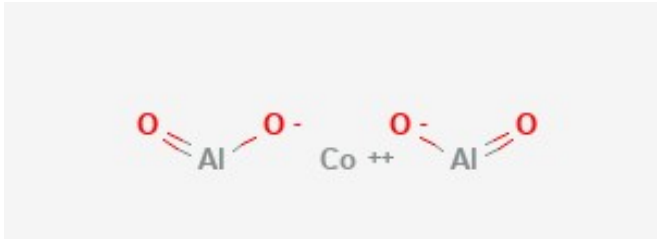
+ O = Ti = O →

Severe acid rain impact:
dE coatings ~20-25



Copper Phthalocyanine

PBl 28

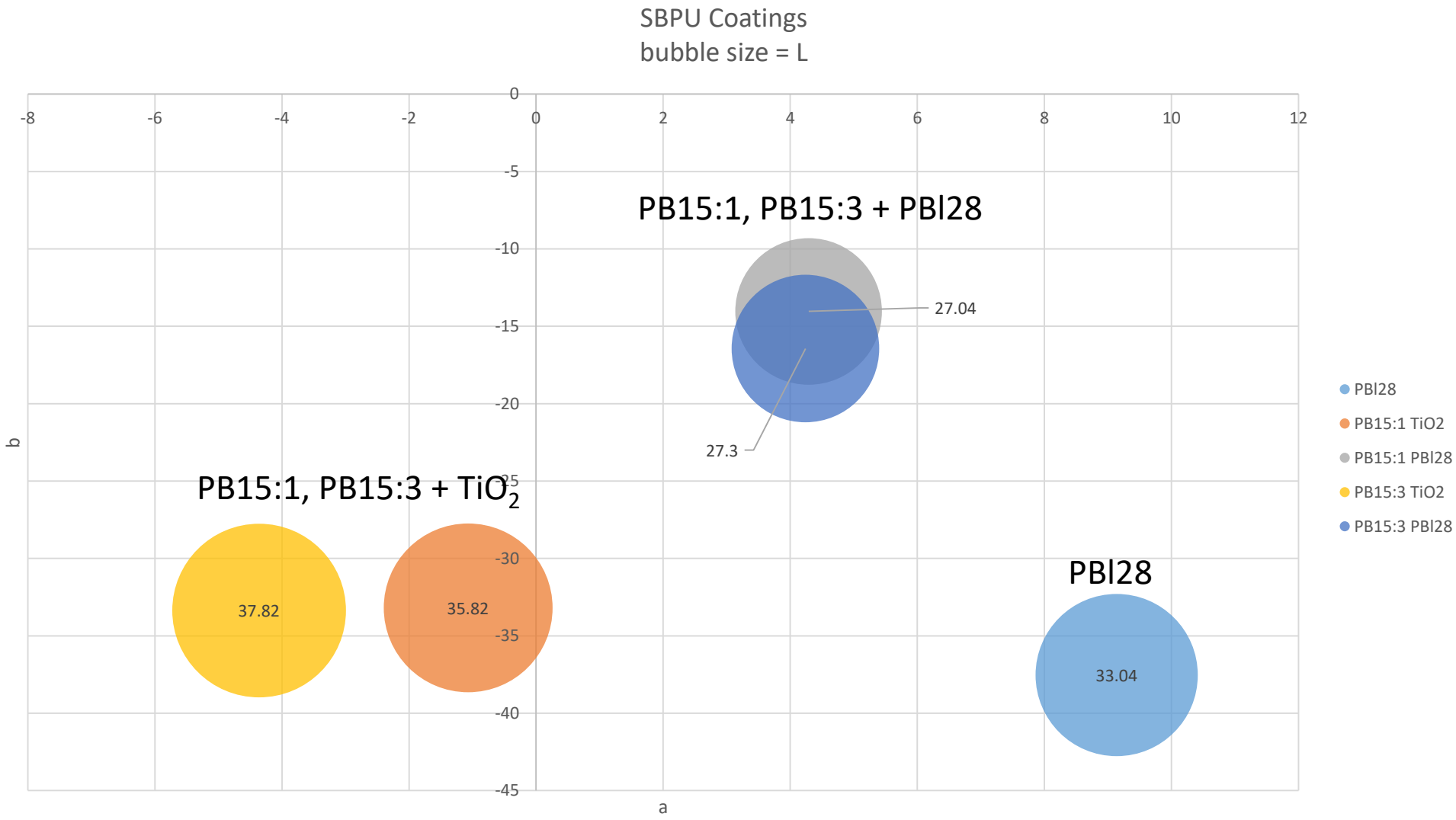
+ 

$CoAl_2O_4$

Spinel Lattice Structure →

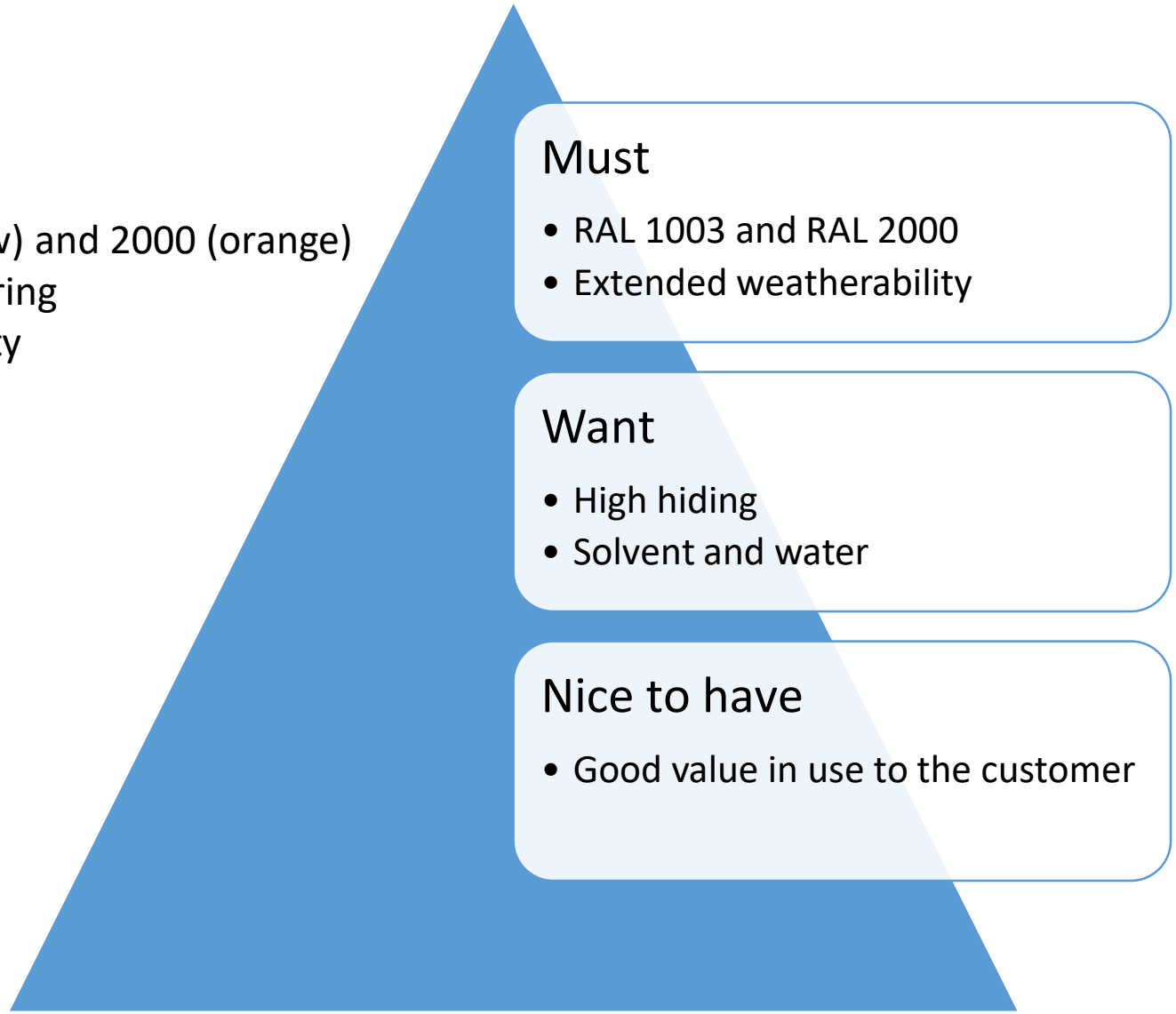
Less acid rain impact:
dE coatings ~10-15
(1/2)

Coatings Evaluation (SBPU)	dE after exposure	Comments After Exposure	Color L	Color a	Color b
PBl28 full tone	**2.13**	Moves green and yellow	33.04	9.14	-37.54
PB15:1:TiO2, 50:50	**20.32**	Moves red and very, very yellow	35.82	-1.07	-33.20
PB15:1:PBl28, 50:50	**12.74**	Moves green and very yellow	27.04	4.29	-14.04
PB15:3:TiO2, 50:50	**21.51**	Moves red and very, very yellow	37.82	-4.36	-33.37
PB15:3:PBl28, 50:50	**12.77**	Moves green and very yellow	27.30	4.24	-16.44


SBPU Coatings
bubble size = L
PB15:1, PB15:3 + PBl28
27.04
27.3
PB15:1, PB15:3 + TiO2
37.82
35.82
PBl28
33.04
b
a
PBl28
PB15:1 TiO2
PB15:1 PBl28
PB15:3 TiO2
PB15:3 PBl28

