

Powder Coatings

Impact of Pigment Finishing on Powder
Coating Performance



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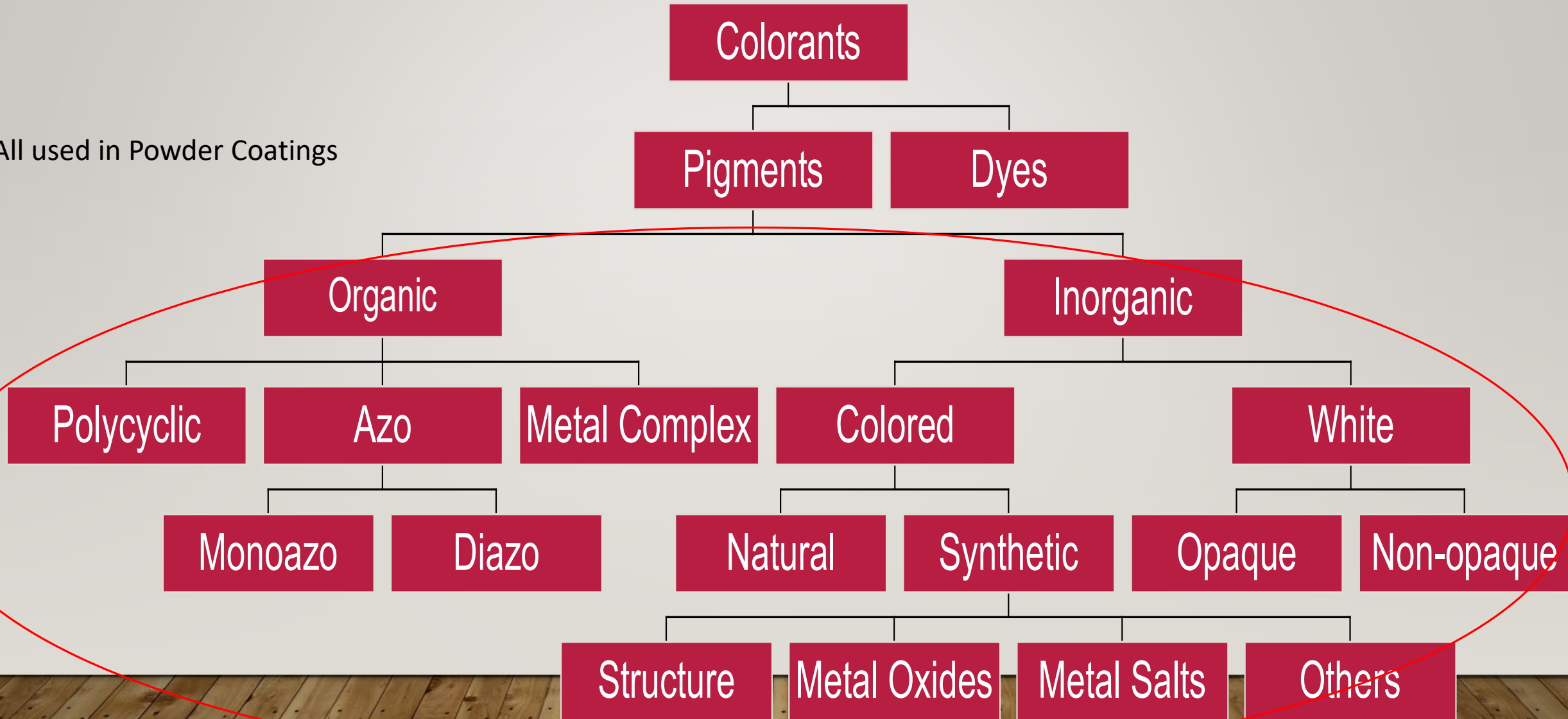
AGENDA

- 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

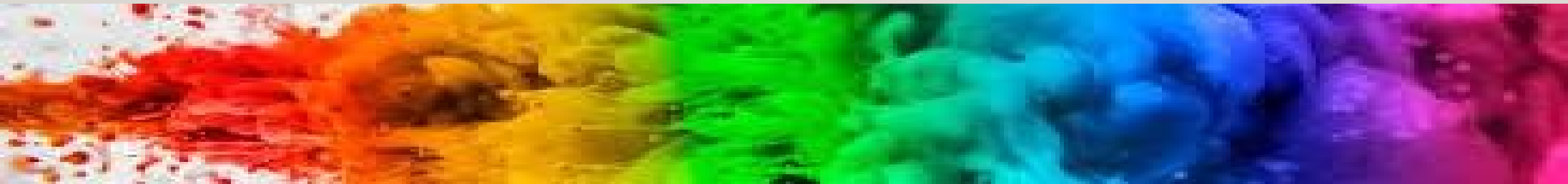


General Trade
Coaters

Powder Coating applications

Powder Coatings – Pigment Requirements

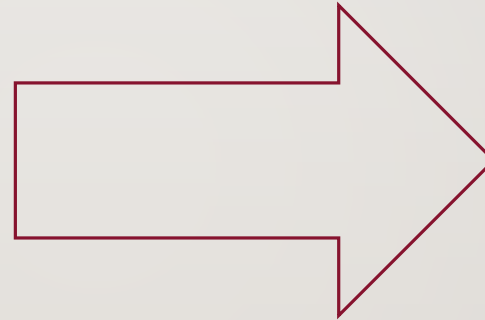
- Excellent range of heat fast colors
- Good light and weather fastness
- Good acid- alkali resistance
- Good dispersibility
- Good over bake resistance
- Good rheology and flow
- Non-migratory during extrusion
- Compatible with wide number of polymers
- Compatible with TGIC and non TGIC curing agent



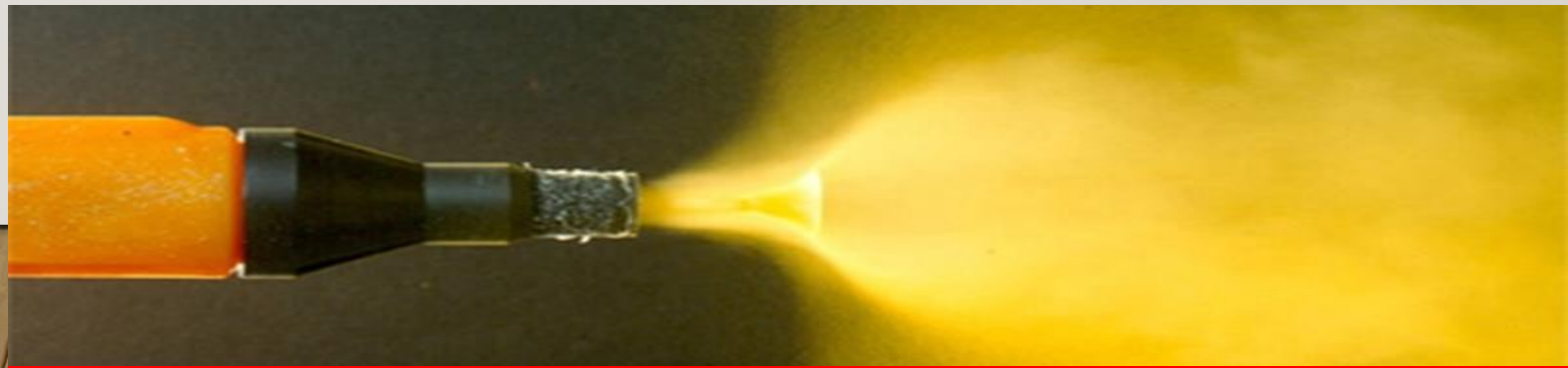
COLORANTS - PHYSICAL PARAMETERS

- 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



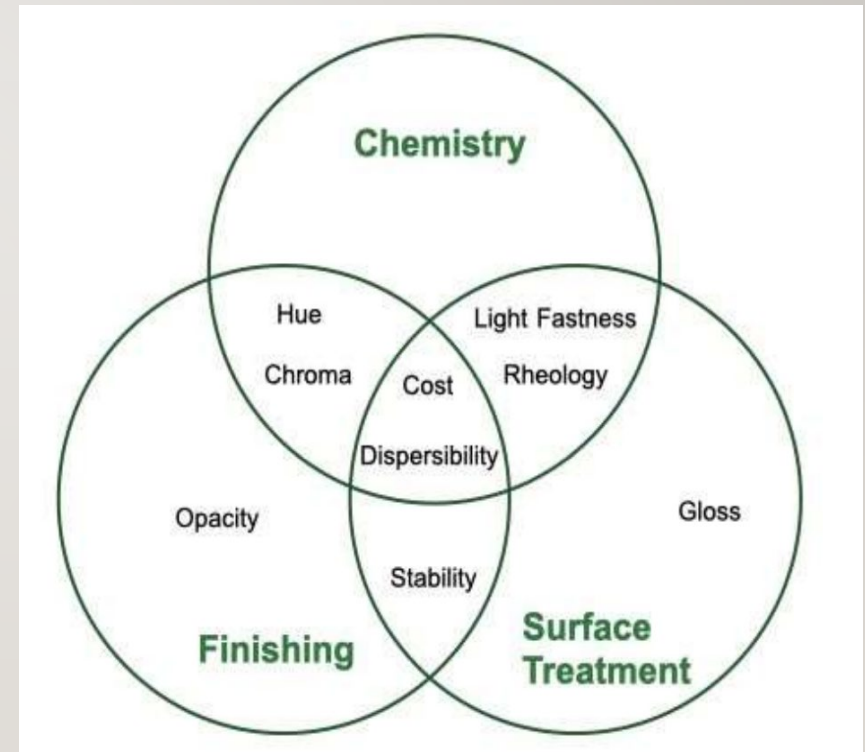
*Pigment parameters
directly impact
application
performance*



