

INGENIA WHITE MASTERBATCH 101

May 2019

White Masterbatches 101

Performance of white masterbatches depends on:

- Pigment selection
 - Typically TiO_2
 - Particle Size Distribution, Refractive Index, surface treatment
- Pigment dispersion
- Pigment loading
- Absence or use of extenders, spacers, opacifiers

Ingenia's White Masterbatch Grades

Several classes depending on your needs:

- Premium: Premium TiO₂ only.
- Standard: TiO₂ only.
- Engineered: TiO₂ and engineered extenders.
- Extended grades: TiO₂ extended with calcium carbonate.
- Blue whites based on any of the above classes.

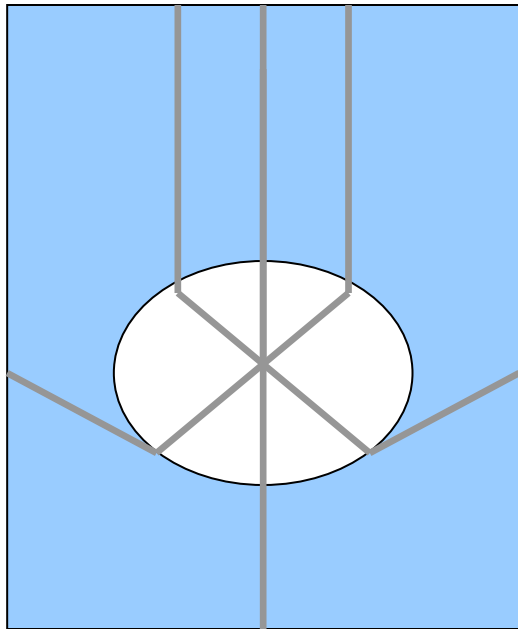
Pigment Selection Criteria

Pigment selection is based on:

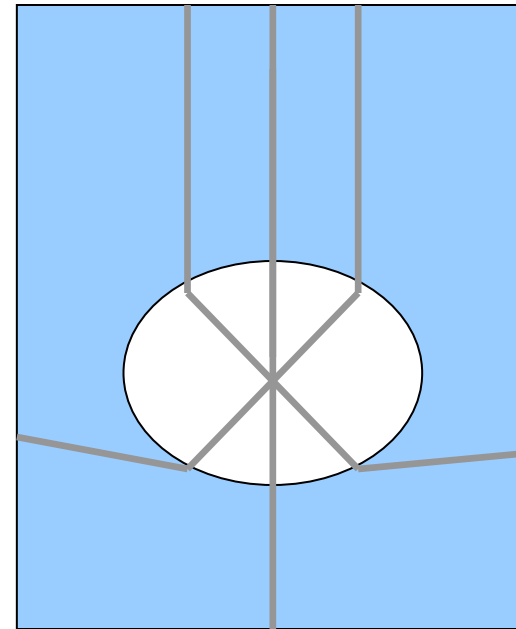
- Light Stability
- Heat Stability
- Ease of Dispersion
- Opacity
- Masstone/ Tint Strength
- Bleed Resistance
- Regulatory compliance (FDA, REACH, etc)

Refraction Of Light

- As light passes through a particle of TiO_2 or other pigment, it is refracted or bent. Materials with a higher refractive index bend the light more sharply.