Example #2

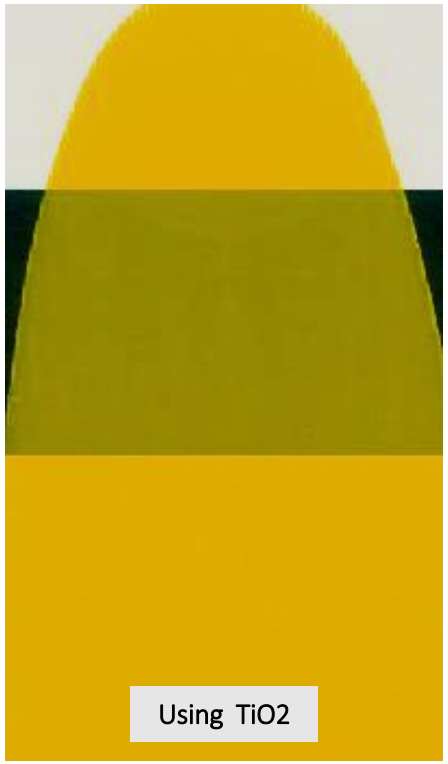
- Liquid Coating
- RAL 1003 (yellow) and 2000 (orange)
- Exterior weathering
- High hide/opacity



RAL 1003 – Signal Yellow

Shade	CI Name	% Pigment
RAL 1003	PY 154	7.28
	PY 139	0.21
	PW 6	1.13
	PY 42	0.31
	Resin & Additives	91.07

RAL 1003



PY 139 Isoindoline

- TiO2 sensitive (weather fastness) – use CICPs or move to PY110.
- Performs poorly when in contact with alkali (WB or with YIO).

PY 154 Benzimidazilone

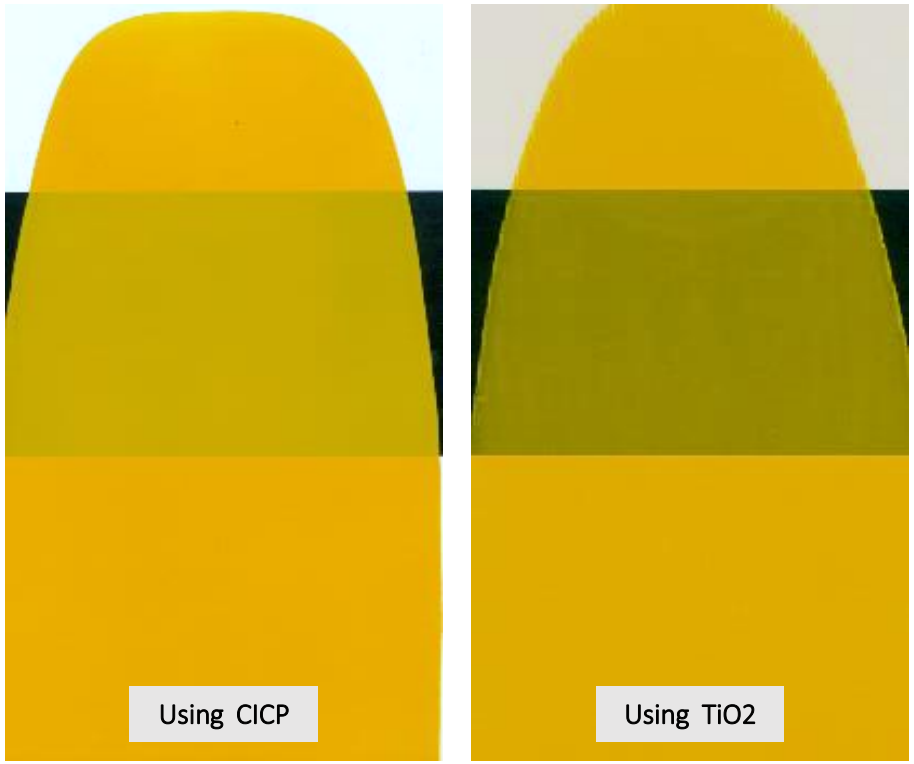
- One “negative” is that its strength is lower than other organic yellow pigments.
- Not TiO2 sensitive (weather fastness).

RAL 1003 – Signal Yellow

Shade	CI Name	% Pigment
RAL 1003	PY 154	6.13
	PBr 24	5.47
	PY 53	0.39
	Resin & Additives	88.02

Shade	CI Name	% Pigment
RAL 1003	PY 154	7.28
	PY 139	0.21
	PW 6	1.13
	PY 42	0.31
	Resin & Additives	91.07

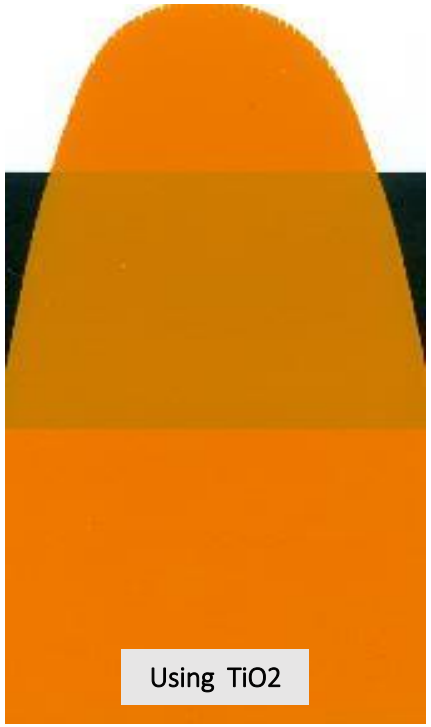
RAL 1003



RAL 2000 – Yellow Orange

Shade	CI Name	% Pigment
RAL 2000	PY 139	6.5
	PO 36	0.8
	PR 254	0.03
	PW 6	2.03
	PBk 7	0.007
	Resin & Additives	90.63

RAL 2000



PY 139 Isoindoline

- TiO2 sensitive (weather fastness) – use CICPs or move to PY110.

PO 36 Benzimidazilone

- TiO2 sensitive (weather fastness) – use CICPs.

PR 254 Diketopyrrolopyrrole (DPP)

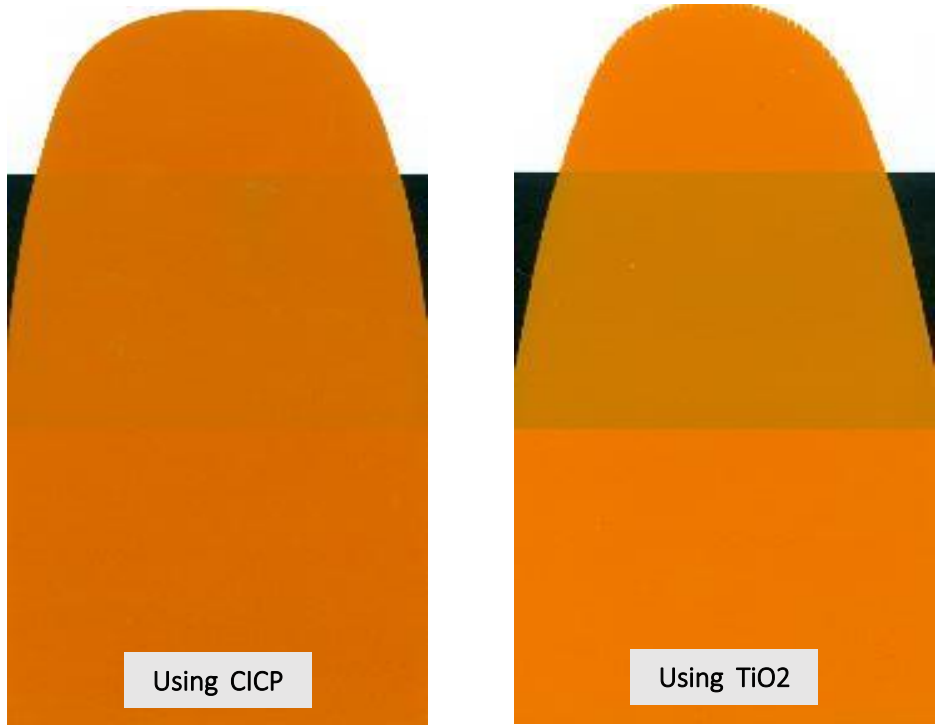
- TiO2 sensitive (weather fastness) – use CICPs.

