

Powder Coatings

Impact of Pigment Finishing on Powder
Coating Performance



Bonnie Piro

Technical Marketing Manager
Sudarshan North America, Inc

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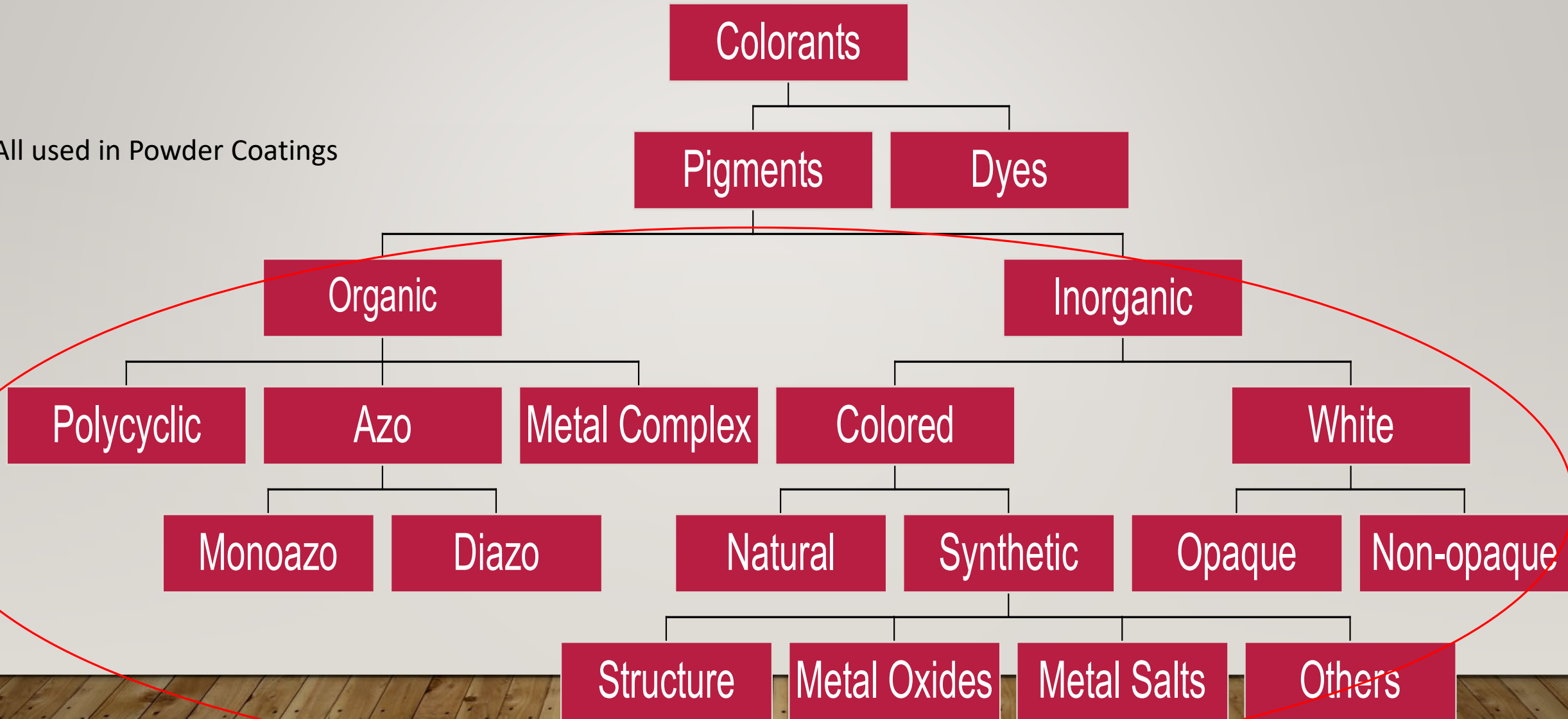
AGENDA

- Pigment Classification
- Pigment Selection Process
- Pigment Manufacturing Process
- Examples of Chemistry and Finishing on Performance



Pigment Classification

All used in Powder Coatings



Pigment Selection Process

- A pigment is only observed as technically valuable to a customer if it performs in the correct manner required for the application it is used for.
- Each market segment has unique technical requirements



Appliance



ACE



Architectural



Automotive



Functional



Furniture



General
Industrial



IT

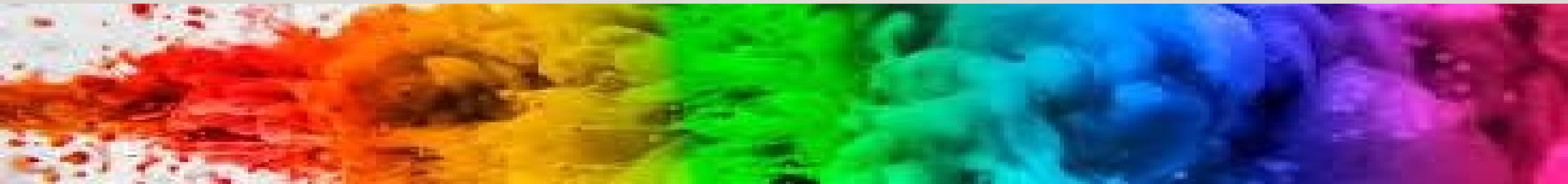


General Trade
Coaters

Powder Coating applications

Powder Coatings – Pigment Requirements

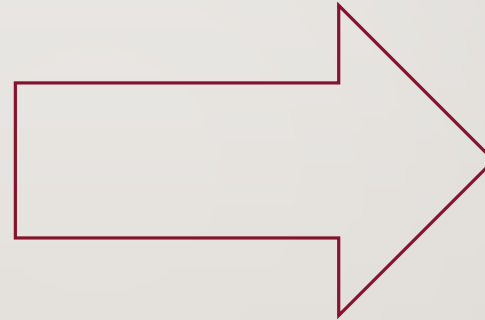
- Excellent range of heat fast colors
- Good light and weather fastness
- Good acid- alkali resistance
- Good dispersibility
- Good over bake resistance
- Good rheology and flow
- Non-migratory during extrusion
- Compatible with wide number of polymers
- Compatible with TGIC and non TGIC curing agent



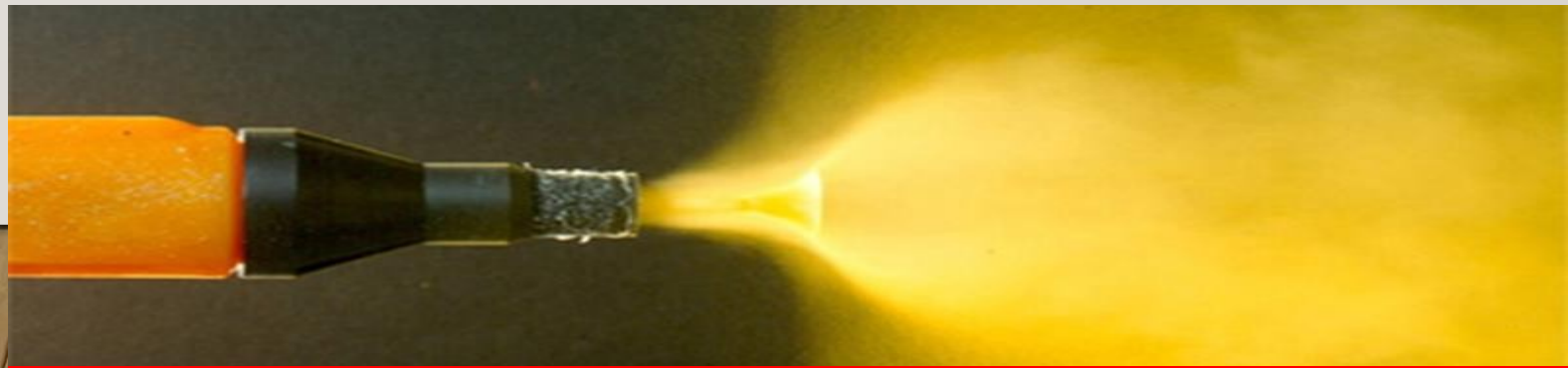
COLORANTS - PHYSICAL PARAMETERS

- Oil absorption
- Surface Area
- Pigment Volume Concentration
- Average particle size
- Particle distribution
- Particle shape
- Texture
- Surface treatment
- Partial Solubility

- Moisture Content
- Conductivity
- Refractive Index
- pH
- Viscosity
- Nucleating
- Shear Stability
- Inertness
- Hardness
- Density



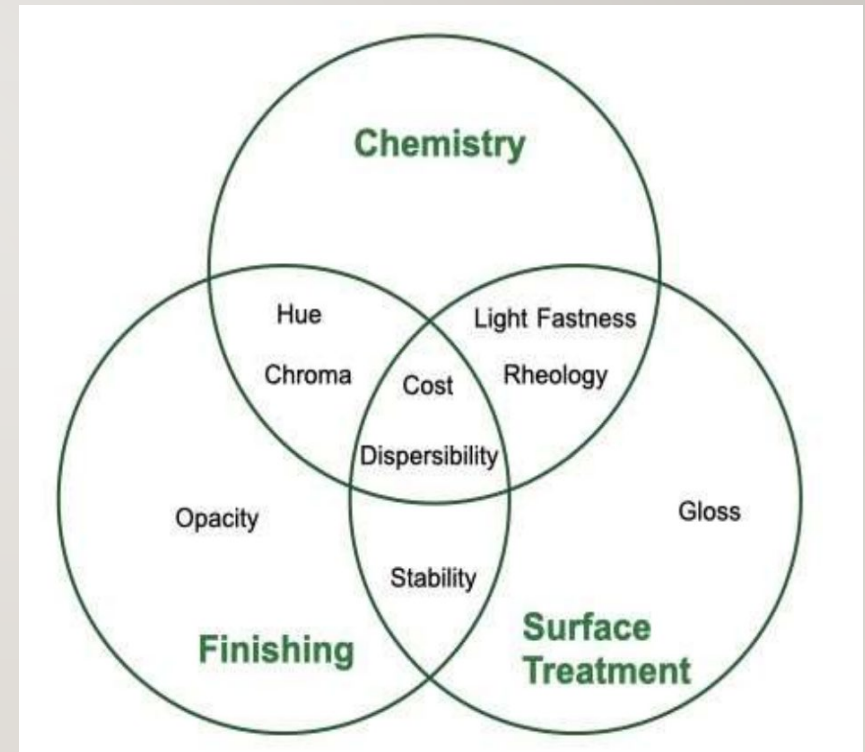
*Pigment parameters
directly impact
application
performance*