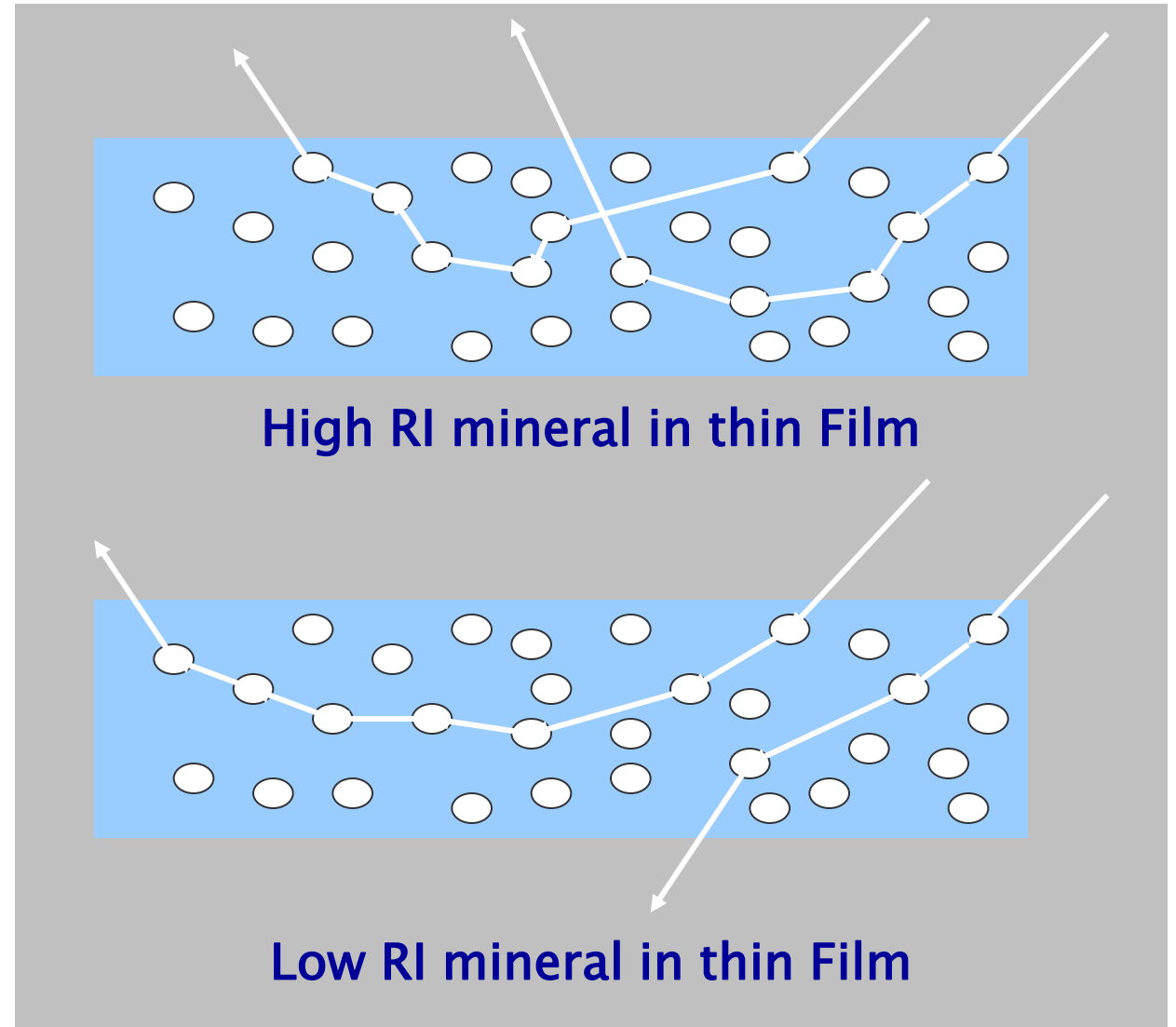
High RI mineral



Low RI mineral

Refraction Of Light In Plastic Film

- Materials with higher refractive index will have higher opacity, especially in thin films