RAL 2000 – Yellow Orange

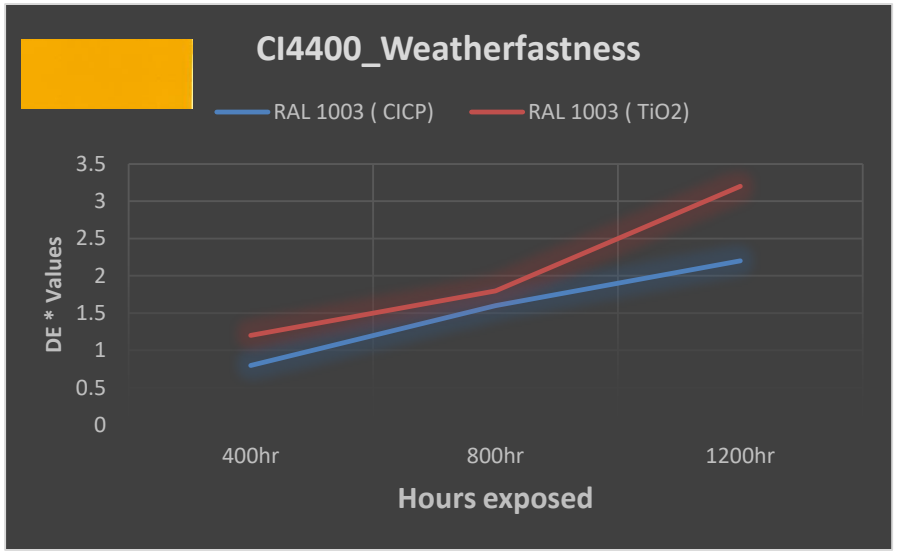
Shade	CI Name	% Pigment
RAL 2000	PY 139	6.16
	PO 36	0.67
	PBr 24	0.86
	PY 119	2.82
	Resin & Additives	89.50

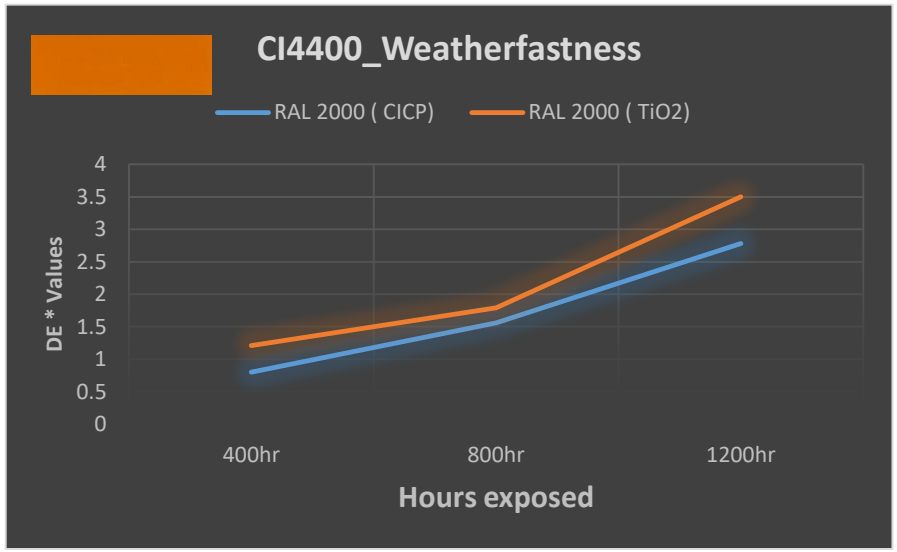
Shade	CI Name	% Pigment
RAL 2000	PY 139	6.5
	PO 36	0.8
	PR 254	0.03
	PW 6	2.03
	PBk 7	0.007
	Resin & Additives	90.63

RAL 2000



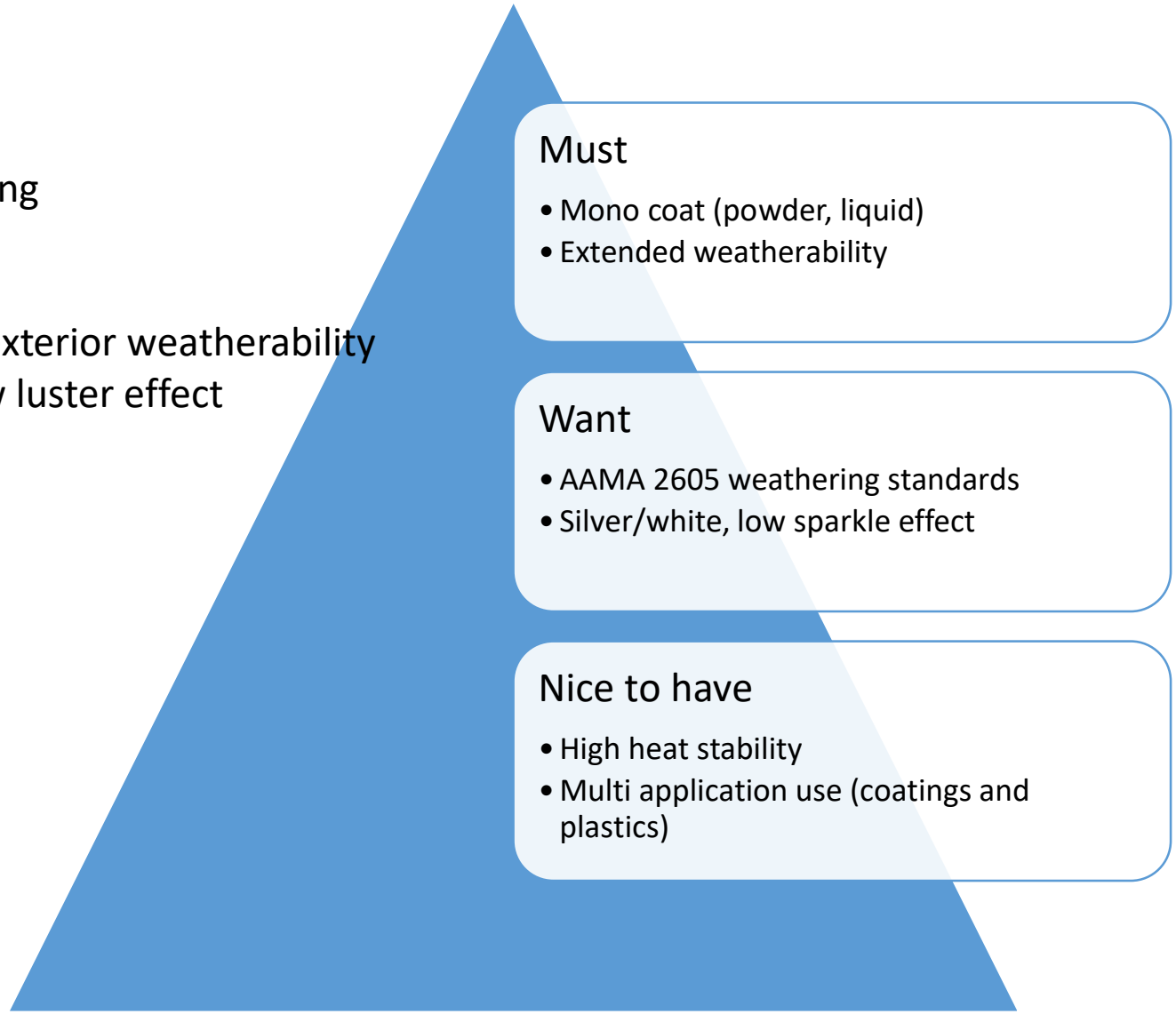
Case study - Weather Fastness





Example #3

- Mono coat coating
  - Powder
  - Liquid
- Very long term exterior weatherability
- Silver/white, low luster effect



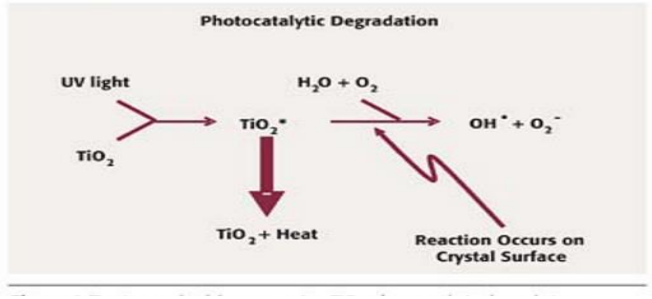
Effect Pigments

- Colors support the balancing act between function and aesthetics, technology and art.

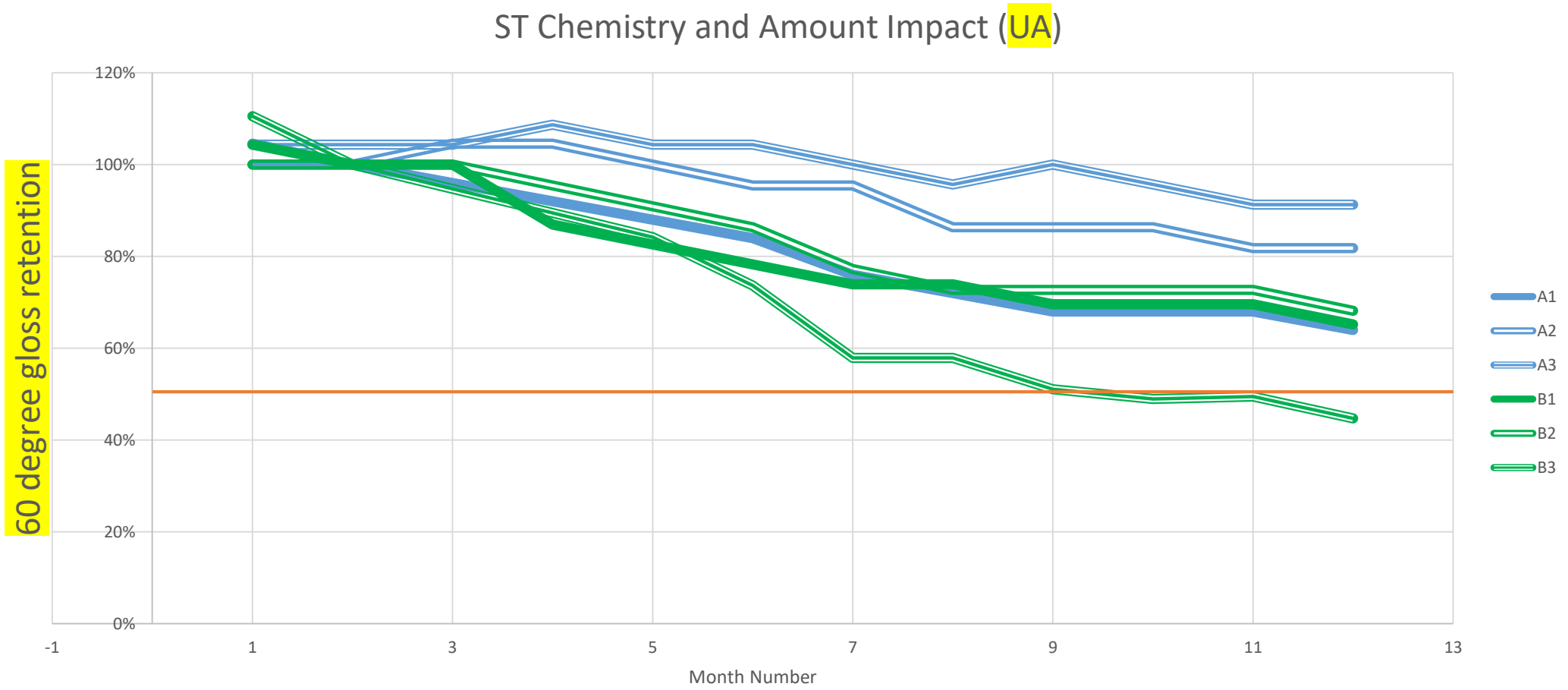
Mica Surface Treatment

- *Why use a surface treatment?*

  - Primary coatings for mica's are titanium dioxide and iron oxide.
    - *Iron oxide is stable when exposed to UV radiation, however titanium dioxide may undergo photocatalytic degradation*