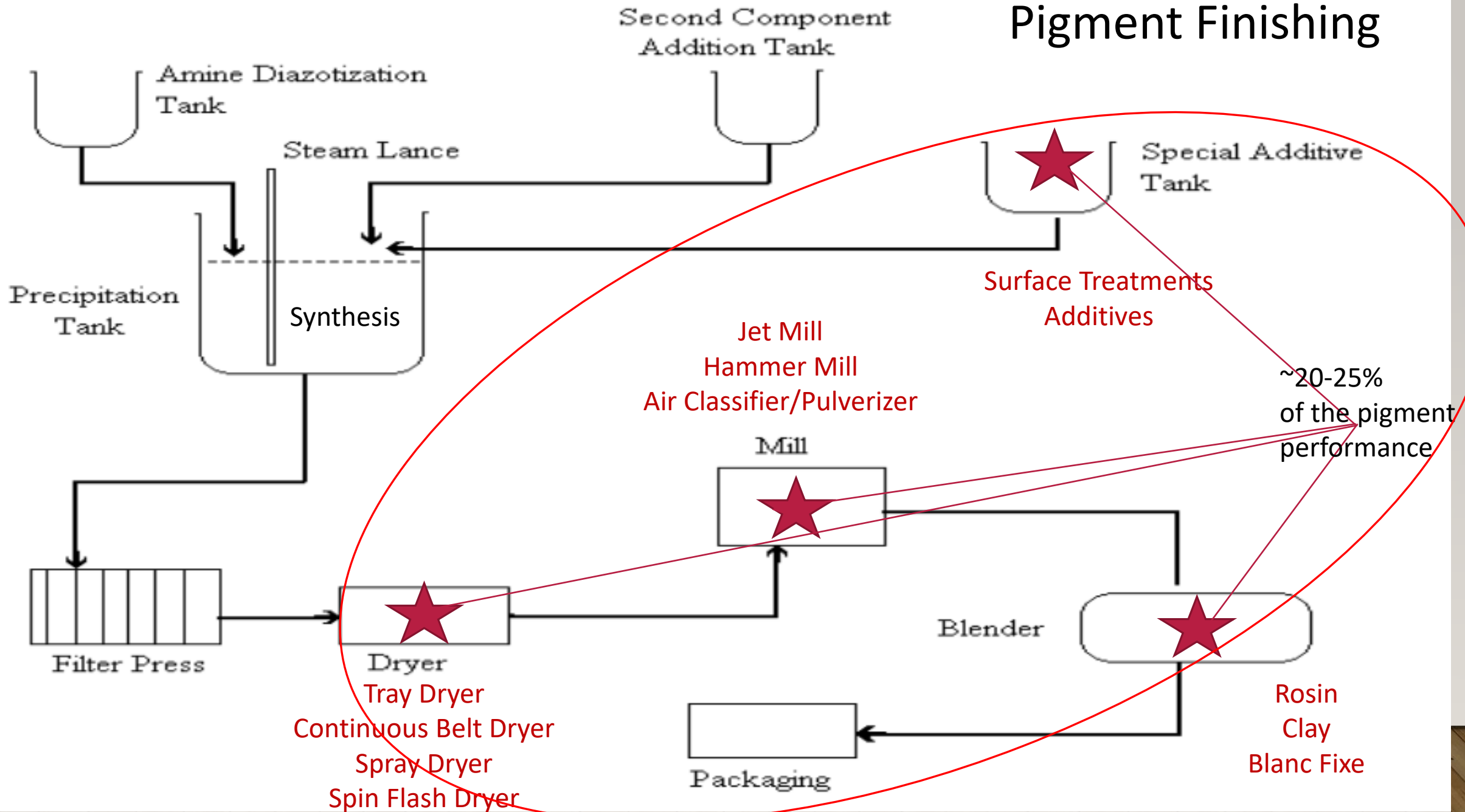
PIGMENT SYNTHESIS

~75-80%
of the pigment
performance

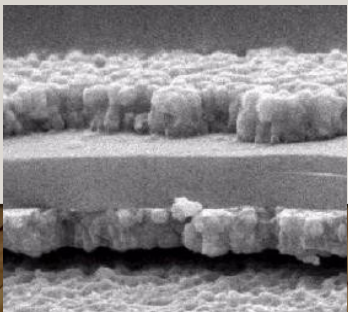
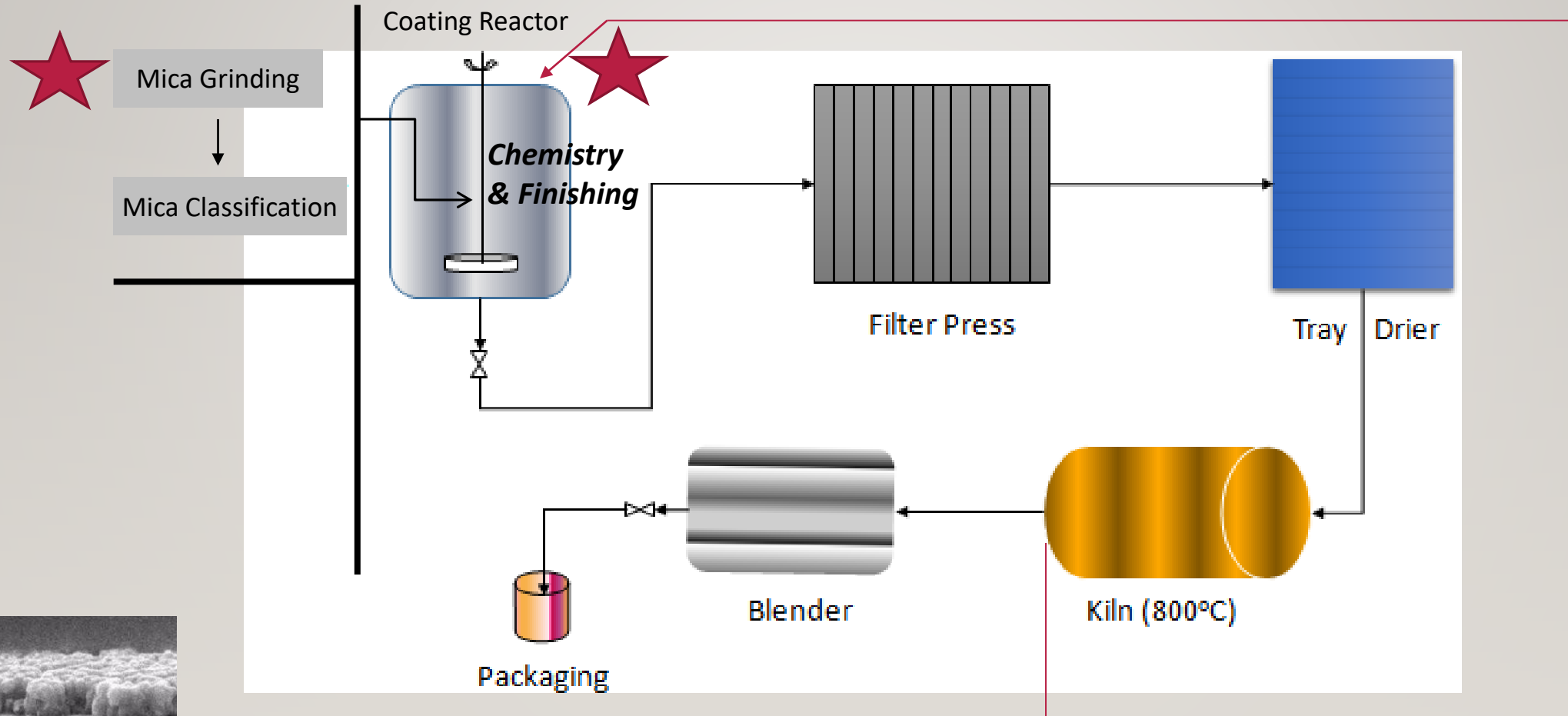
- The first manufacturing step(s) determine the chemical identity of the pigment.
- Crude pigment is the end product of the synthesis.
- Finishing and surface treatment provide the end use properties.