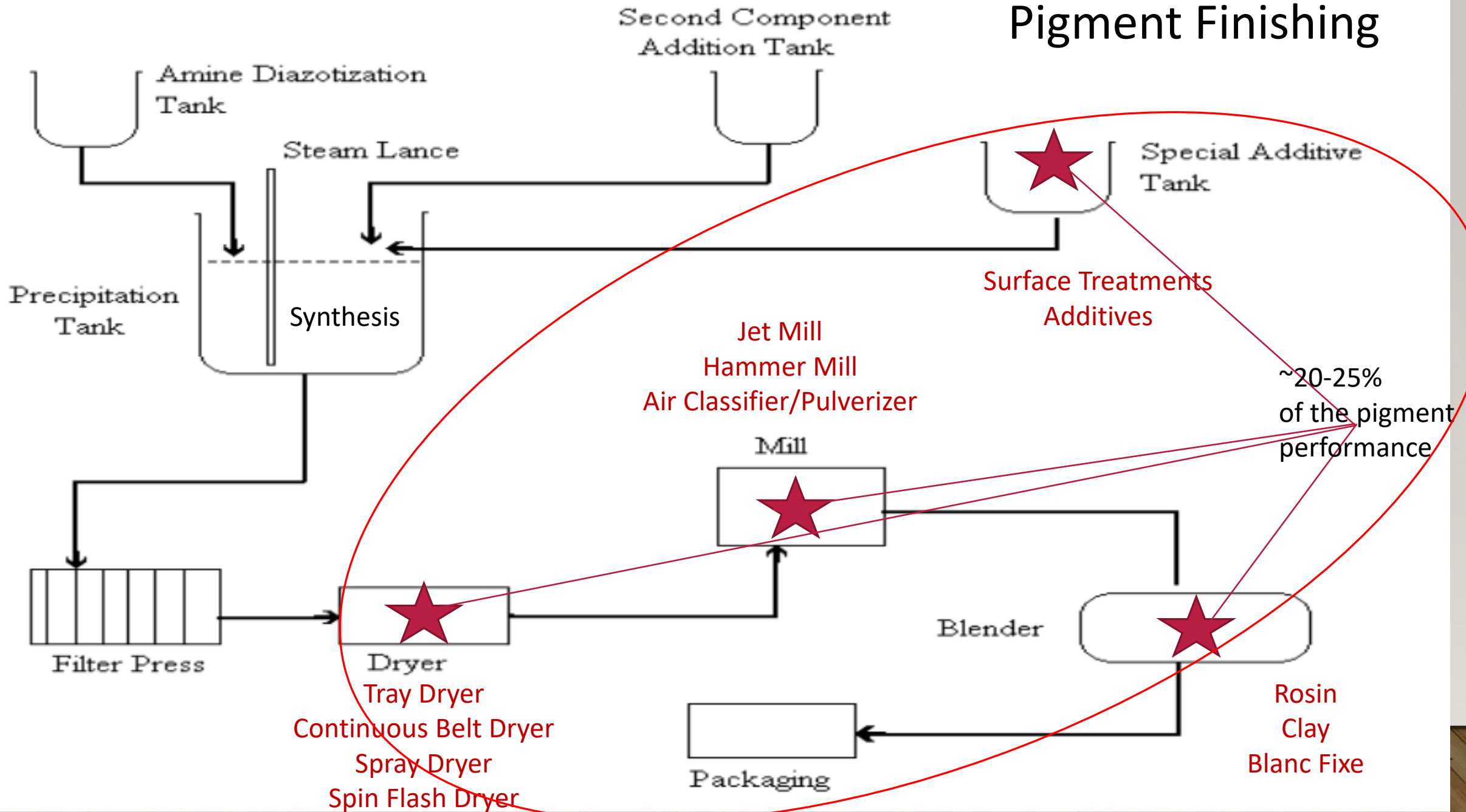
PIGMENT SYNTHESIS

~75-80%
of the pigment
performance

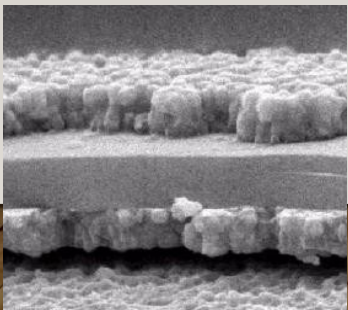
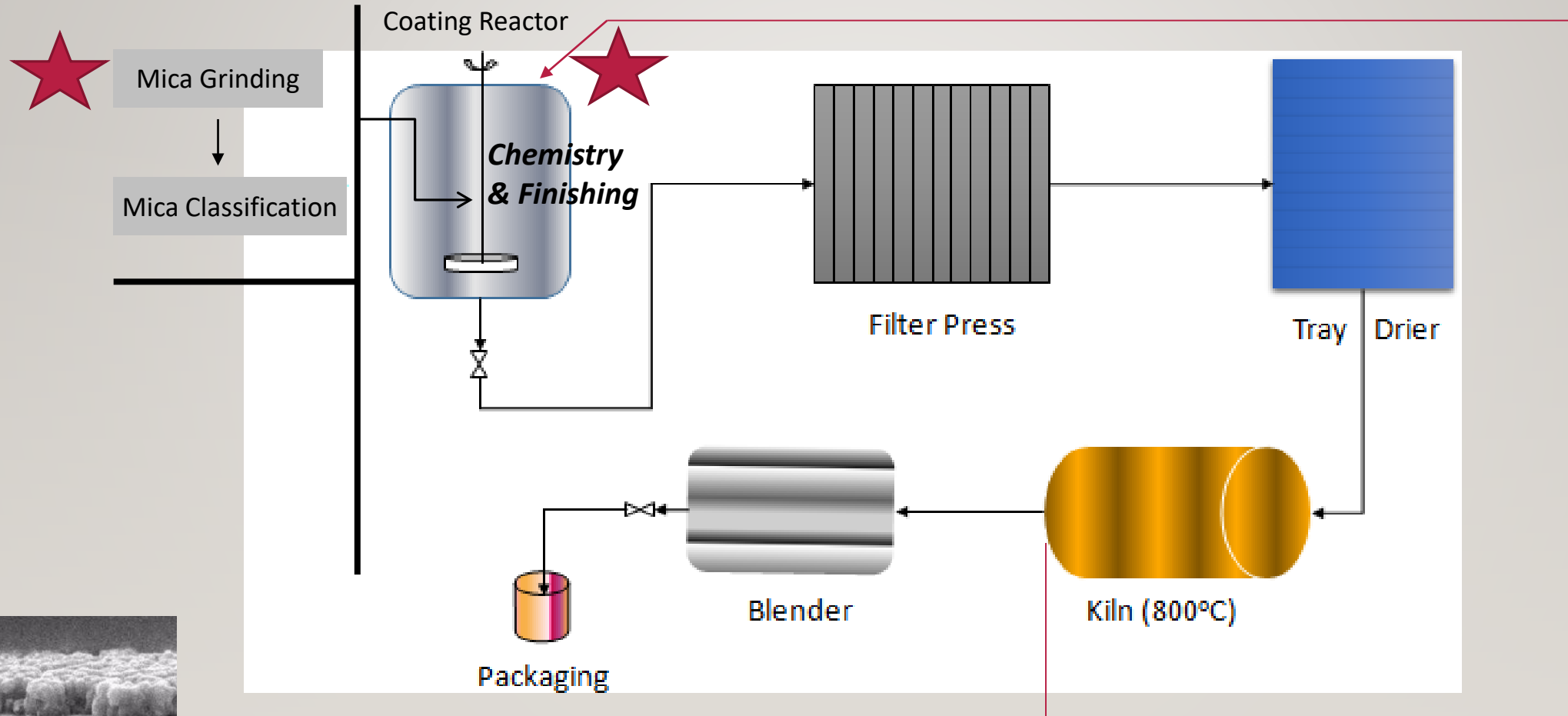
- The first manufacturing step(s) determine the chemical identity of the pigment.
- Crude pigment is the end product of the synthesis.
- Finishing and surface treatment provide the end use properties.



Pigment Finishing



EFFECT PIGMENT MANUFACTURING



Example of substrate coated with metal oxide

Finishing Steps – Impact on Application.....*in general*



Pigments for Plastics

- No additives or surface treatments
- Spray or Spin Flash Dryer
- Jet mill or hammer mill
- No fillers
- Plastic formulations require “clean”, softer and smaller in size for improved polymer dispersion.



Pigments for Coatings

- Additives and surface treatments are used to improve dispersing and stability
- Tray dryers or continuous belt dryers
- Hammer mills or air classifiers
- Fillers can be used
- Coatings formulations are the most complex resulting in a wide variety of finishing steps.



Pigments for Inks

- Additives and surface treatments can be used especially for the more “high tech” inks like inkjet
- A variety of drying methods are used
- Different pulverizing methods are used
- Fillers are rarely used
- Ink formulations span the gamut of “low to high tech” thus pigments “designed” for another application maybe more appropriate.