Surface Treatments for Pearlescent Pigments

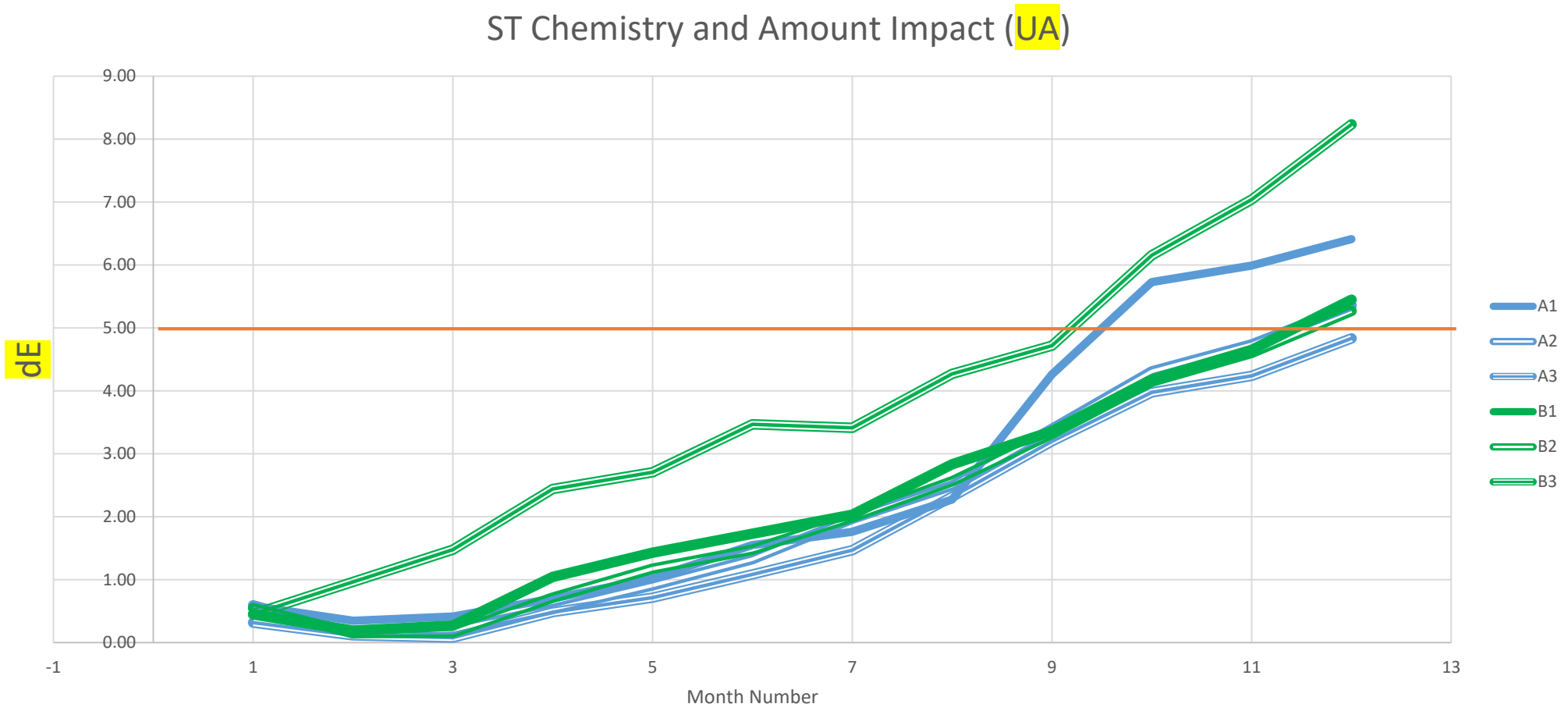


1 – 15 micron silver mica

A – Chrome-Containing Surface Treatment (WR)

B – Chrome-Free Surface Treatment (NXR)

Surface Treatments for Pearlescent Pigments



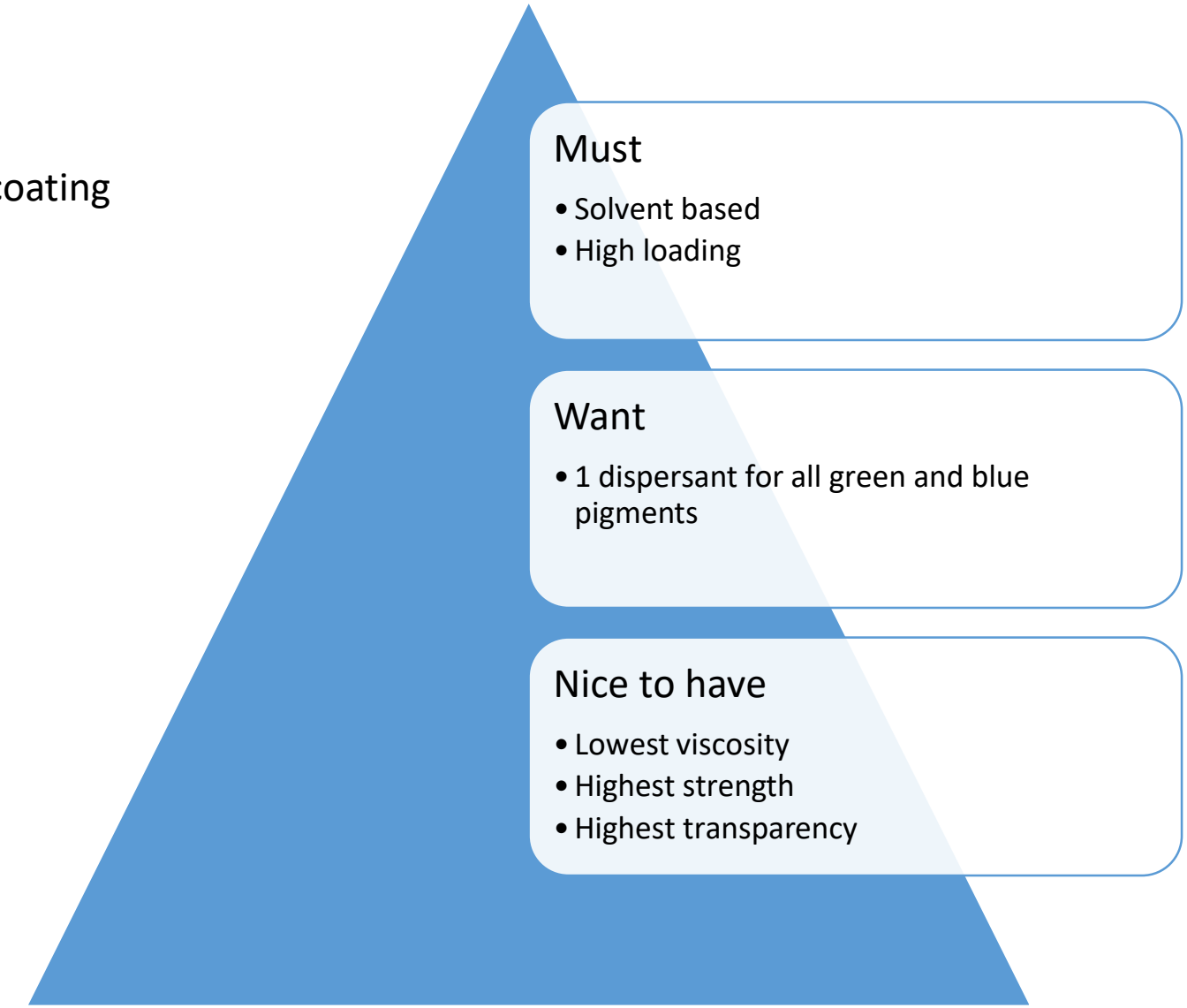
1 – 15 micron silver mica

A – Chrome-Containing Surface Treatment (WR)