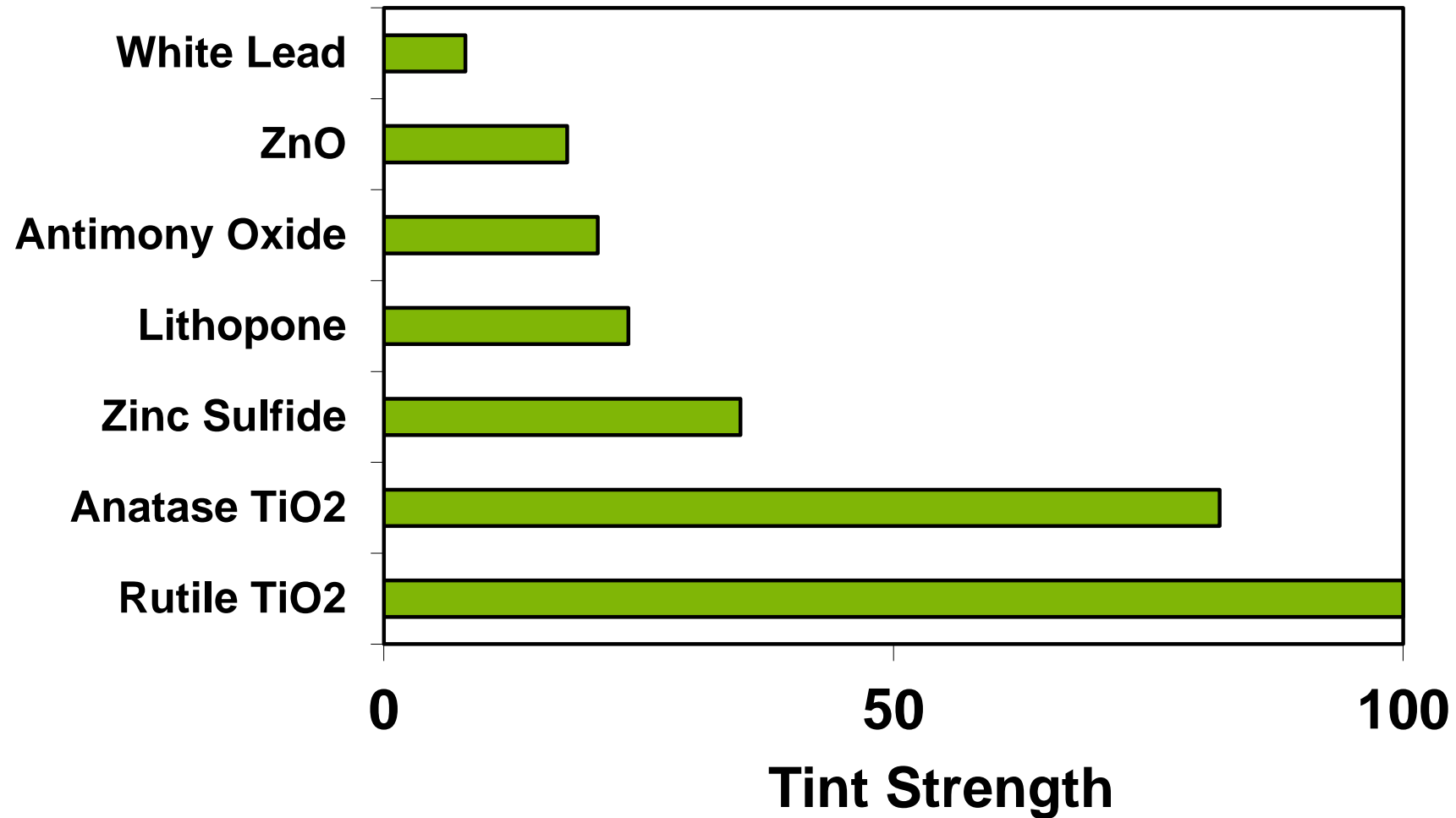


TiO2 Refractive Index

- Rutile TiO2 is the white pigment of choice

Mineral	R.I.	Plastic	R.I.
Rutile TiO2	2.73	PE	1.5-1.54
Anatase TiO2	2.55	PS	1.6
Antimony Oxide	2.15	PVC	1.48
Zinc Oxide	2.02	PC	1.59
Lithopone	1.84		
Calcium Carbonate	1.63		
Silica	1.45		

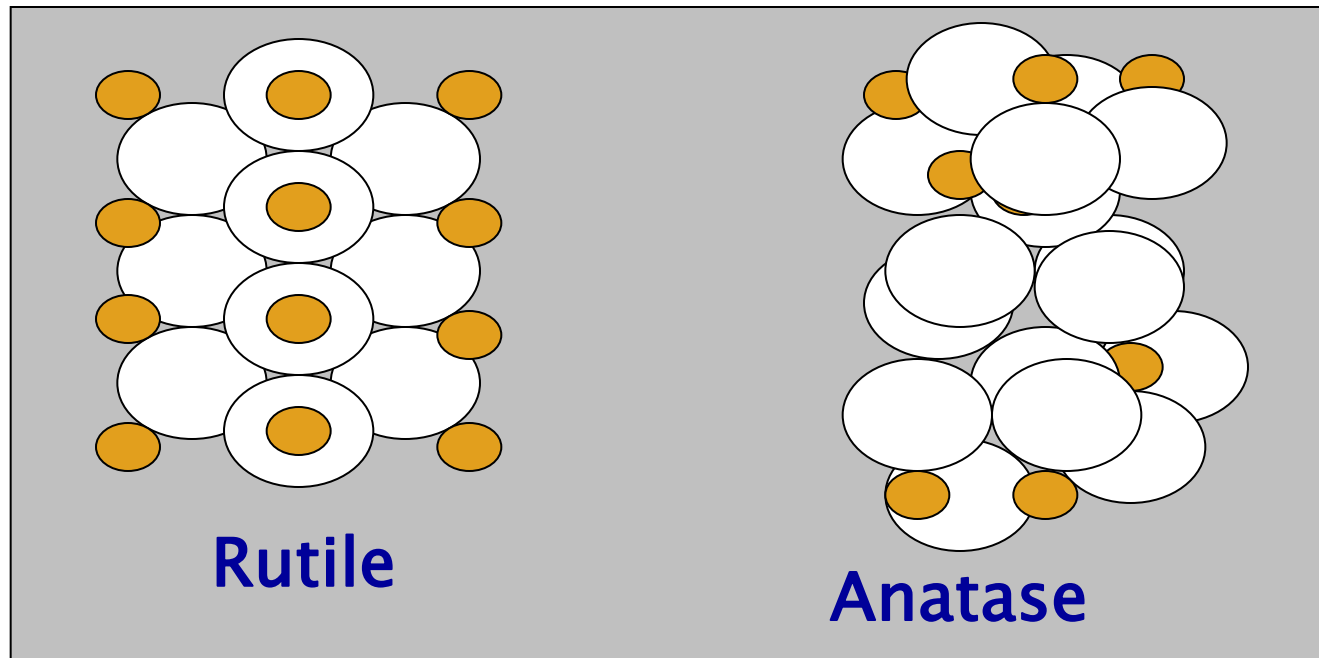
Relative Tint Strength of White Pigments