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 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

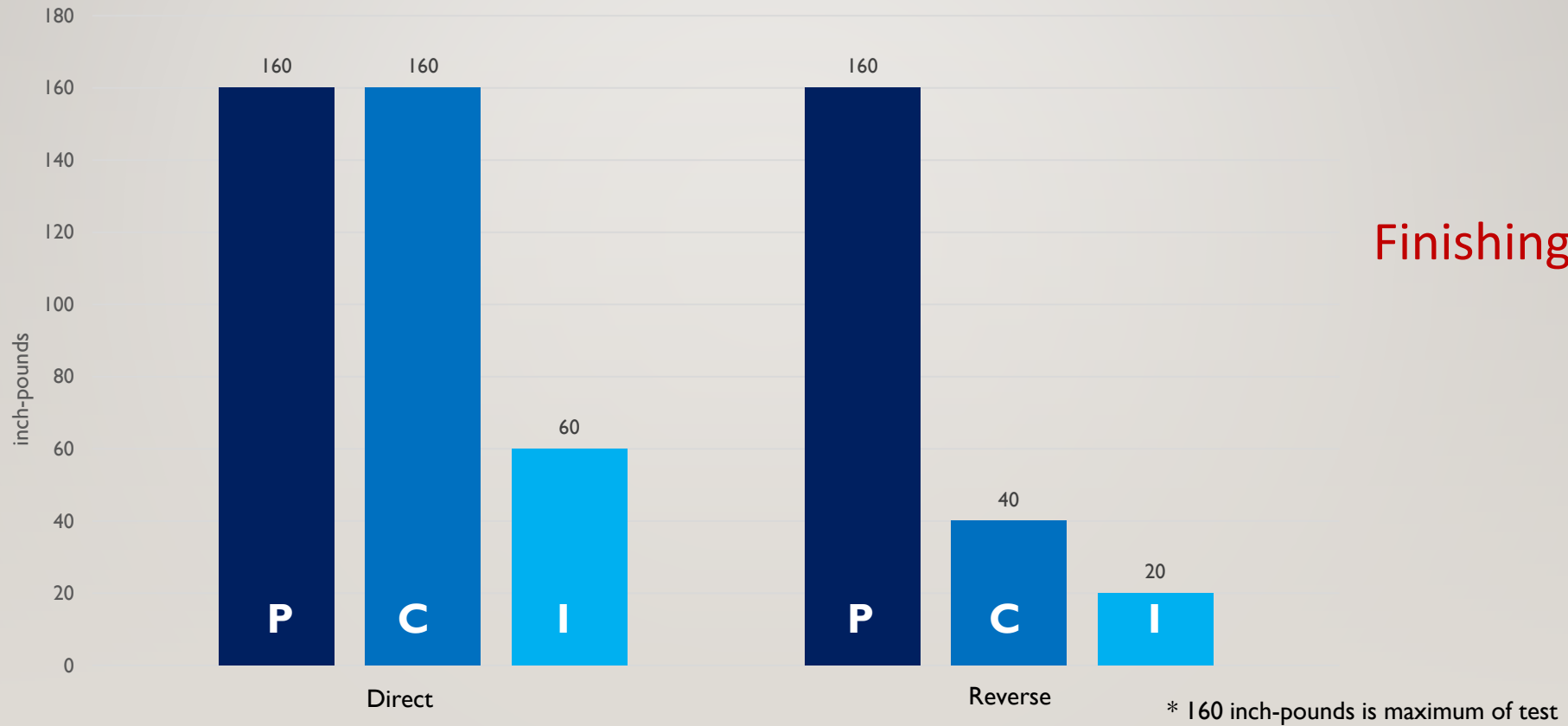
PBI5:3 - Plastics
1.55
56.9
118
45

PBI5:3 - Coatings
1.70
57.0
159
40

PBI5:3 - Inks
1.45
34.3
161
34

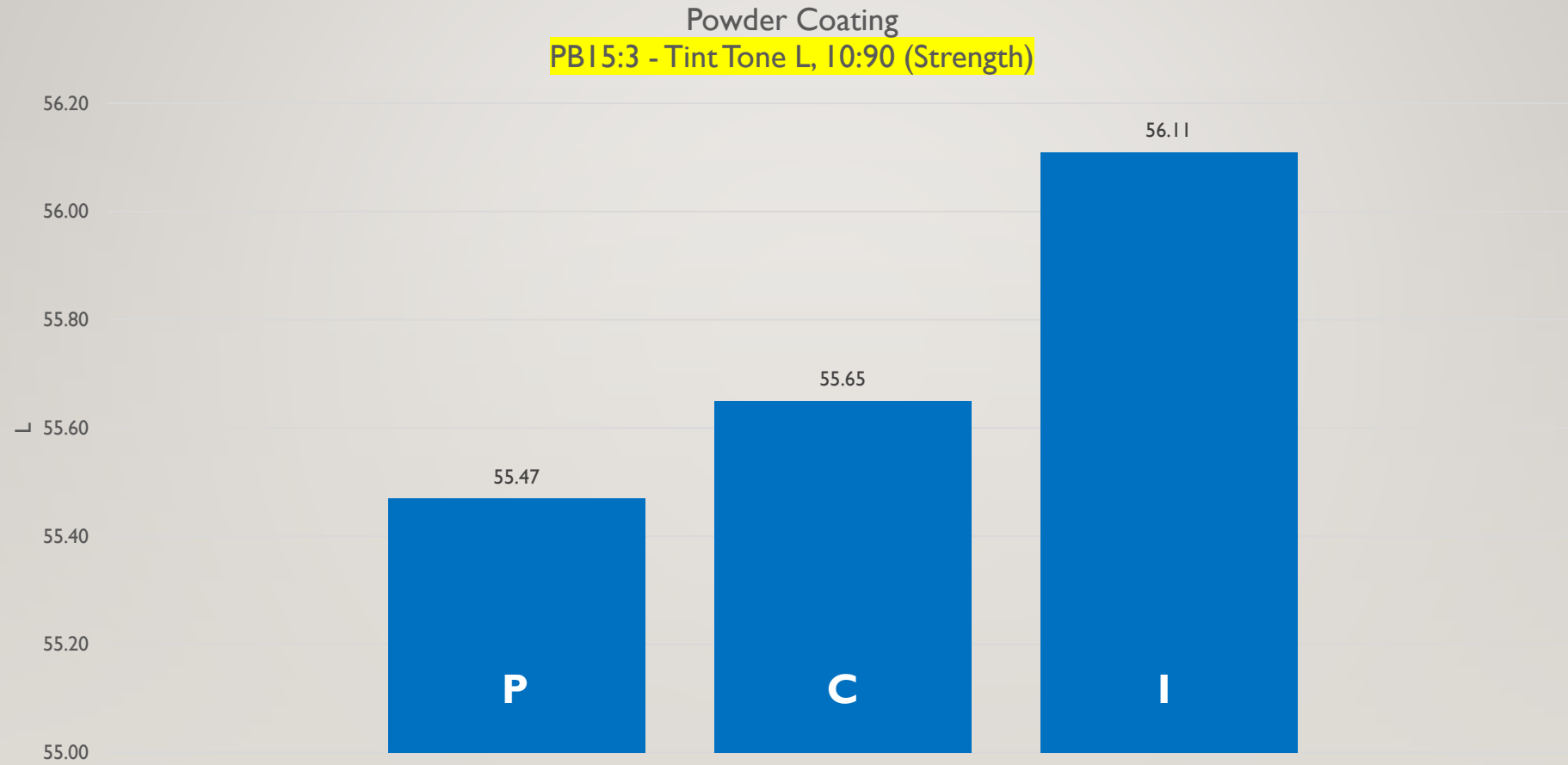