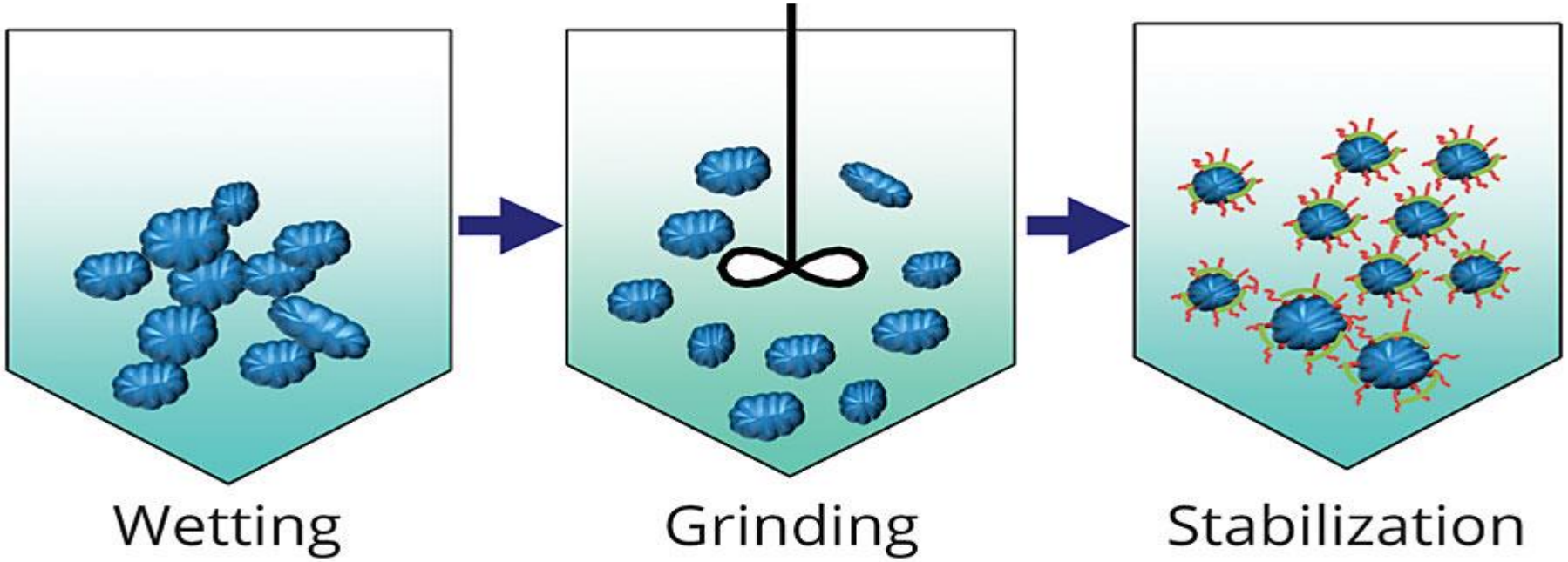
B – Chrome-Free Surface Treatment (NXR)

Example #4

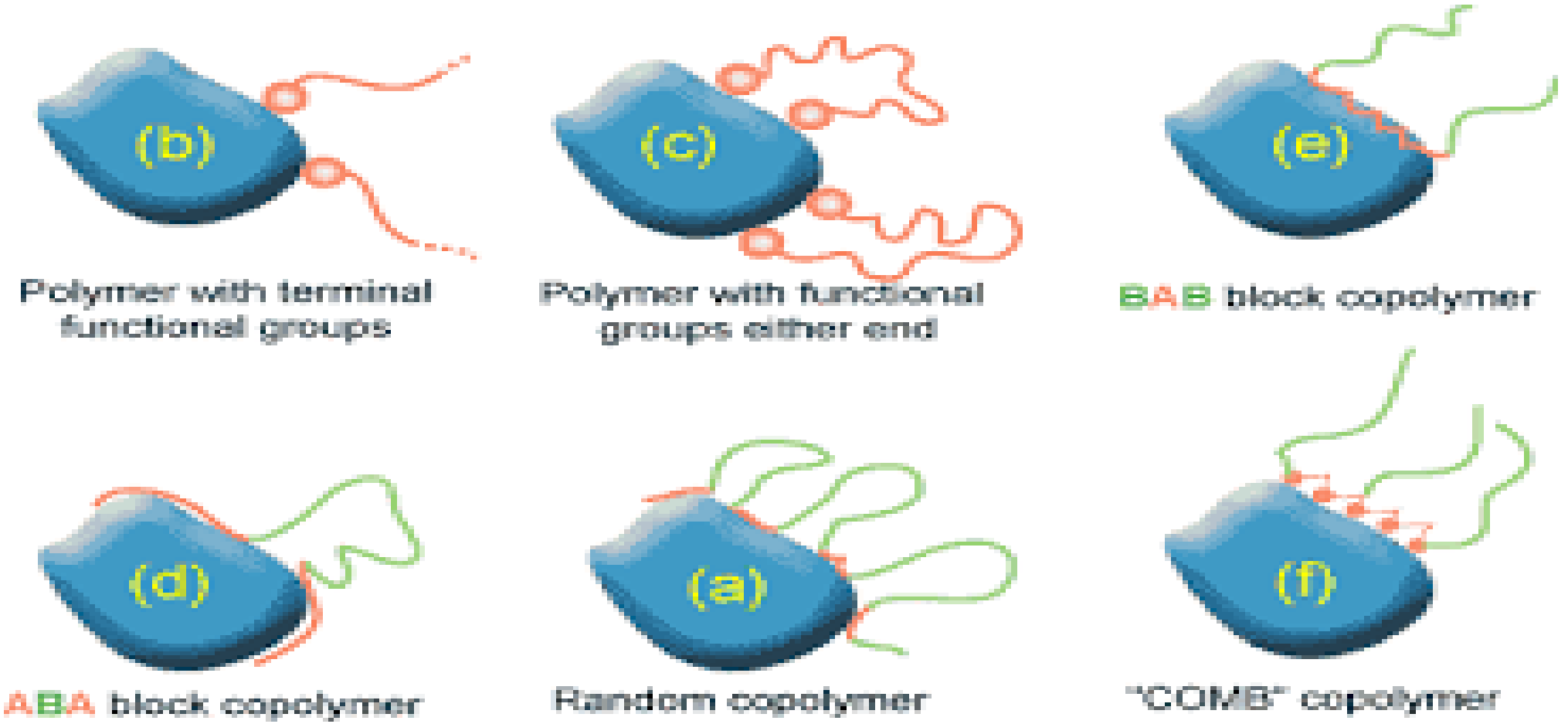
- Solvent based coating
- Blue and Green
- High loading