Powder Coating

POWDER COATING DISPERSION – IS IT MORE LIKE A LIQUID DISPERSION OR PLASTICS DISPERSION?

Liquid

- Single pigment dispersion.
- Dispersant used is matched to the pigment chemistry.
- Carrier resin is typically non-functional to the dispersing of the pigment.
- Pigment loading is maximized but dictated by pigment chemistry and rheology of the dispersion.
- Final product color is achieved by mixing the single pigmented dispersions.
- Shading is done in the mixer as the final step.

Powder

- Multiple pigment dispersion.
- No dispersing agent is typically used but other additives are part of the formulation.
- Pigment loading is dictated by opacity needs and other physical property limitations of the formula.
- Final product color is achieved in the extruder chamber.
- Shading is done via re-extrusion with added “raw” pigment powder.

Plastic

- Can be single pigment master batches (high pigment loading) or multiple pigment dispersion.
- No dispersing agent is typically used but other additives are part of the formulation.
- Pigment loading is dictated by pigment chemistry for master batches and by physical property limitations for the final product needs.
- Final product color is achieved by mixing single pigmented master batches and re-extruding or from the mixed pigment extrusion.

Answer: It depends on the pigment chemistry (CI)

Examples of Pigments on Powder Coating Performance

PB 15:3 -	Finishing Differences (Plastic/Coating/Ink)
PY 83 -	Particle Size Differences
PY 83/PY 139 - PO 36/PO 64/PO 34 -	Similar Color; Different Chemistry Similar Color; Different Chemistry
PB 15:4 -	Resin Formulation Differences
PR 170 -	Same Chemistry; Shade Differences
Mica -	Surface Treatment Chemistry



Property
Specific gravity
Specific surface area (m2/g)
Particle size (nm, media)
Oil Absorption