Powder Coating

PBI5:3 - 10:90 Impact Resistance



Finishing Differences

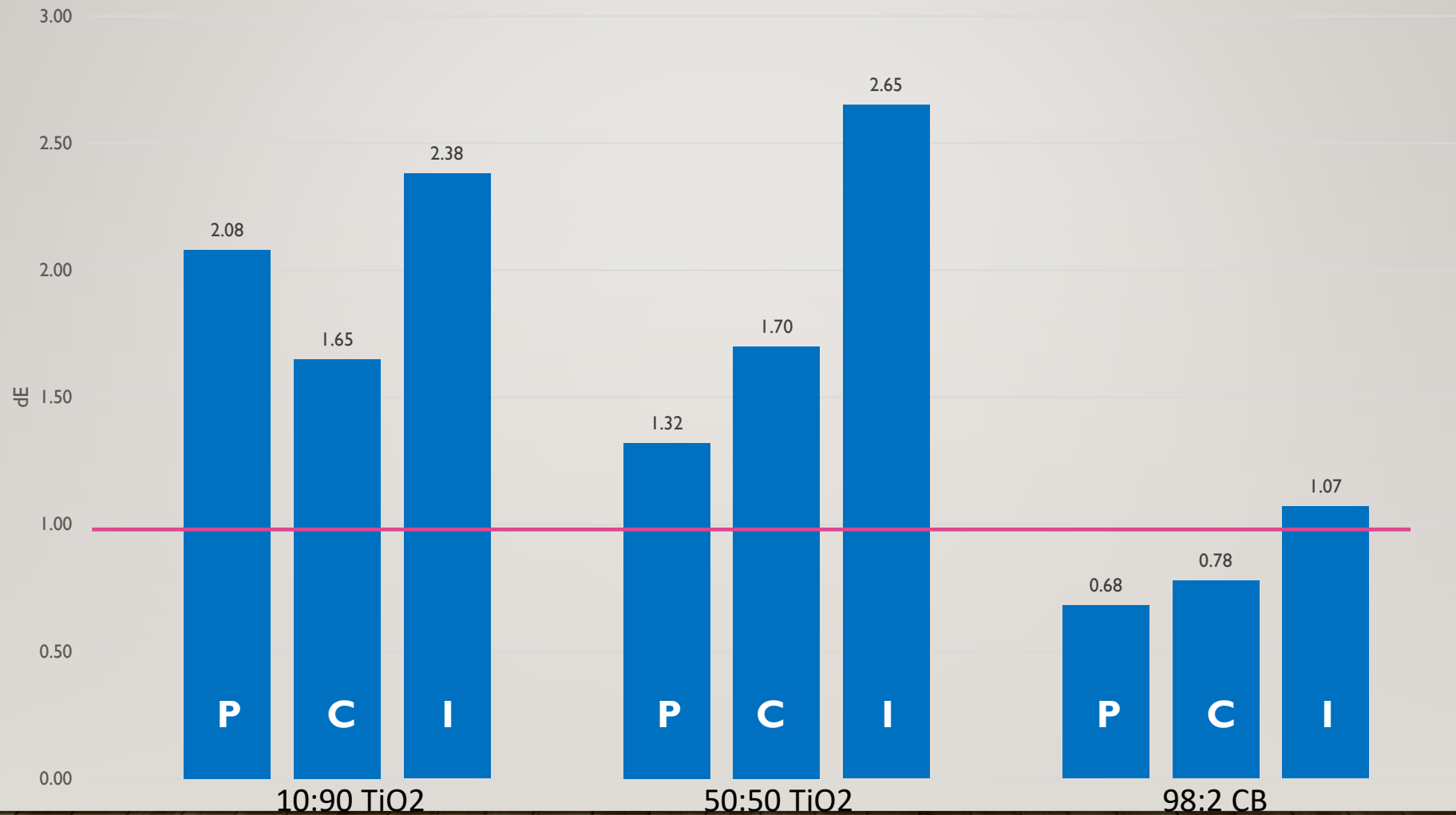
Finishing Differences



Finishing Differences

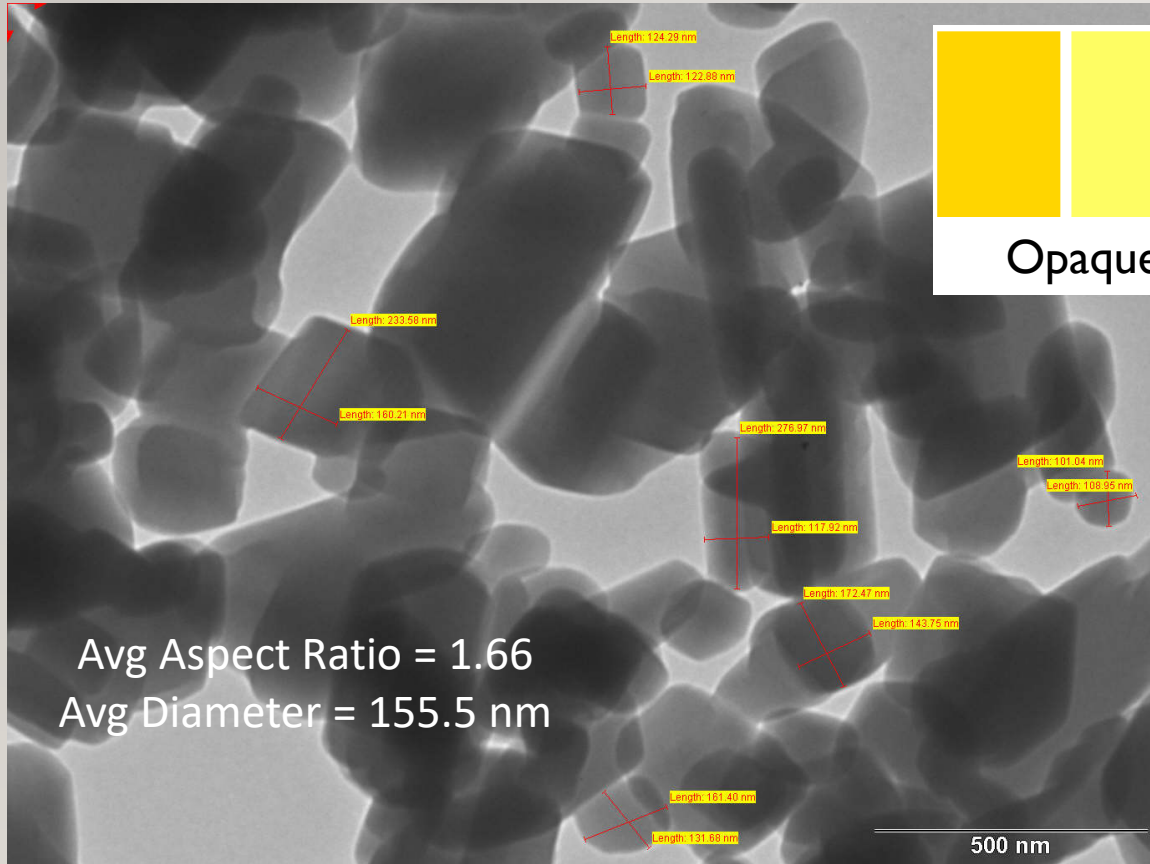
Powder Coating

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