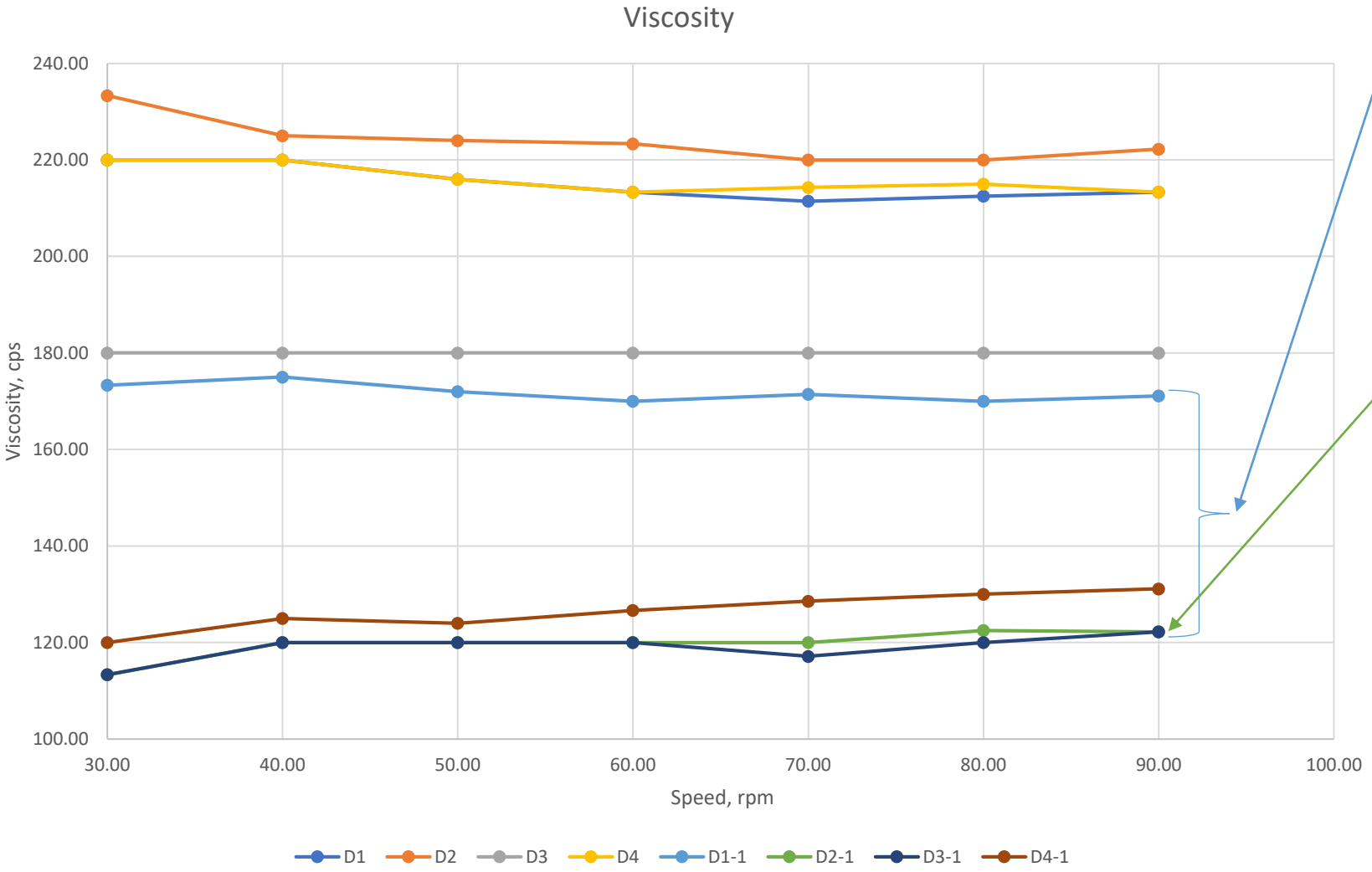
Dispersion Steps



Dispersants

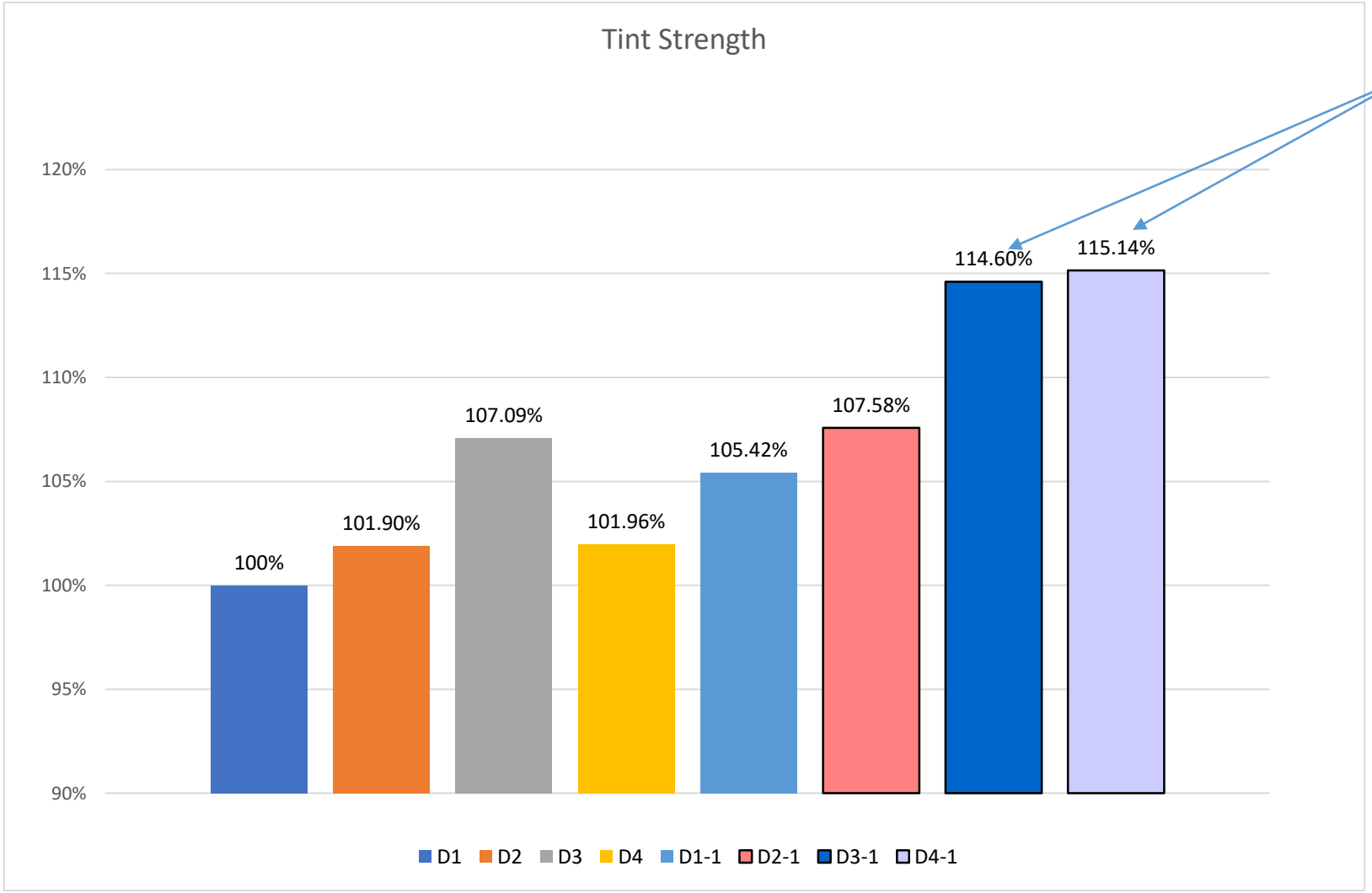


Dispersant Screening for PB15:2



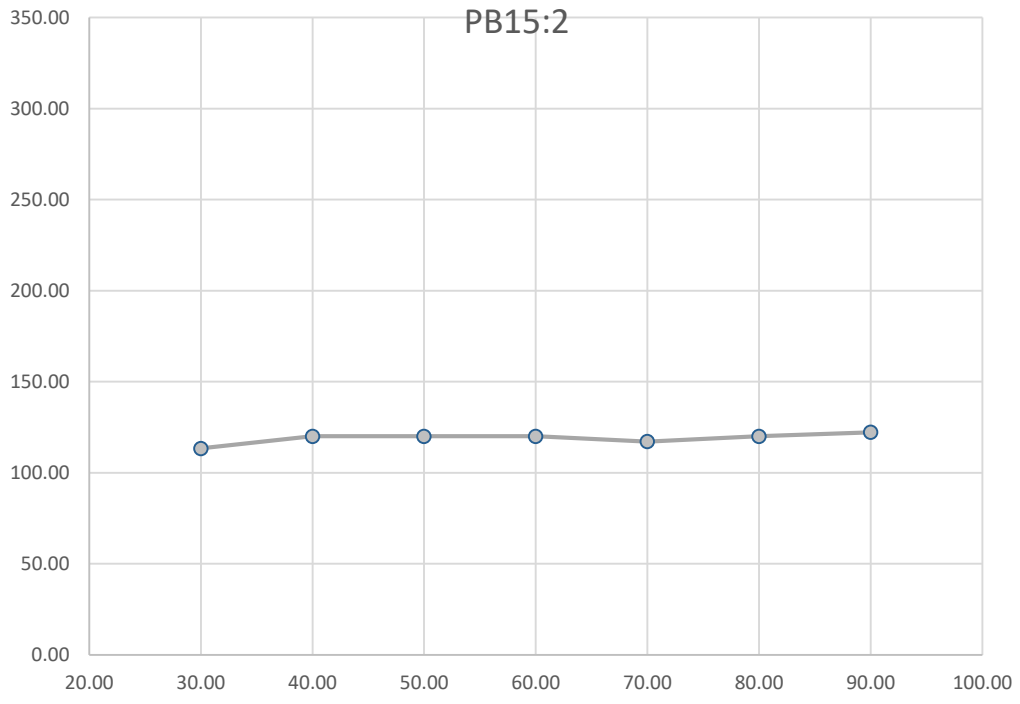
- The addition of “-1” lowers viscosity of all dispersants.
- D2-1 and D3-1 provide the lowest viscosity overall.

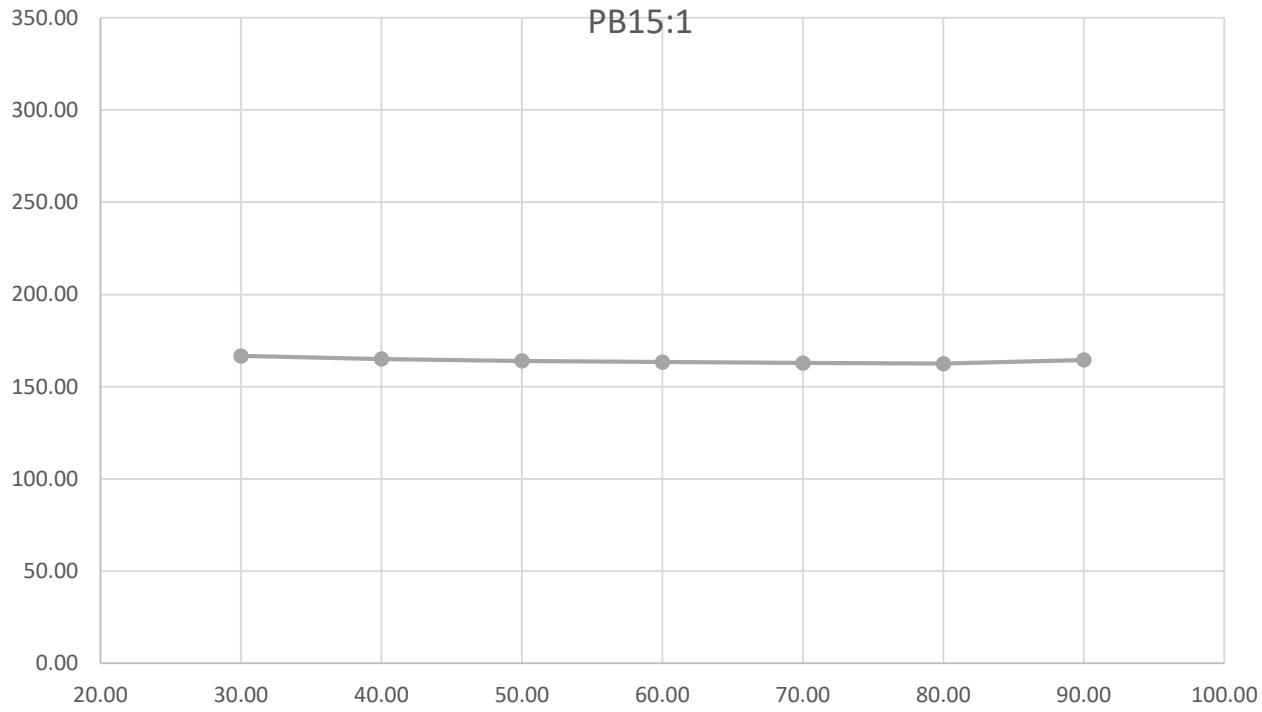
Dispersant Screening for PB15:2



- Highest strength is D3-1 and D4-1.
- In all cases the addition of "-1" increased the strength.