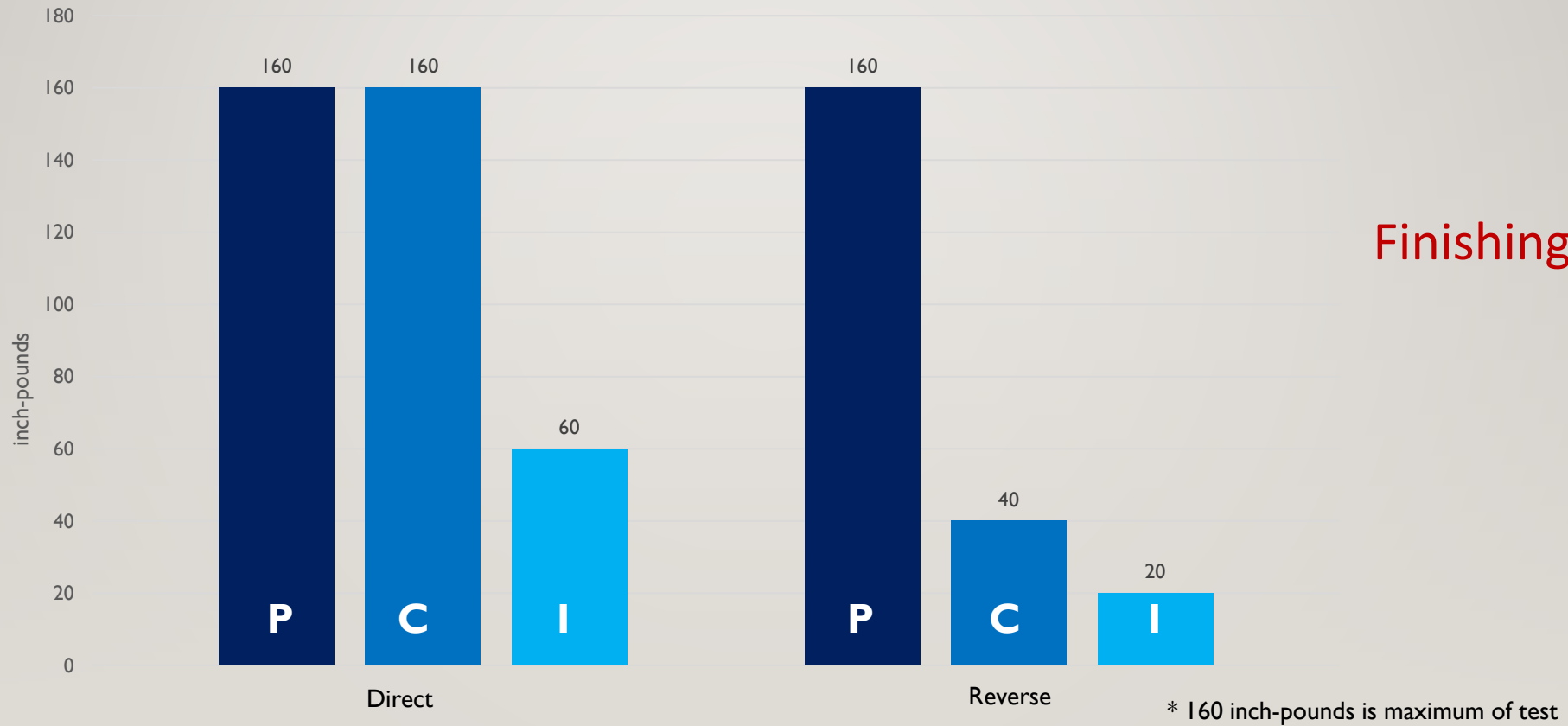
PBI5:3 - Plastics
1.55
56.9
118
45

PBI5:3 - Coatings
1.70
57.0
159
40

PBI5:3 - Inks
1.45
34.3
161
34

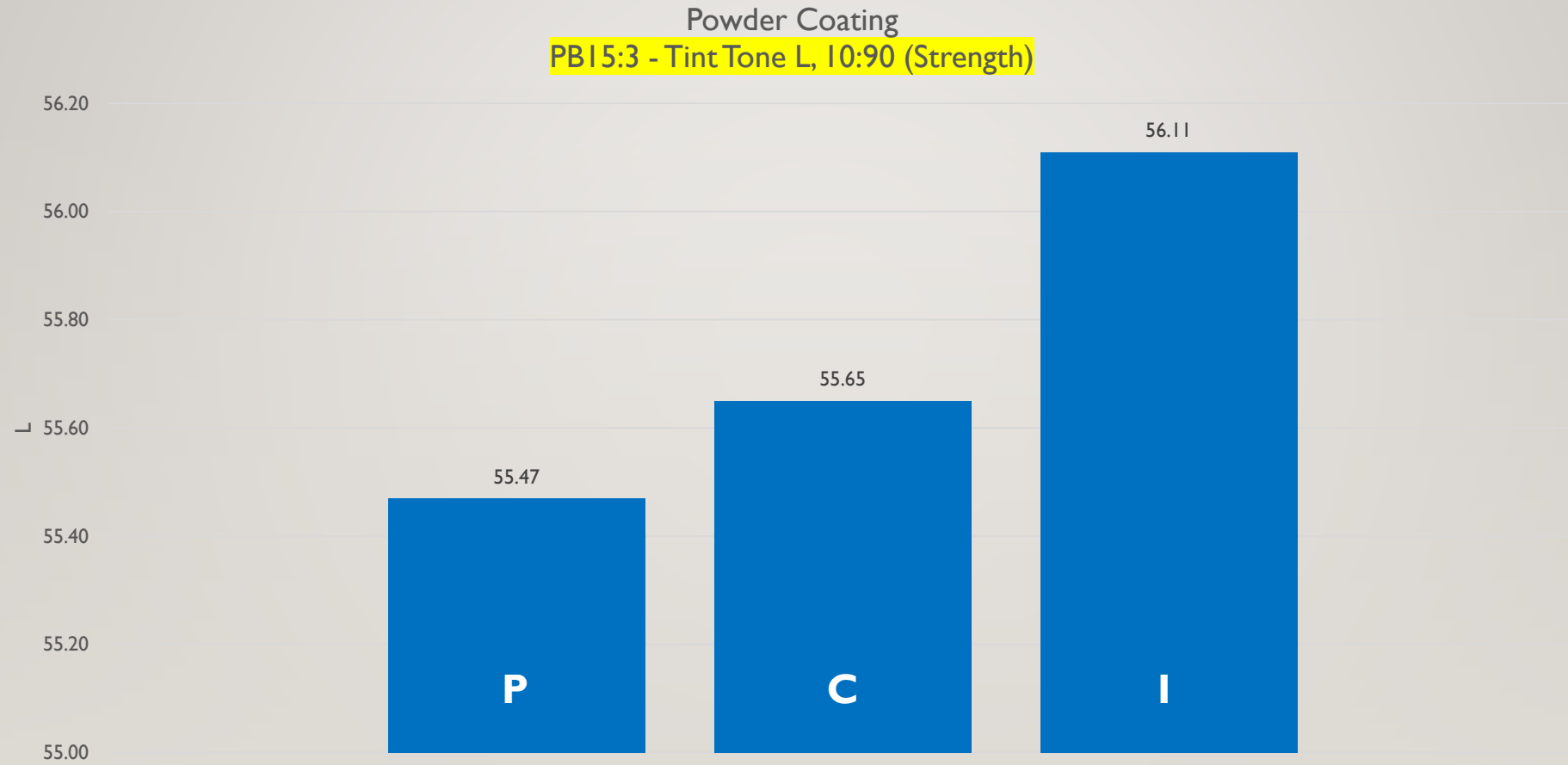
Powder Coating

PBI5:3 - 10:90 Impact Resistance



Finishing Differences

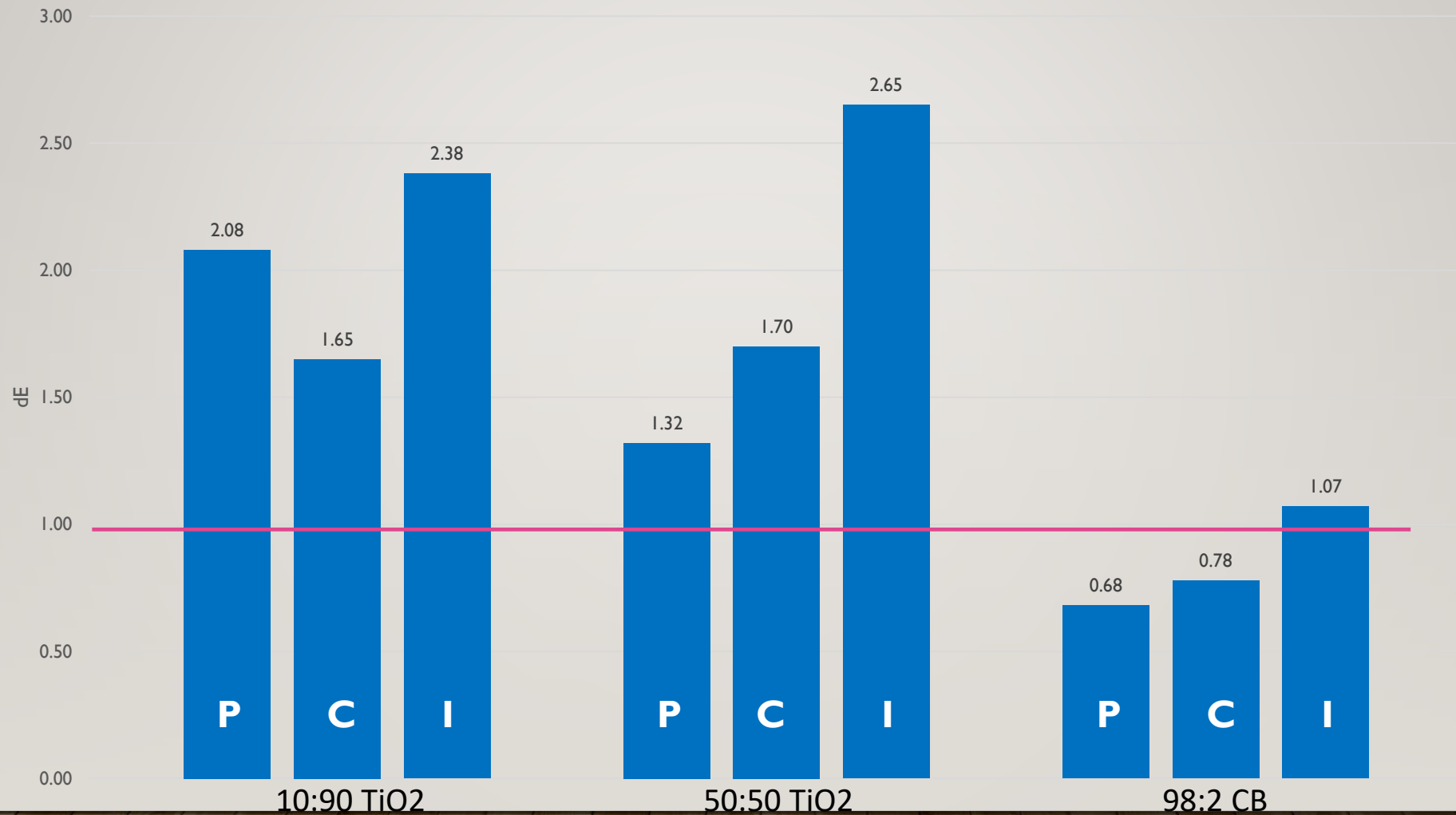
Finishing Differences



Finishing Differences

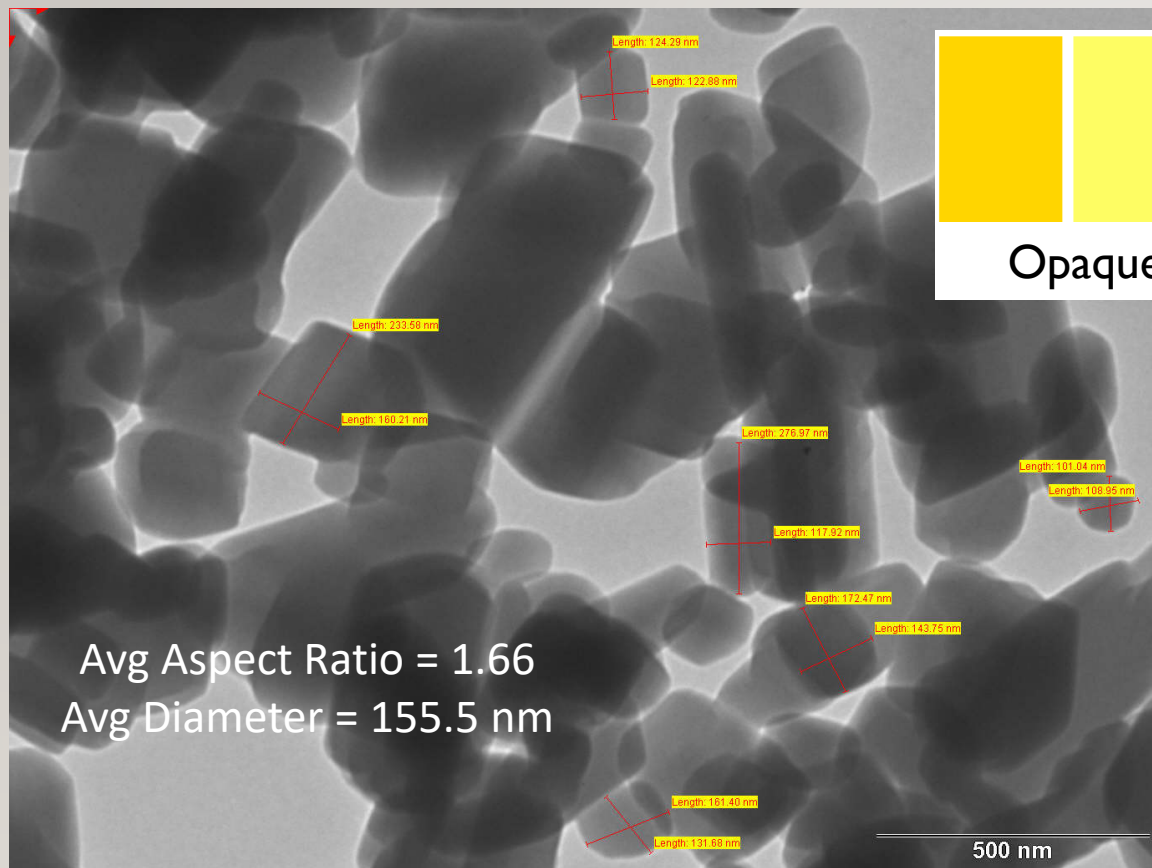
Powder Coating

PB15:3 - Overbake Stability, dE - 60 minutes @ 425°F

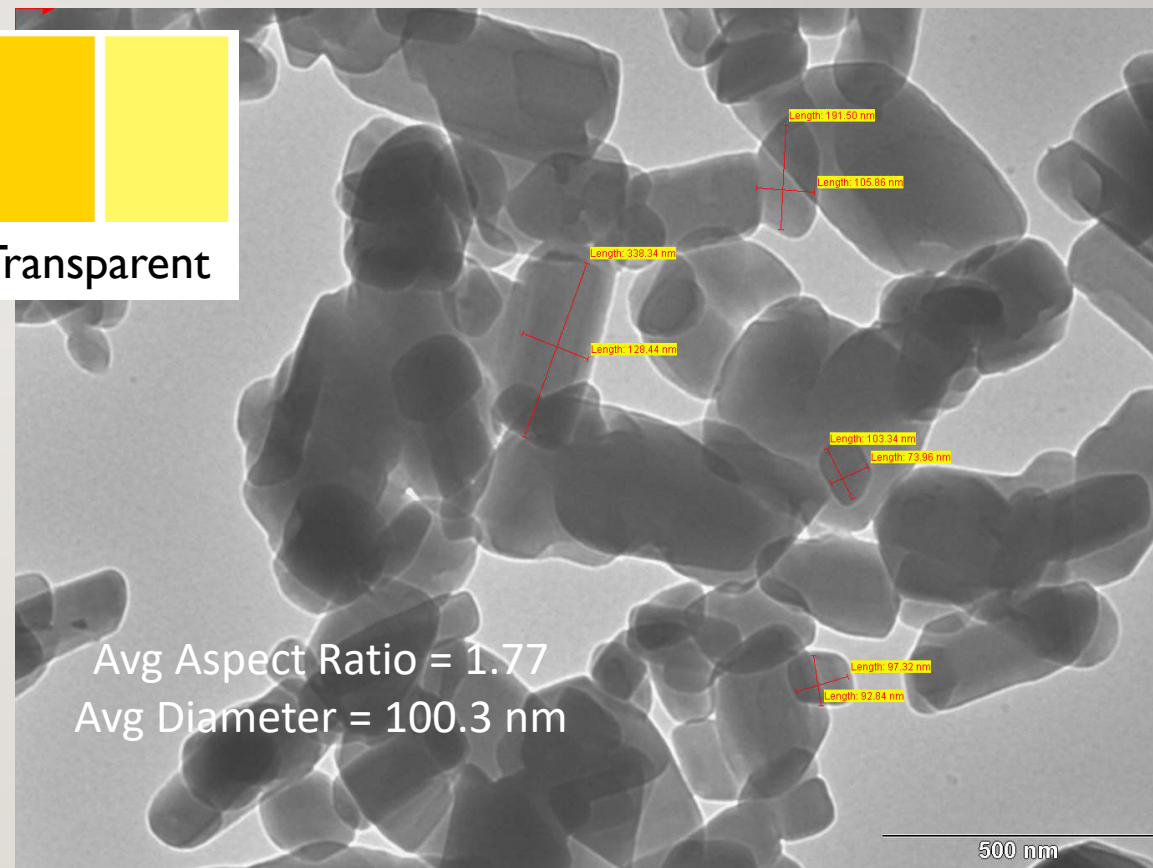
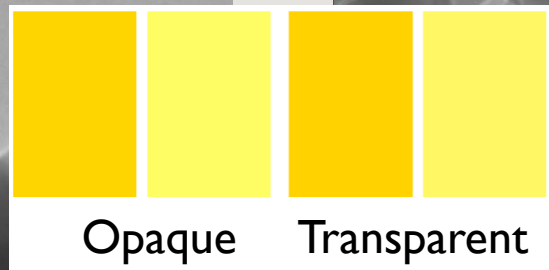