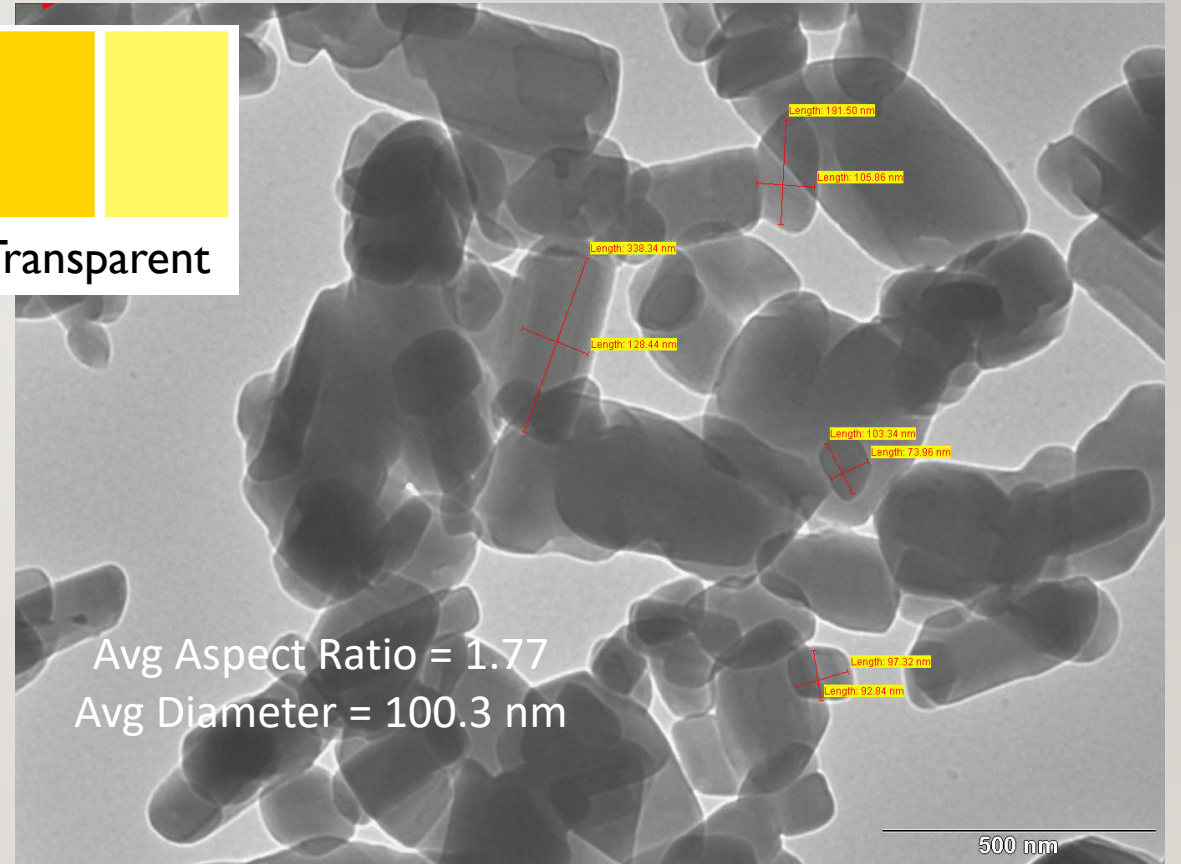


TEM: PY83

Particle Size Differences



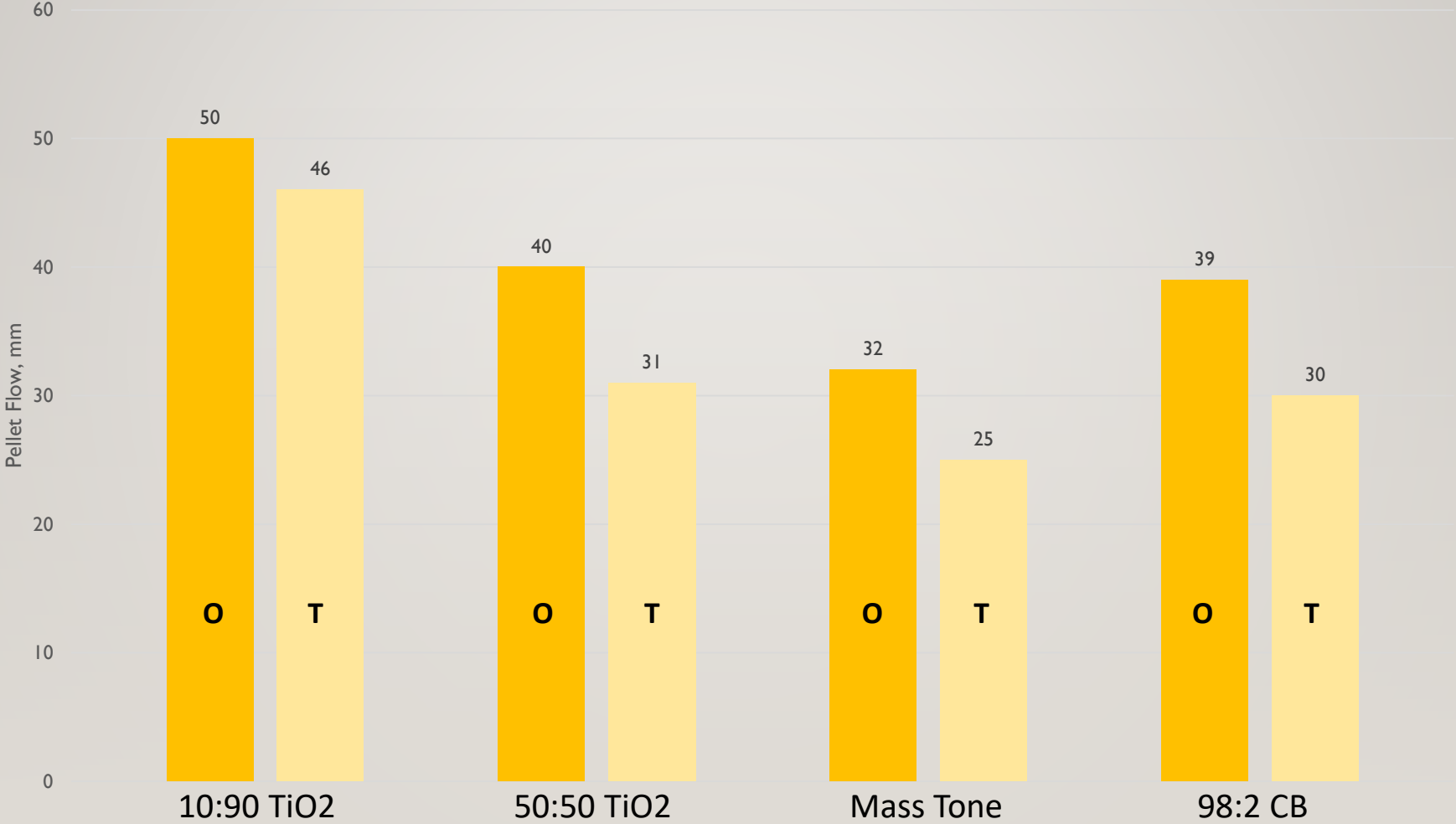
Opaque



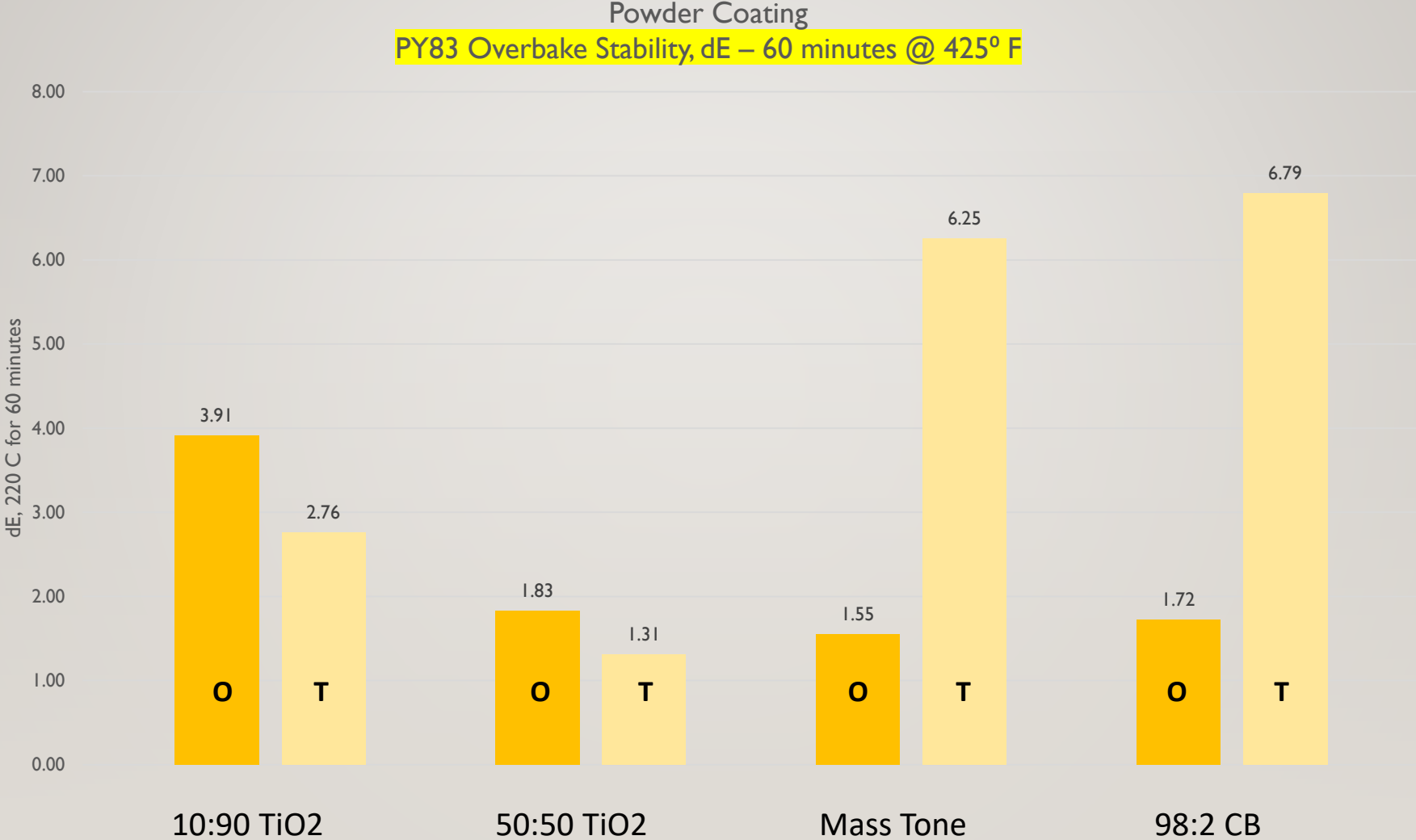
Transparent

Particle Size Differences

Powder Coating
PY83 Pellet Flow, mm

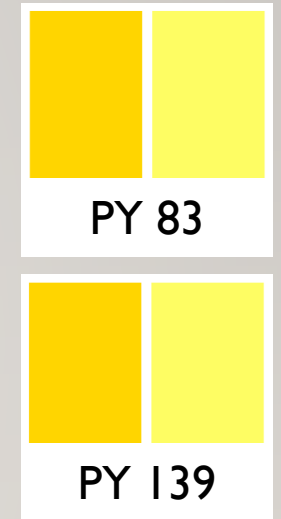