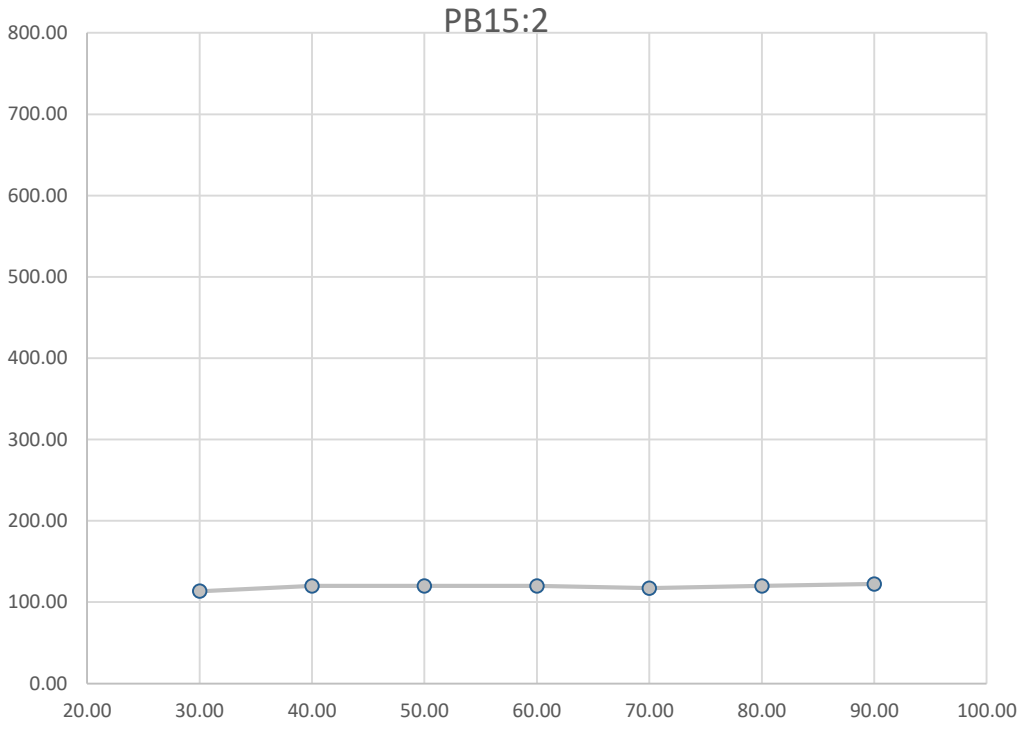
Applying D3-1 to PB15:1

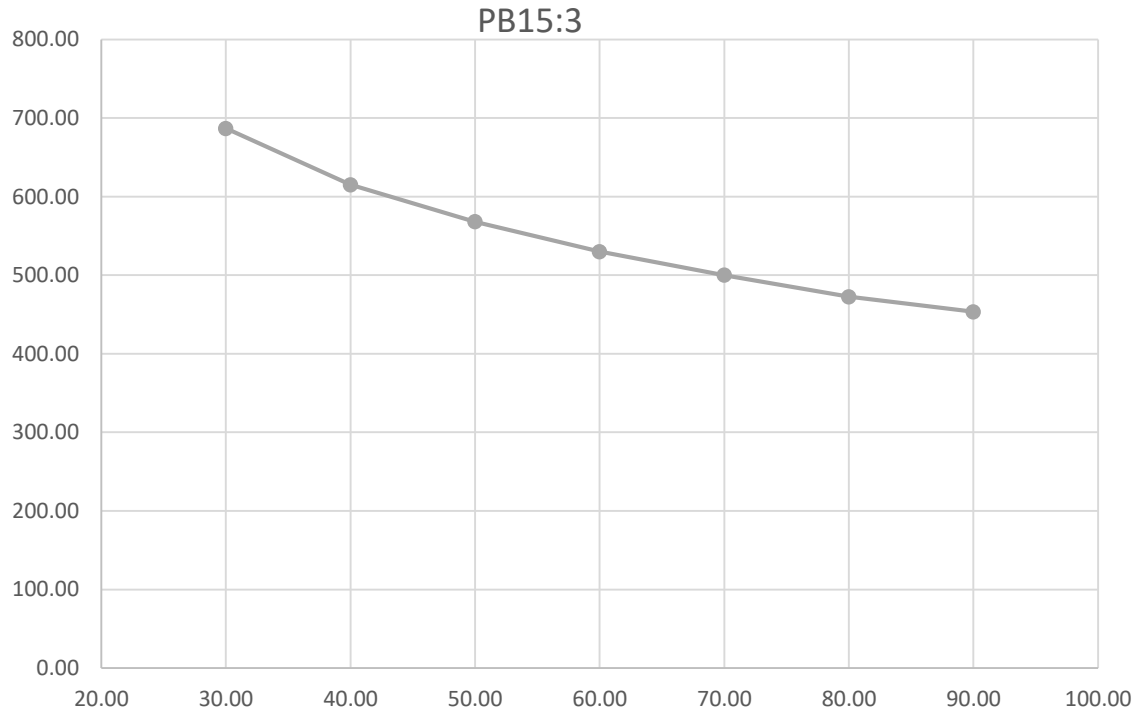




Alpha ==========➔ Alpha

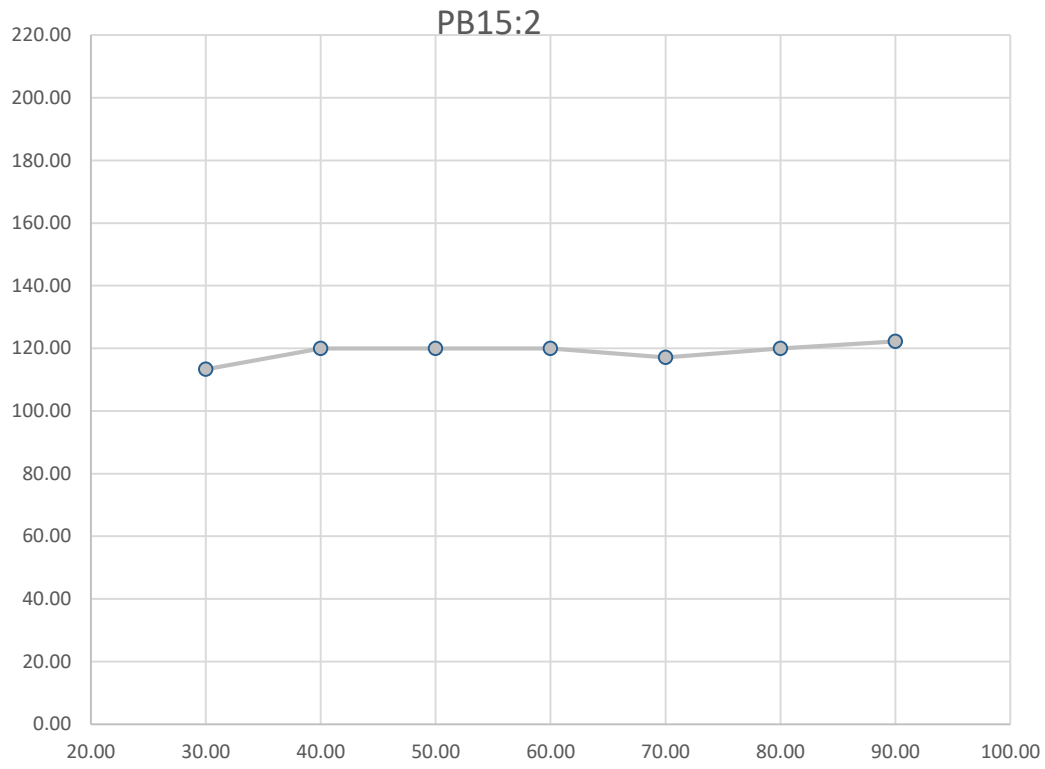
Applying D3-1 to PB15:3

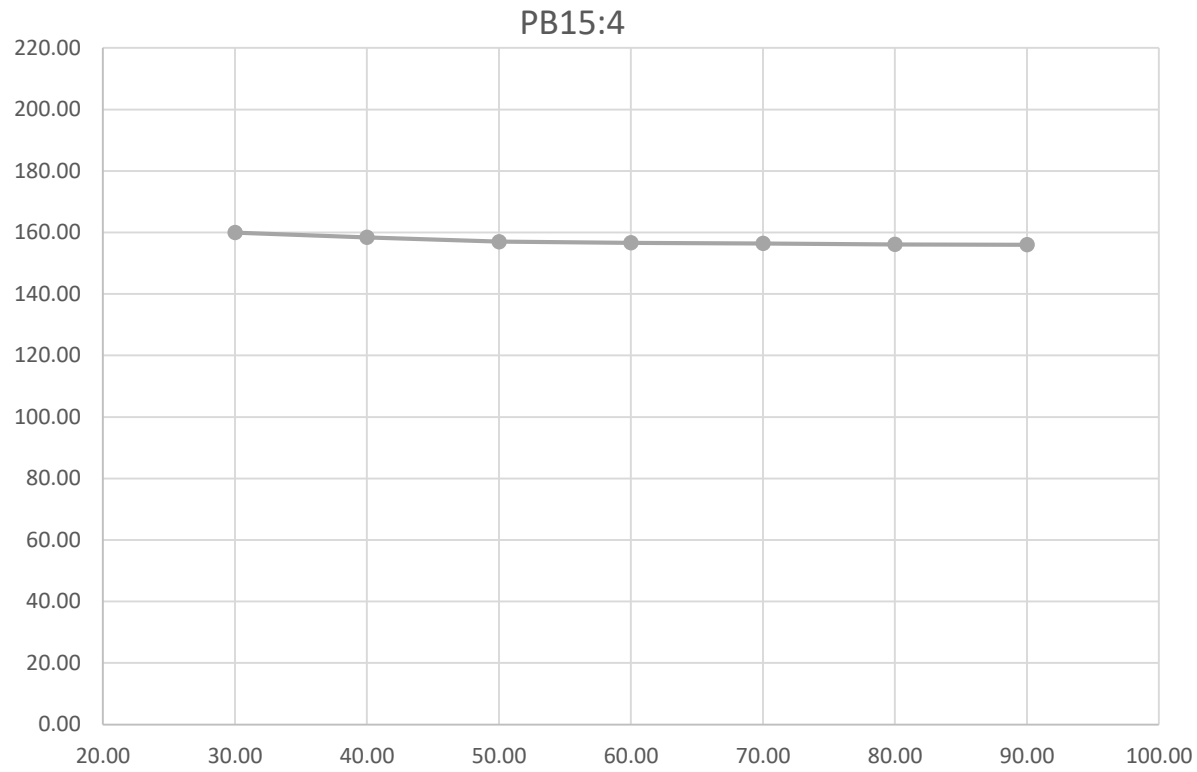




Alpha ==========➔ Beta

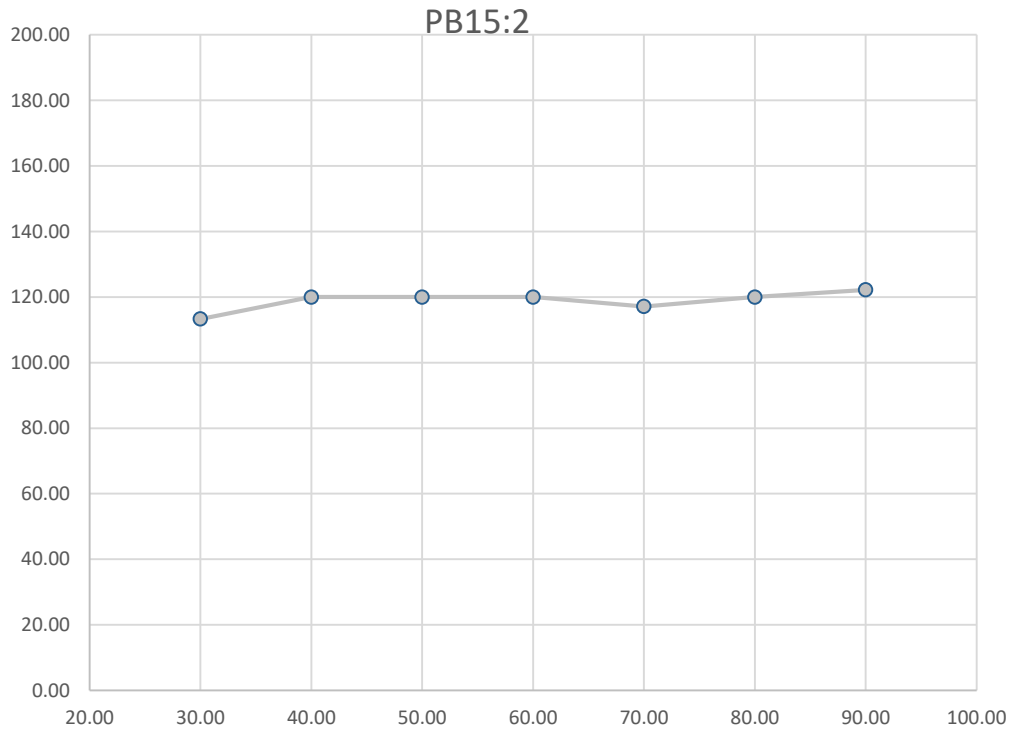