TEM: PY83

Particle Size Differences



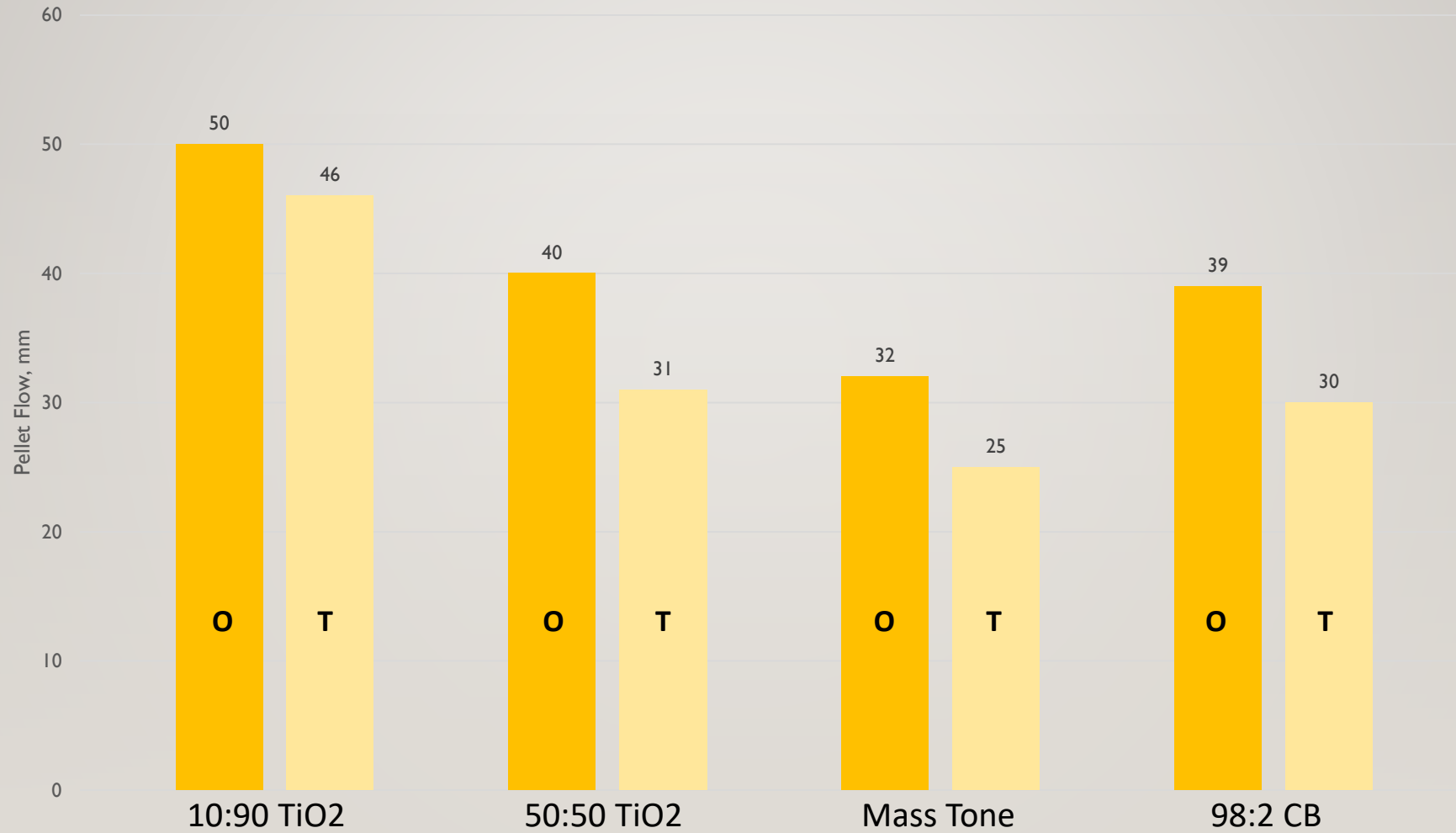
Opaque



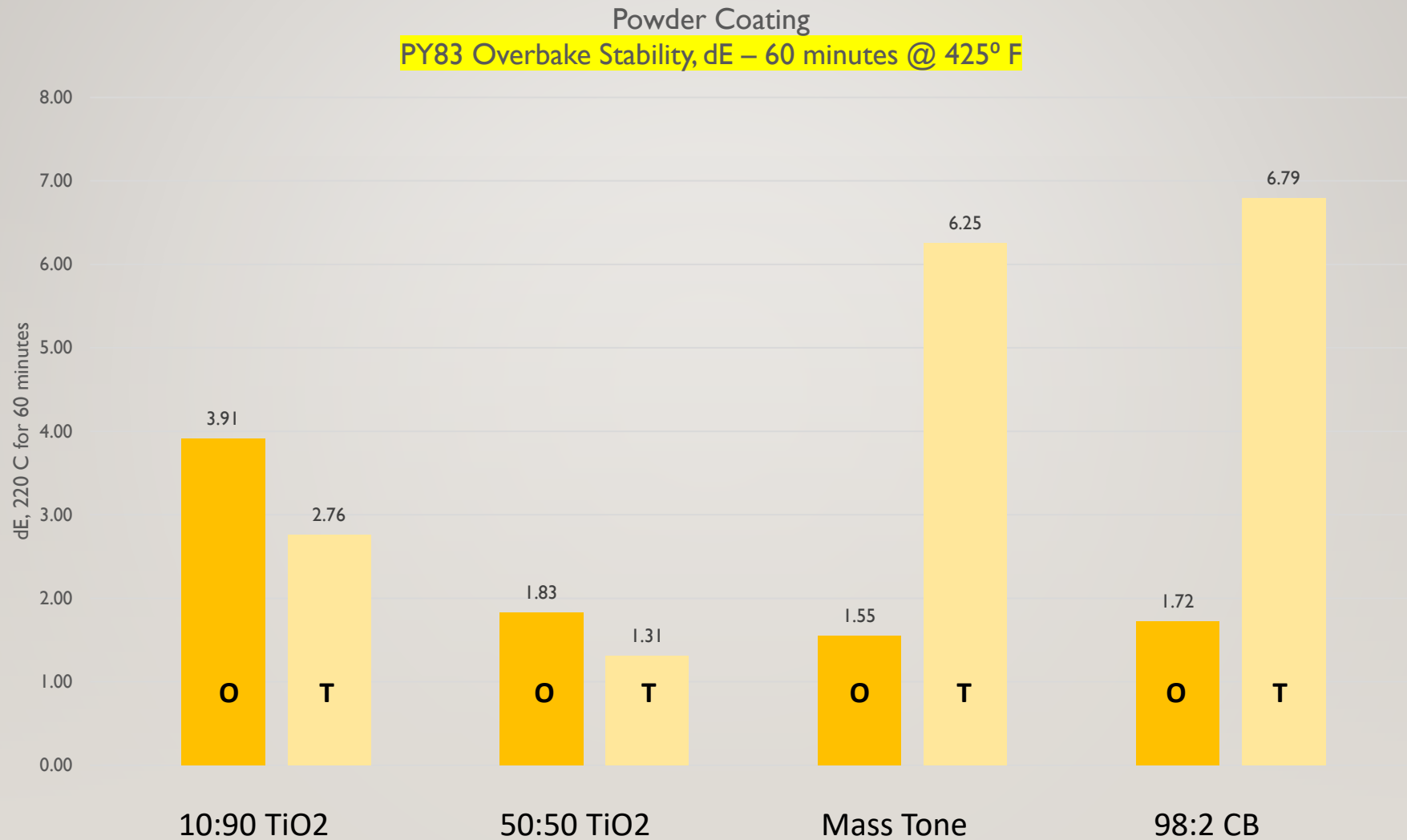
Transparent

Particle Size Differences

Powder Coating
PY83 Pellet Flow, mm

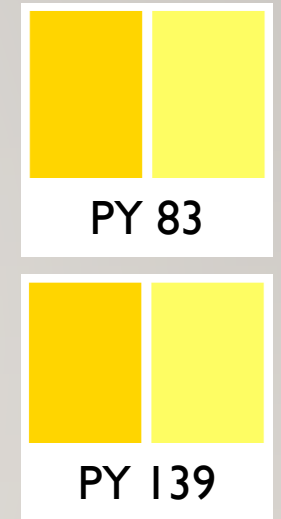