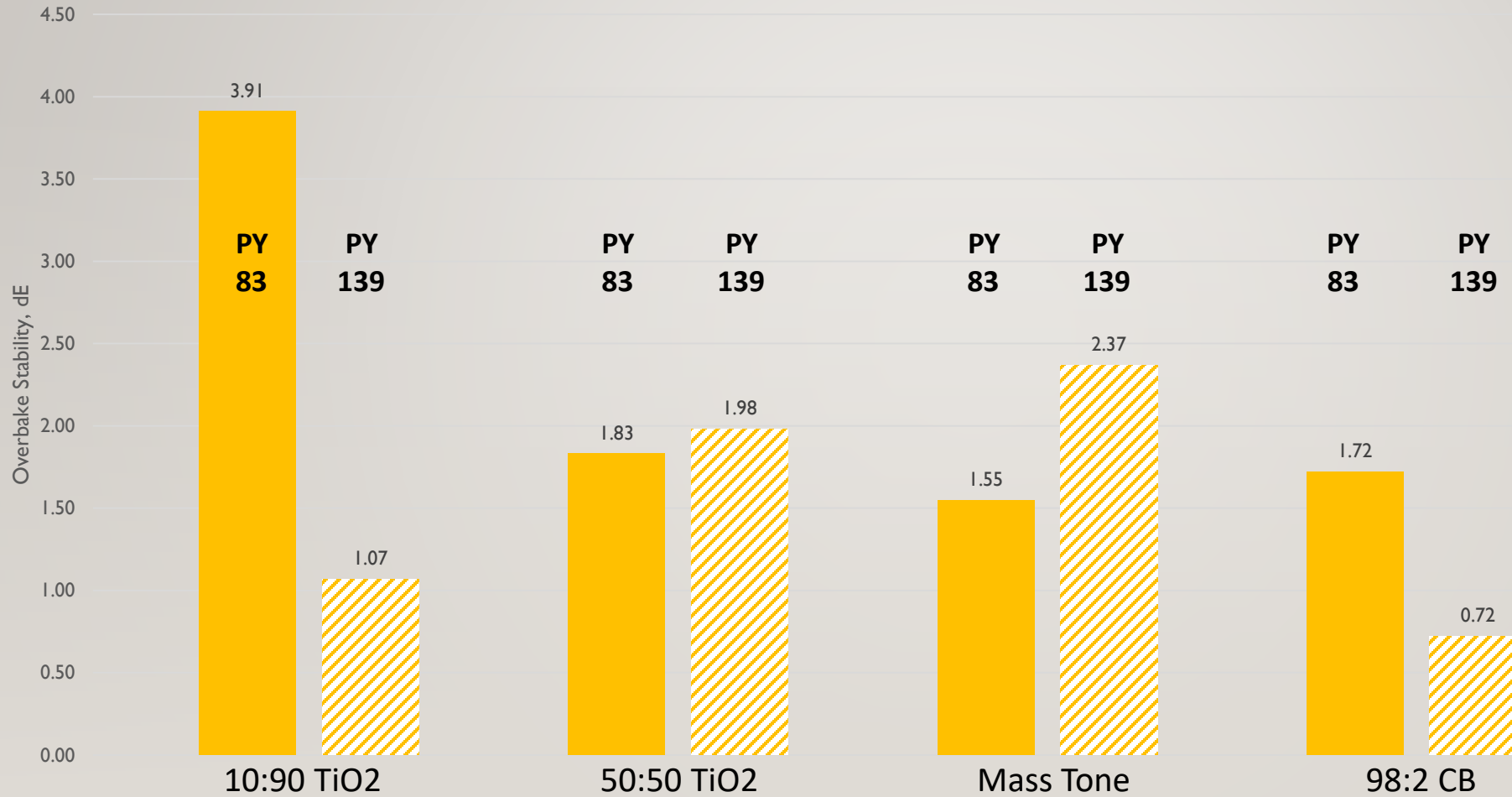


Particle Size Differences

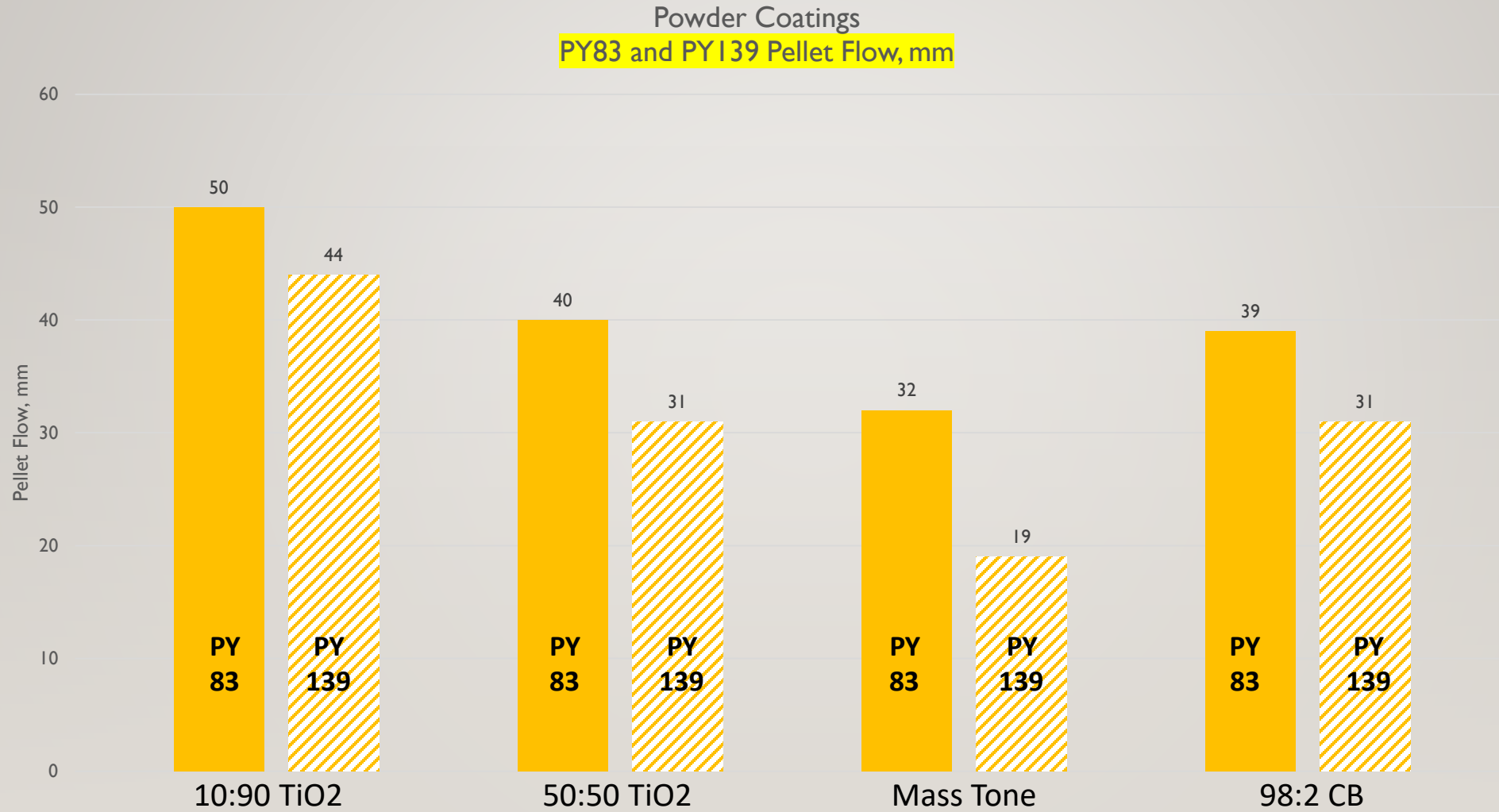


Chemistry Differences Similar Color

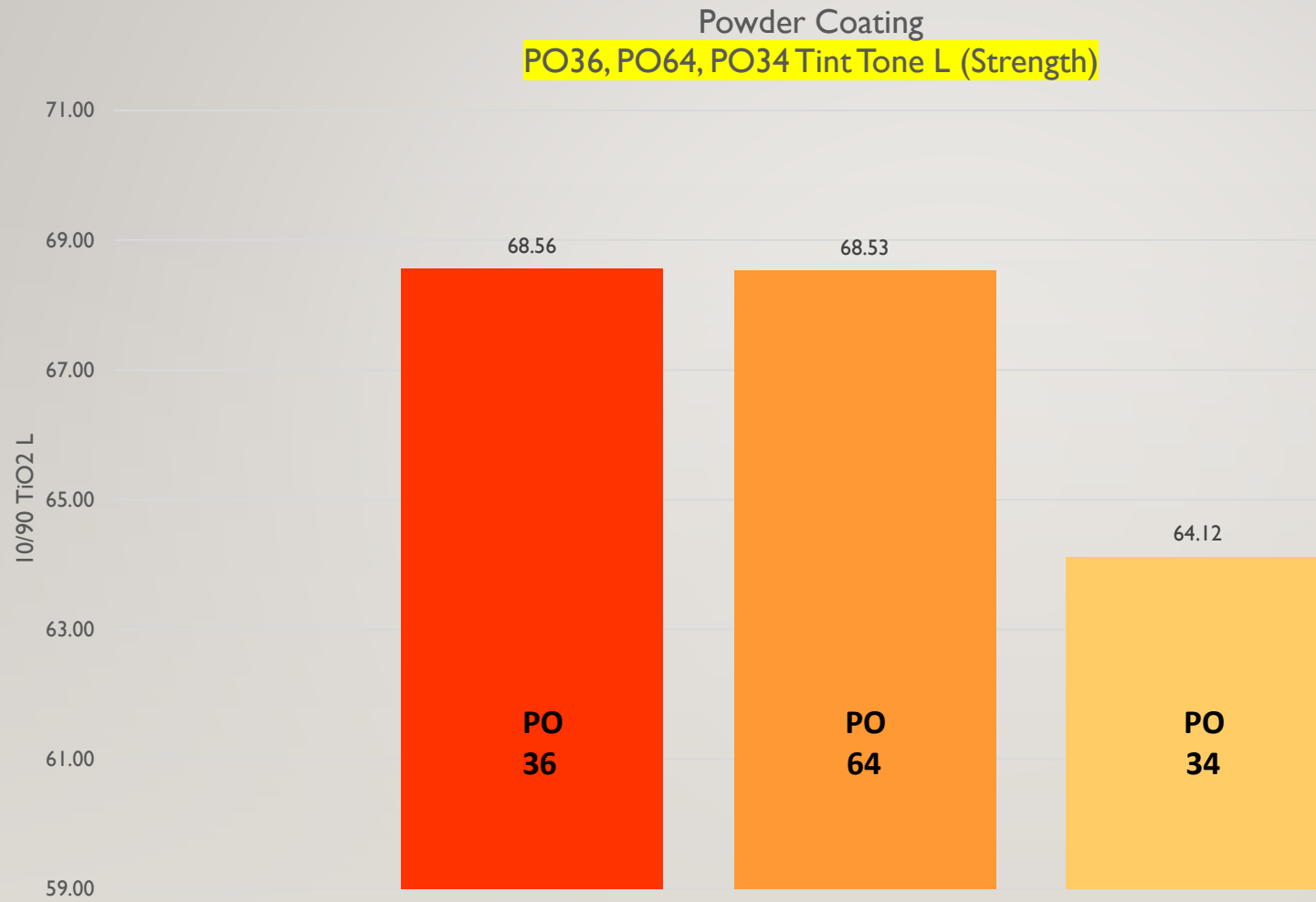
Powder Coating
PY83 and PY139 Overbake Stability, dE – 60 minutes @ 425°