Applying D3-1 to PB15:4

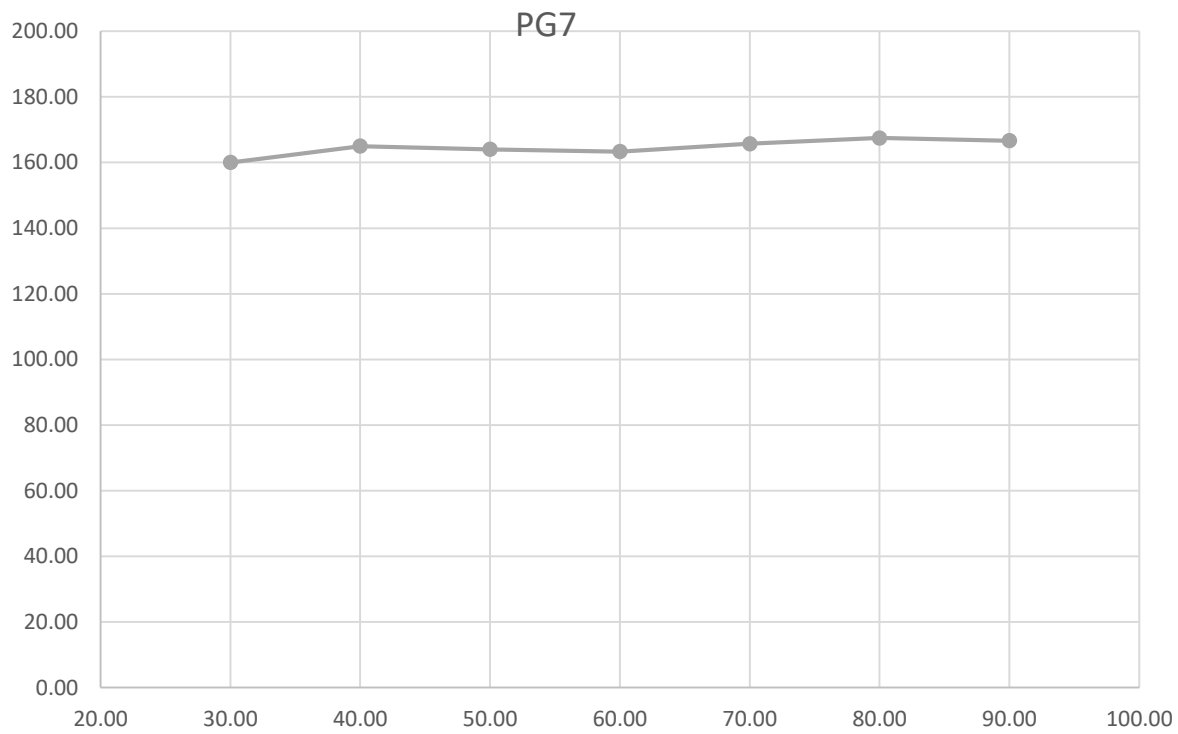




Alpha, ST ==========➔ Beta, ST

Applying D3-1 to PG 7

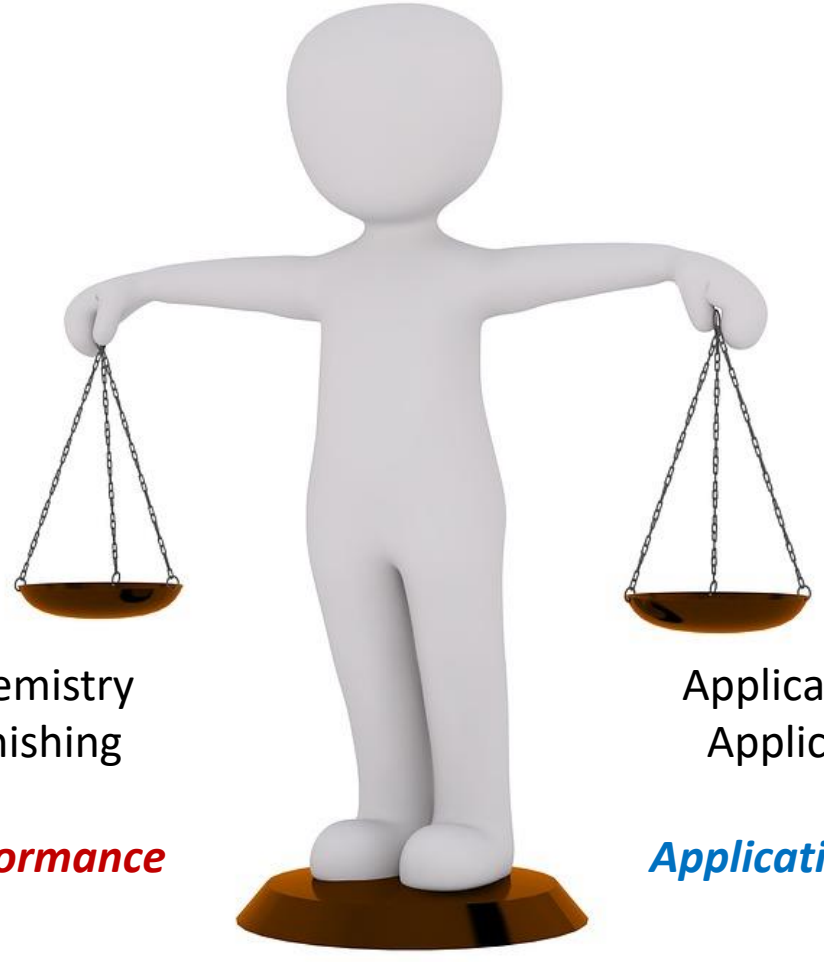




MUST's WANT's NICE TO HAVE's

Questions?

Questions?



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