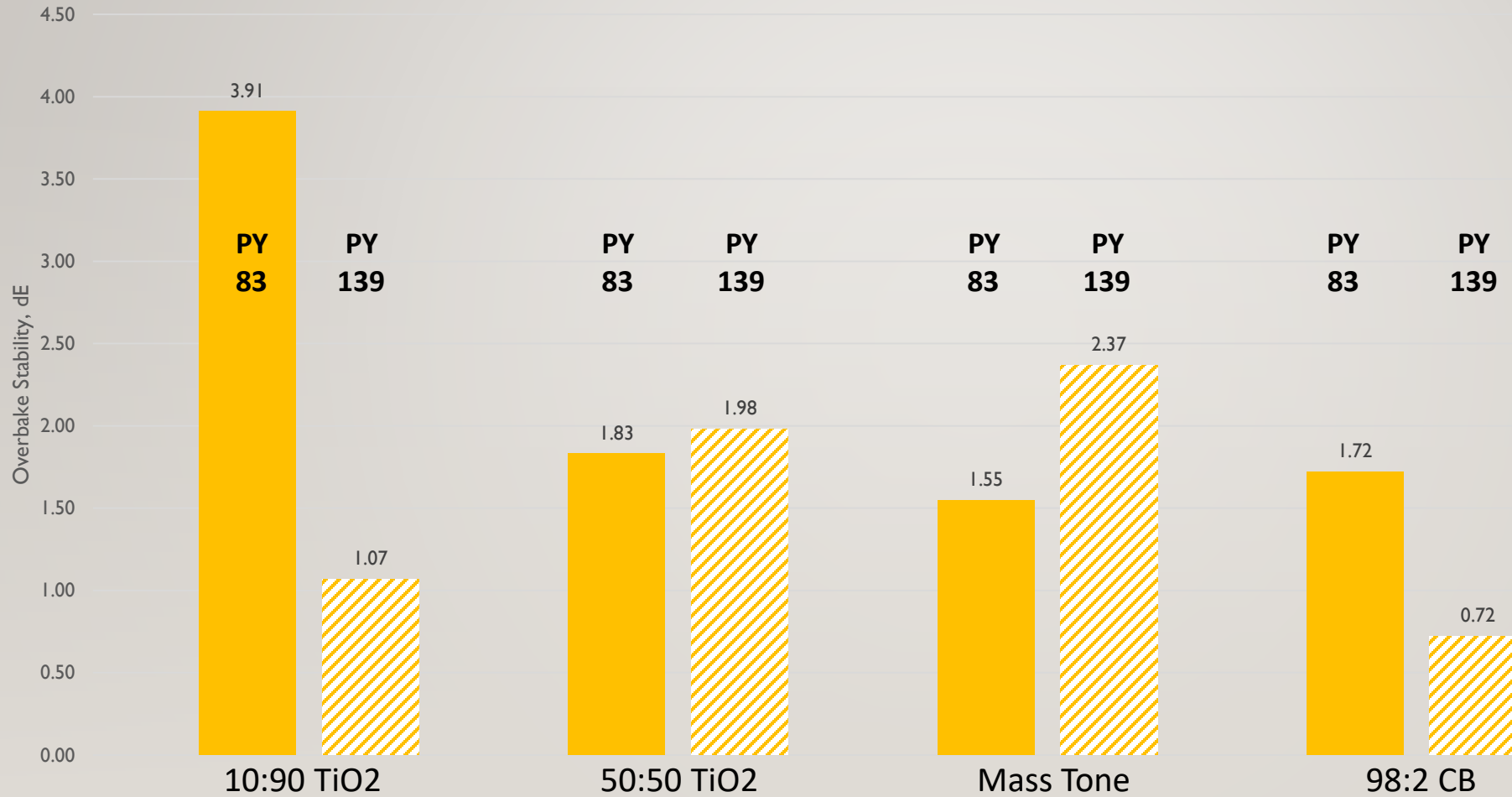


Particle Size Differences

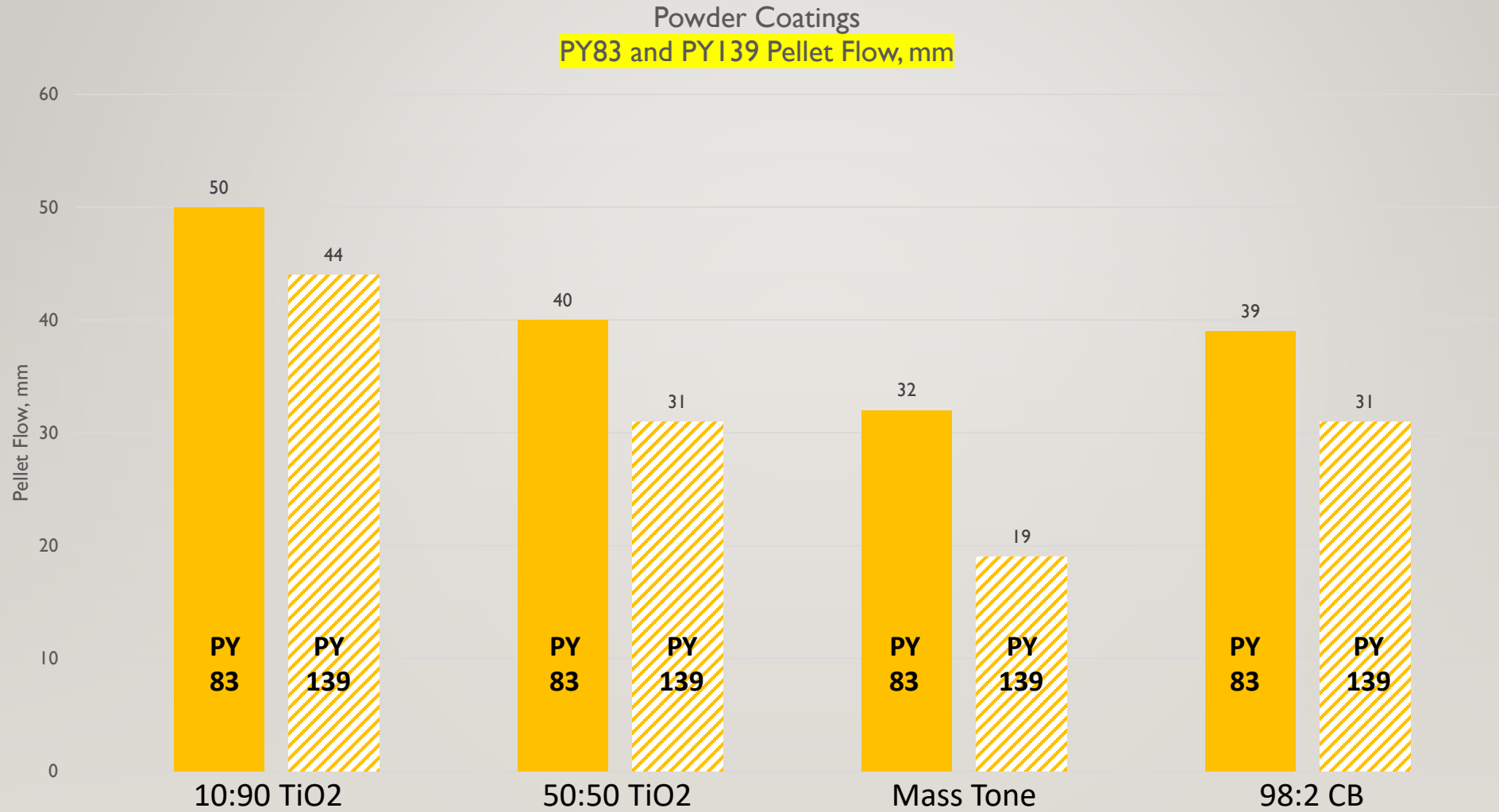


Chemistry Differences Similar Color

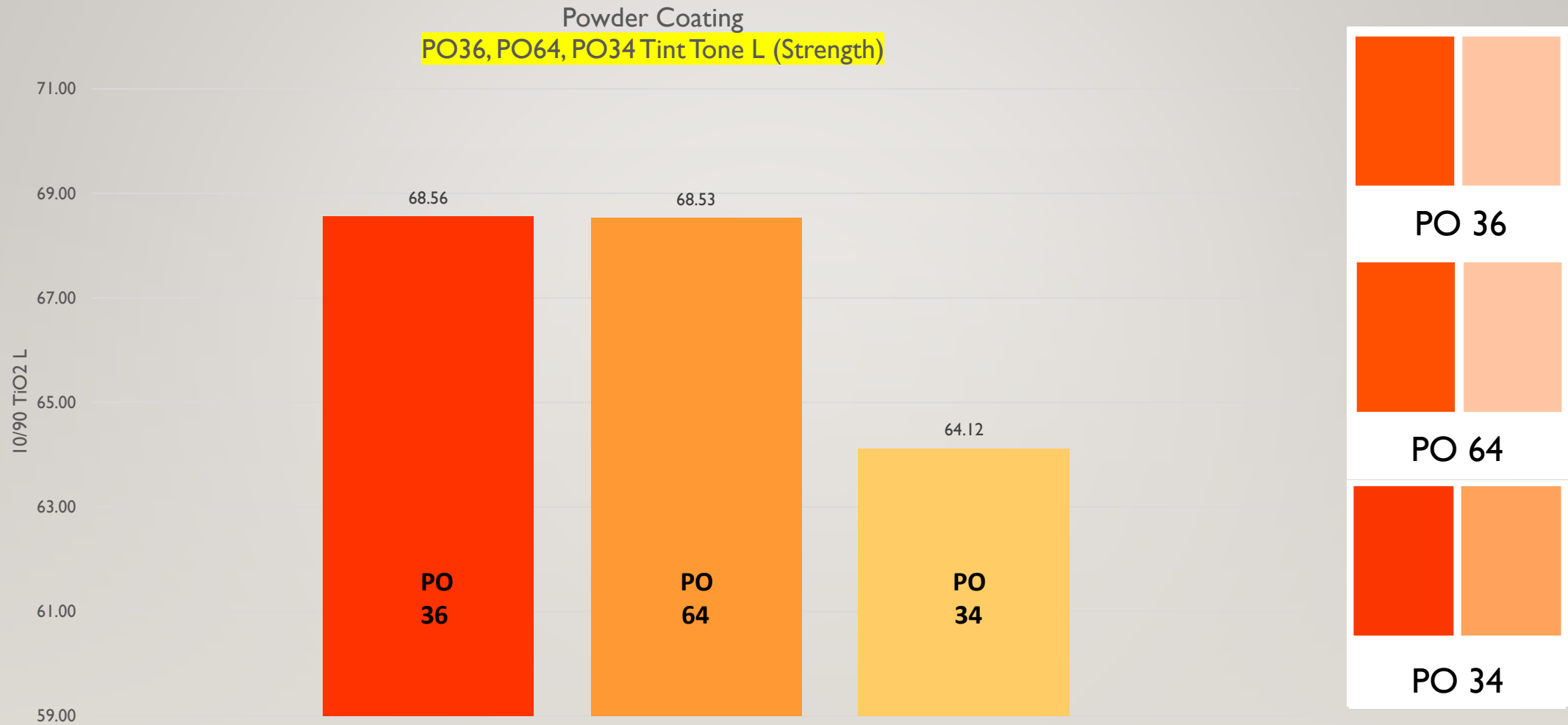
Powder Coating
PY83 and PY139 Overbake Stability, dE – 60 minutes @ 425°