Chemistry Differences Similar Color



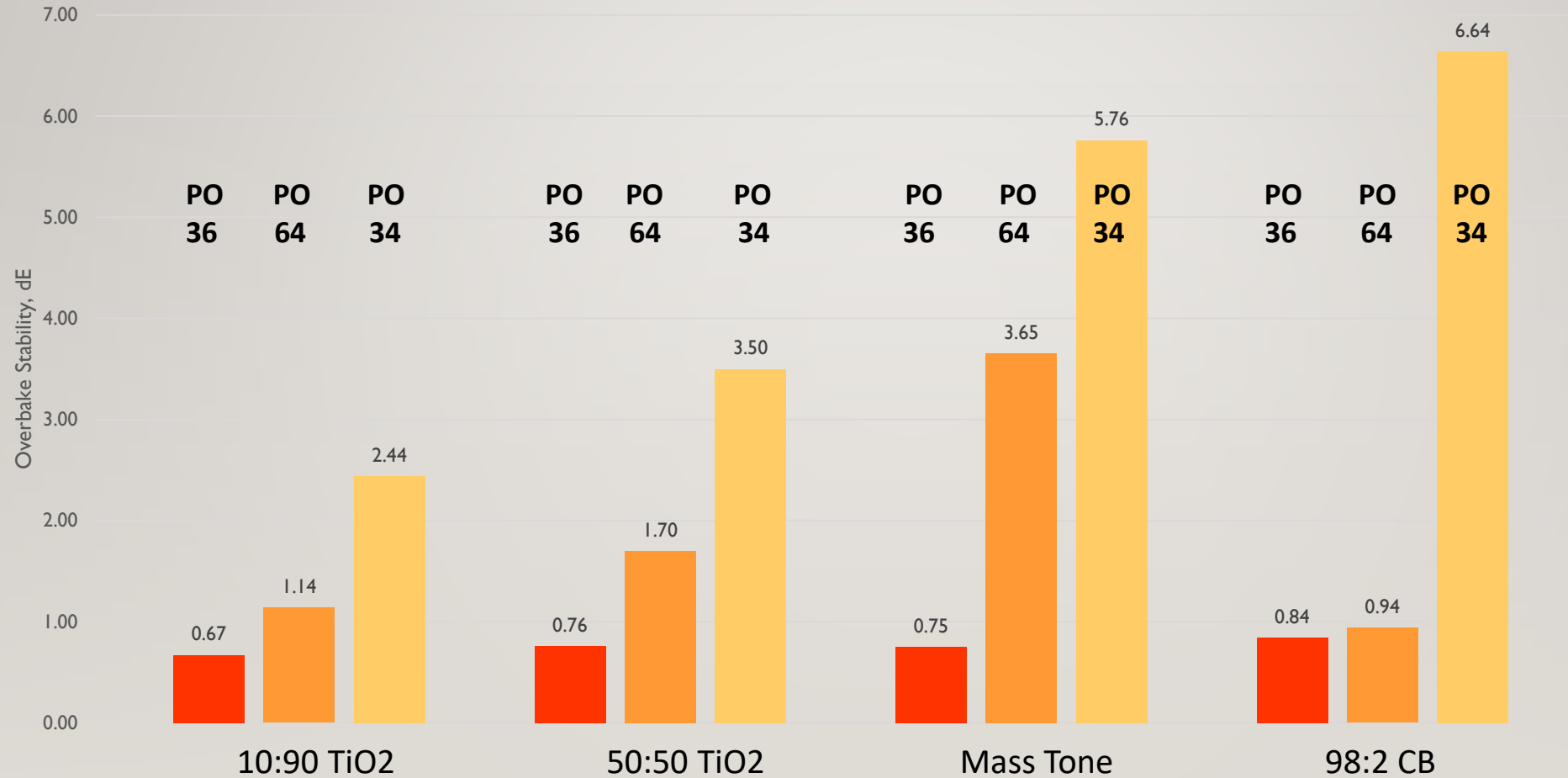
Chemistry Differences Similar Color Space



Chemistry Differences Similar Color Space

Powder Coatings

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

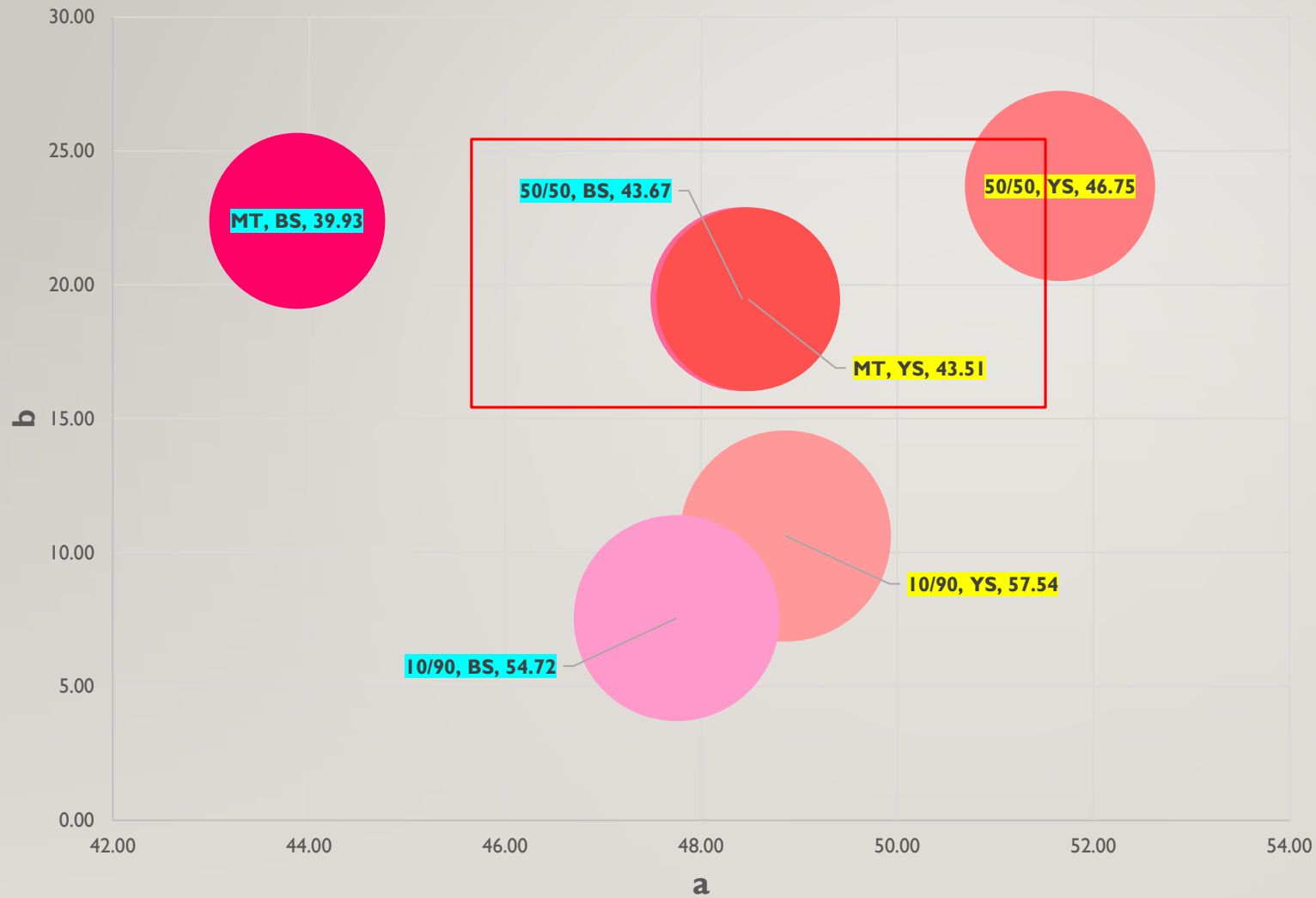


Resin Chemistry Differences Finishing Differences

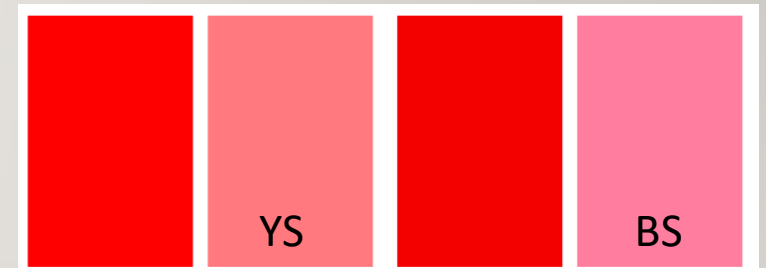


1 – polyester
2 – acrylic-epoxy hybrid

PRI70 Powder Coatings
bubble size = L

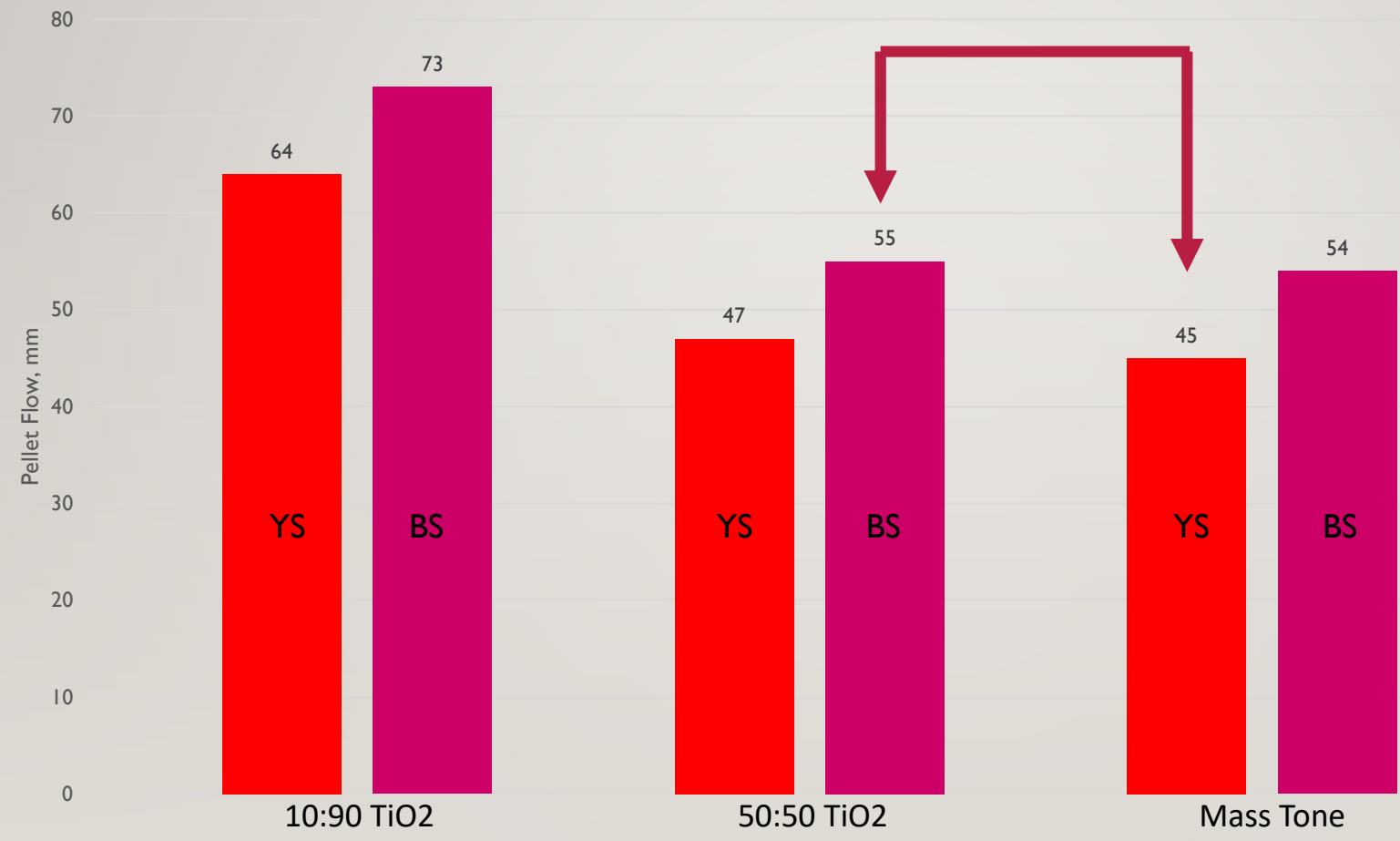


Same Chemistry
Yellow Shade vs Blue Shade



Same Chemistry Yellow Shade vs Blue Shade

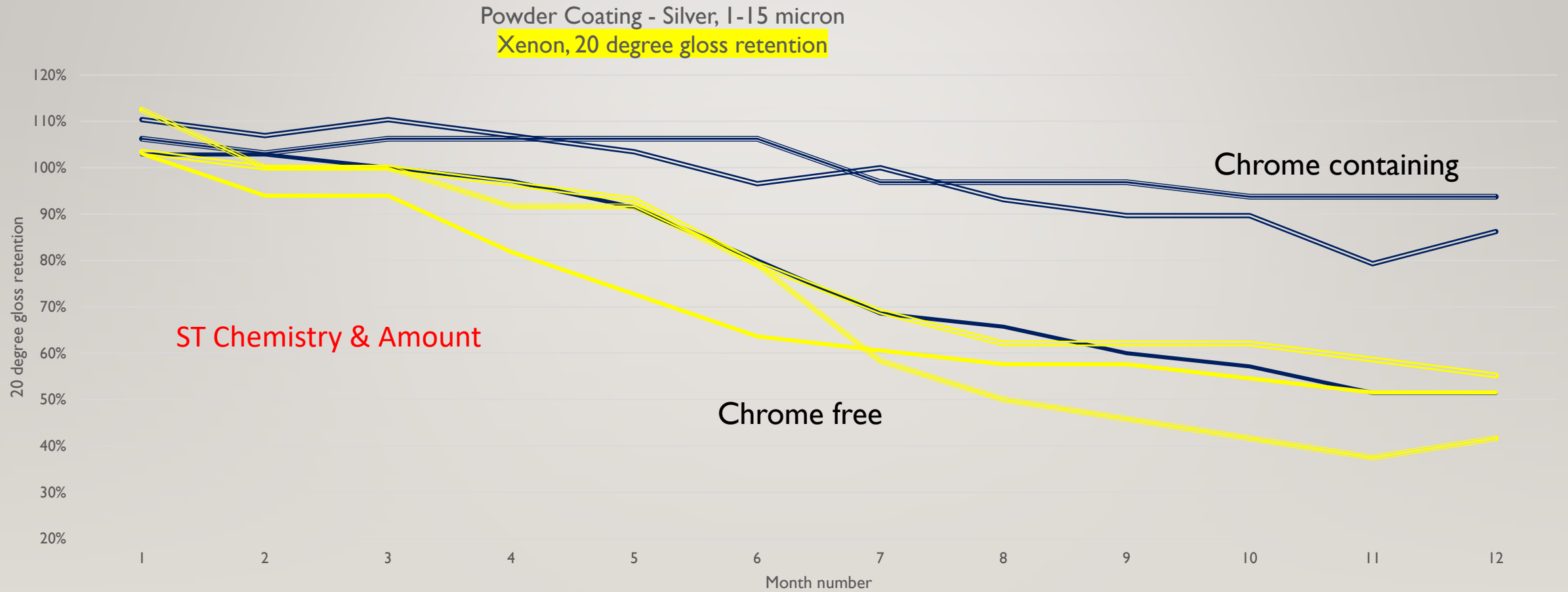
Powder Coating
PRI70 Pellet Flow, mm



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?

Word cloud featuring the phrase "thank you" in multiple languages and scripts. The central text is "thank you" in large red letters. Surrounding it are various translations:

- danke
- 謝謝
- teşekkür ederim
- gracias
- tapadh leat
- спасибо
- спасибі
- blagodaram
- dank je
- misaoitra
- matondo
- paldies
- grazzi
- mahaio
- Баярлалаа
- faafetai lava
- vinaka
- spas
- merci
- kia ora
- barka
- welalin
- tack
- нугуабуиҕа
- hvala
- mauruuru
- koszonom
- dhanyavad
- kiitos
- dankie
- chokrame
- murakoze
- tenki
- asante
- manana
- obrigada
- bedankt
- nanni
- nandri
- bayarlalaa
- gracie
- enkosi
- dziękuję
- dekuji
- sobodi
- moichhakkeram
- tau
- djere dieuf
- дякую
- mamnun
- go raibh maith agat
- sulpáy
- chnorakaloutioun
- gratias ago
- gracies
- talaku
- arigatō
- takk
- dakujem
- trugarez
- obrigado
- mesii
- didi madoba
- sagolun
- najis tuke
- kam sah hamnida
- rahmat
- sukriya
- kop khun krap
- ありがとう
- tanemirt
- rahmet
- terima kasih
- xiexie
- ευχαριστώ
- diolch
- dhanyavadagalau
- shukriya
- merce
- merci
- 감사합니다