Chemistry Differences Similar Color



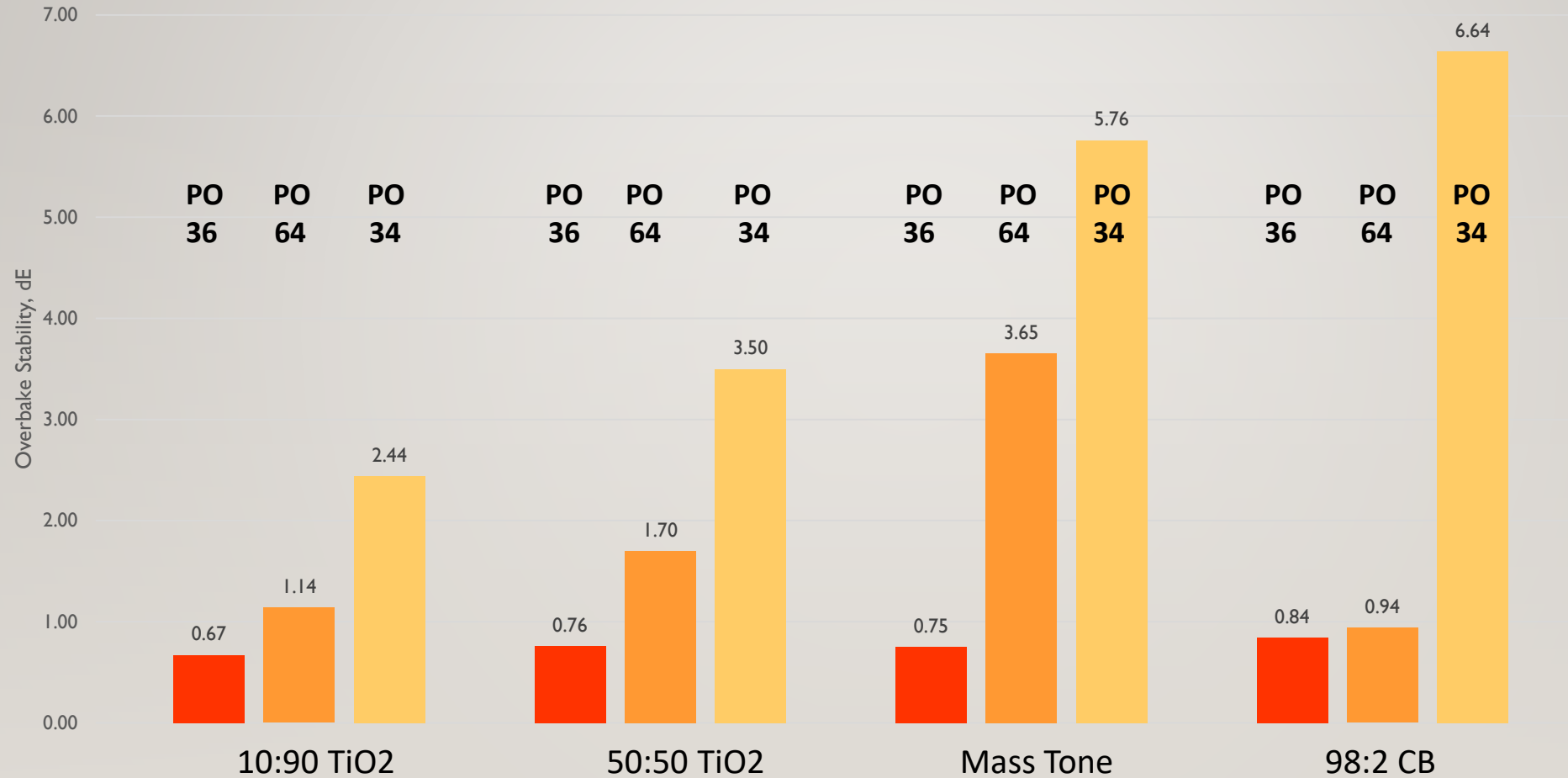
Chemistry Differences Similar Color Space



Chemistry Differences Similar Color Space

Powder Coatings

PO36, PO64, PO34 Overbake Stability, dE – 60 minutes @ 425° F

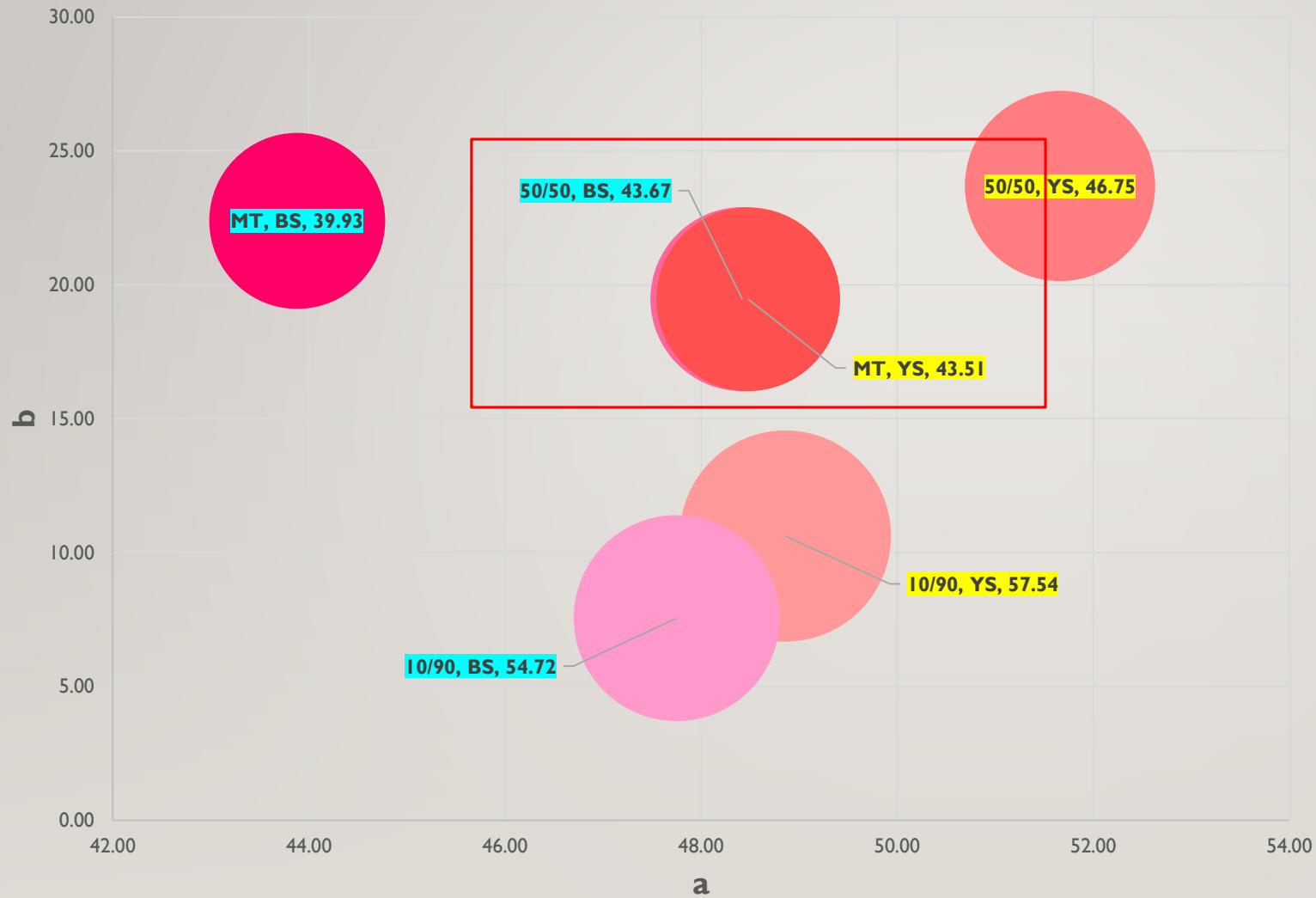


Resin Chemistry Differences Finishing Differences

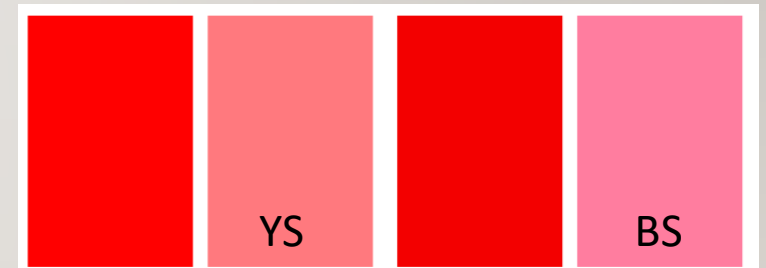


1 – polyester
2 – acrylic-epoxy hybrid

PRI70 Powder Coatings
bubble size = L

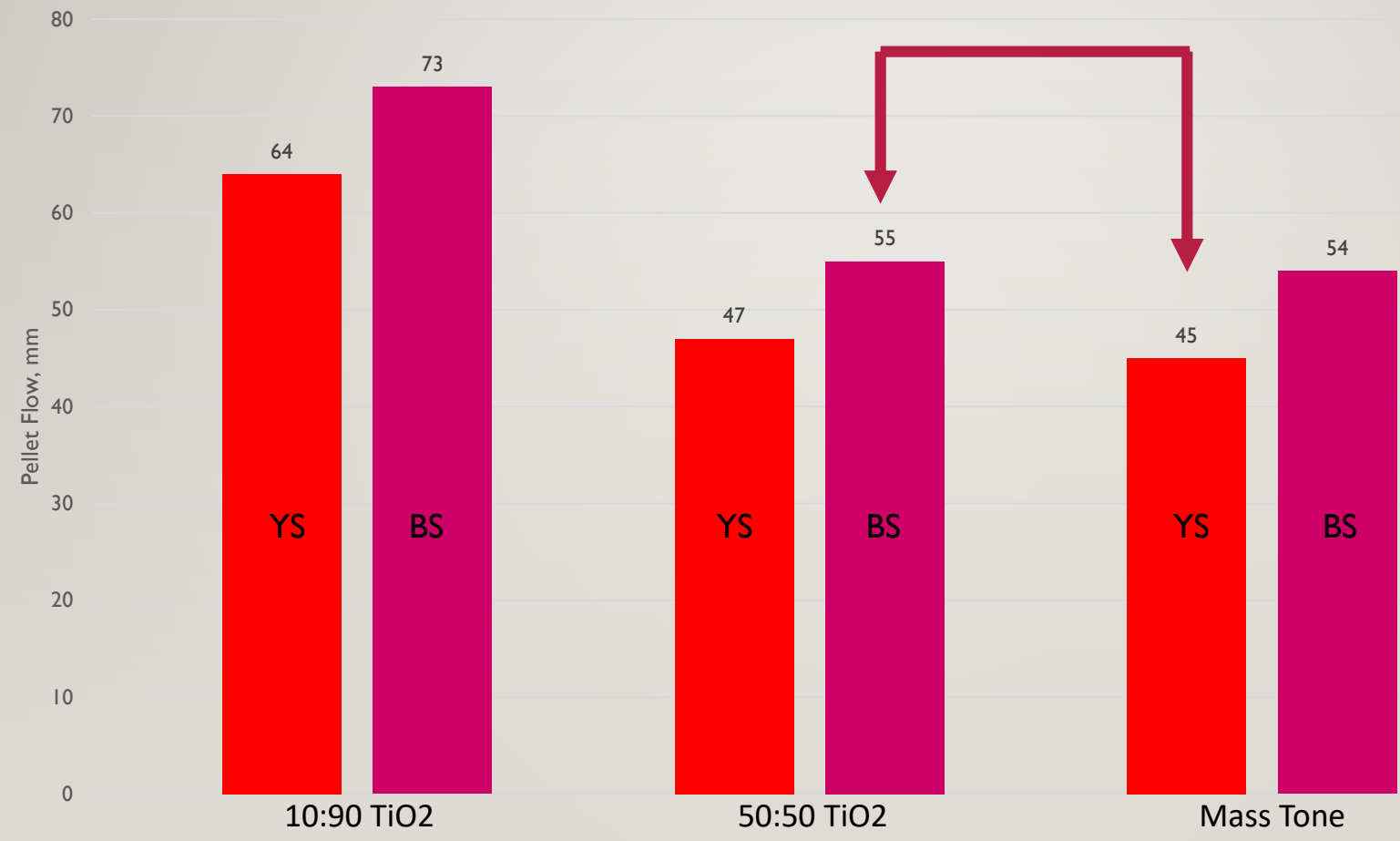


Same Chemistry
Yellow Shade vs Blue Shade



Same Chemistry Yellow Shade vs Blue Shade

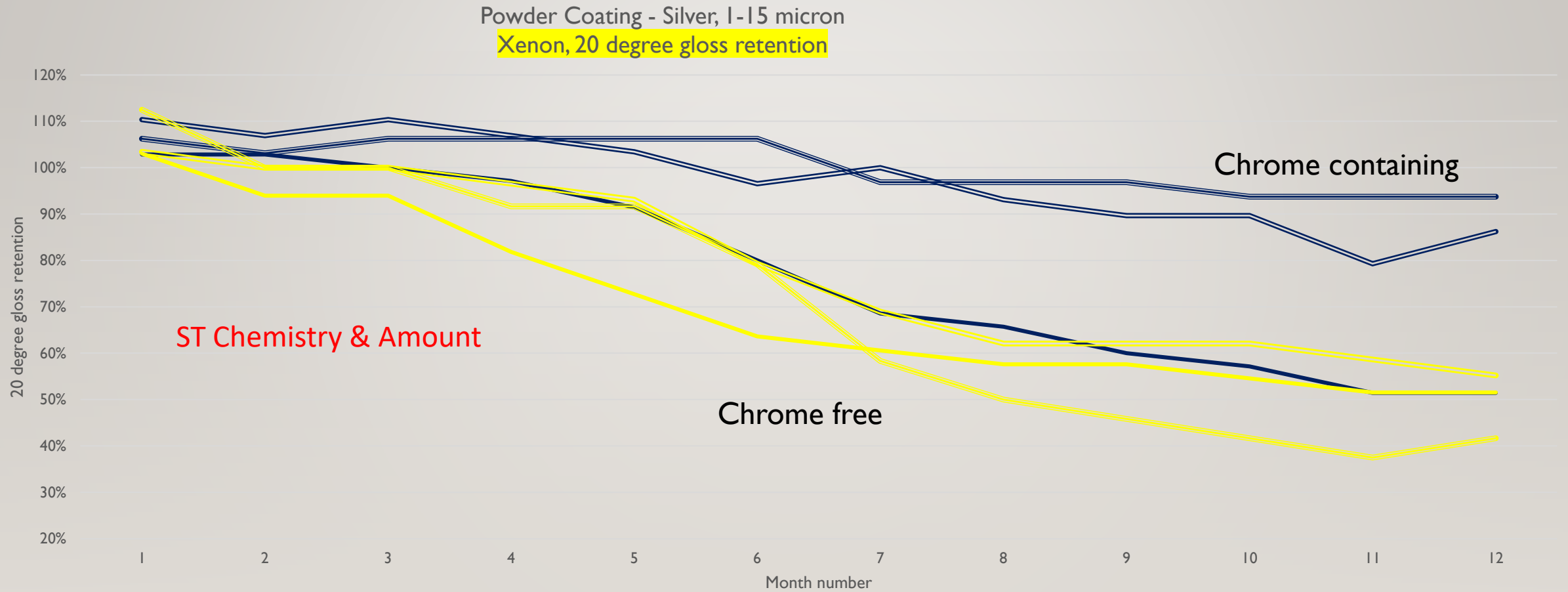
Powder Coating
PRI70 Pellet Flow, mm



Surface Treatments for Pearlescent Pigments

- *Why use a surface treatment or encapsulation?*
 - ✓ To slow or prevent an undesirable reaction from occurring
 - Photo degradation
 - Humidity effects
 - ✓ To change the rheology of the system
 - Improve dispersion
 - Compatibility with the system
 - ✓ To improve overall performance
 - Durability
 - Adhesion
 - ✓ To reduce or eliminate an undesired effect in the formulation
 - Cure inhibition or acceleration

Surface Treatments for Pearlescent Pigments



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QUESTIONS?

Bаярлалаа
 спасибо
 рахмат
 danke
 謝謝
 spas
 teşekkür ederim
 mahalo
 tapadh leat
 faafetai lava
 mersi
 barka
 welalin tack
 misaotra
 matondo
 paldies grazzi
 хвала
 asante manana
 nanni
 nandri
 kiitos dankie
 maururu
 koszonom
 vinaka
 spasibi
 blagodaram
 dank je
 akum dankon aciu
 gracias
 tapadh leat
 enkosi
 bayarlalaa
 dhanyavad
 hvala
 maururu
 koszonom
 дякую
 djiere dieuf tau
 mochchakkeram
 mamnun
 chokrane murakoze
 tenki
 obrigado
 sobodi
 dekuji
 sagolun
 chnorakaloutioun
 gratias ago
 gracies
 sulpáy
 go raibh maith agat
 mami
 najs tuke
 sukriya
 kop khun krap
 ありがとう
 tanemirt rahmet
 grazie
 arigatō
 takk
 dakujem
 trugarez
 didi madoba
 kam sah hamnida
 rahmat
 terima kasih
 rahmet
 shukriya
 merce
 мерси
 ܘܚܪܝܫܘܬܘ
 diolch
 dhanyavadagalu
 shukriya
 merce
 мерси
 ܘܚܪܝܫܘܬܘ
 merci
 ܘܚܪܝܫܘܬܘ
 merci