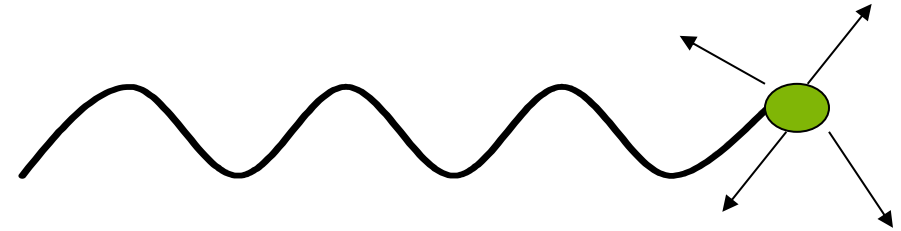
Titanium Dioxide Structure

Titanium dioxide comes in two crystal forms:

- Anatase
- Rutile: higher refractive index. Better opacity.



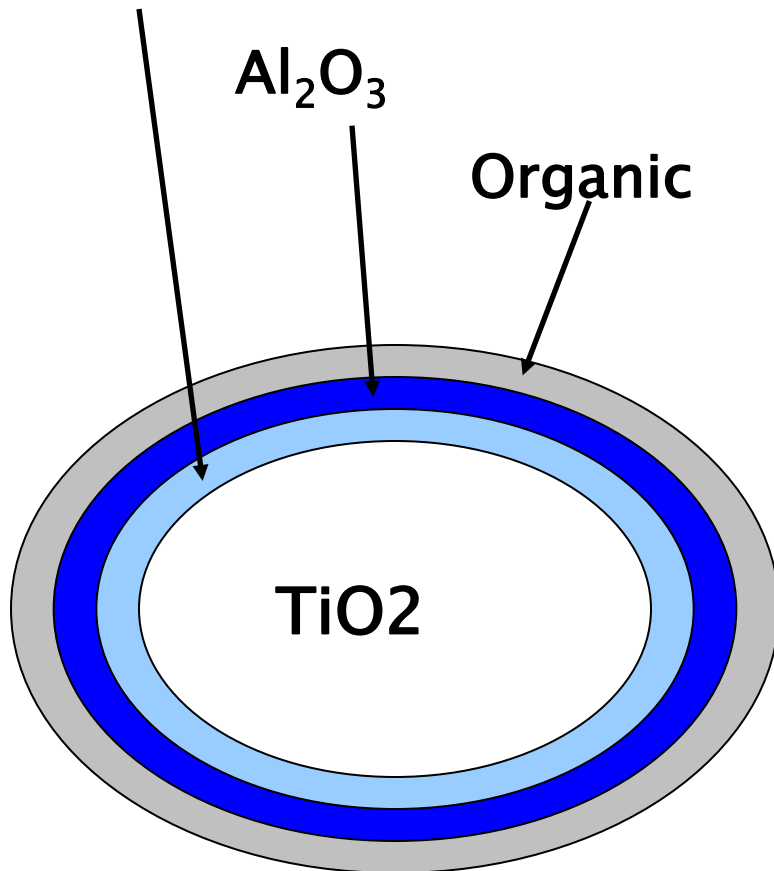
TiO₂ Light Scattering Efficiency



- Rutile TiO₂ is the material of choice
- Particle size is controlled to produce the final tint tone, smaller particle size results in a bluer tint, larger in yellow tint
- Scattering efficiency of the base particle increases as you approach the optimal size, approx. half the wave length of visible light
- Slightly smaller than optimal size results in a rapid decrease opacity

TiO₂ Coatings / Treatments

Dense Silica



- TiO₂ particles are treated to facilitate handling, processability and dispersion
- Inorganic treatments aid in-process handling and improve durability
 - Alumina treatment minimizes moisture pickup
 - Silica is used to enhance durability
- Organic treatments aid dispersion
 - Uniformly applied in amounts small enough to avoid volatility, interactions and overlubrication

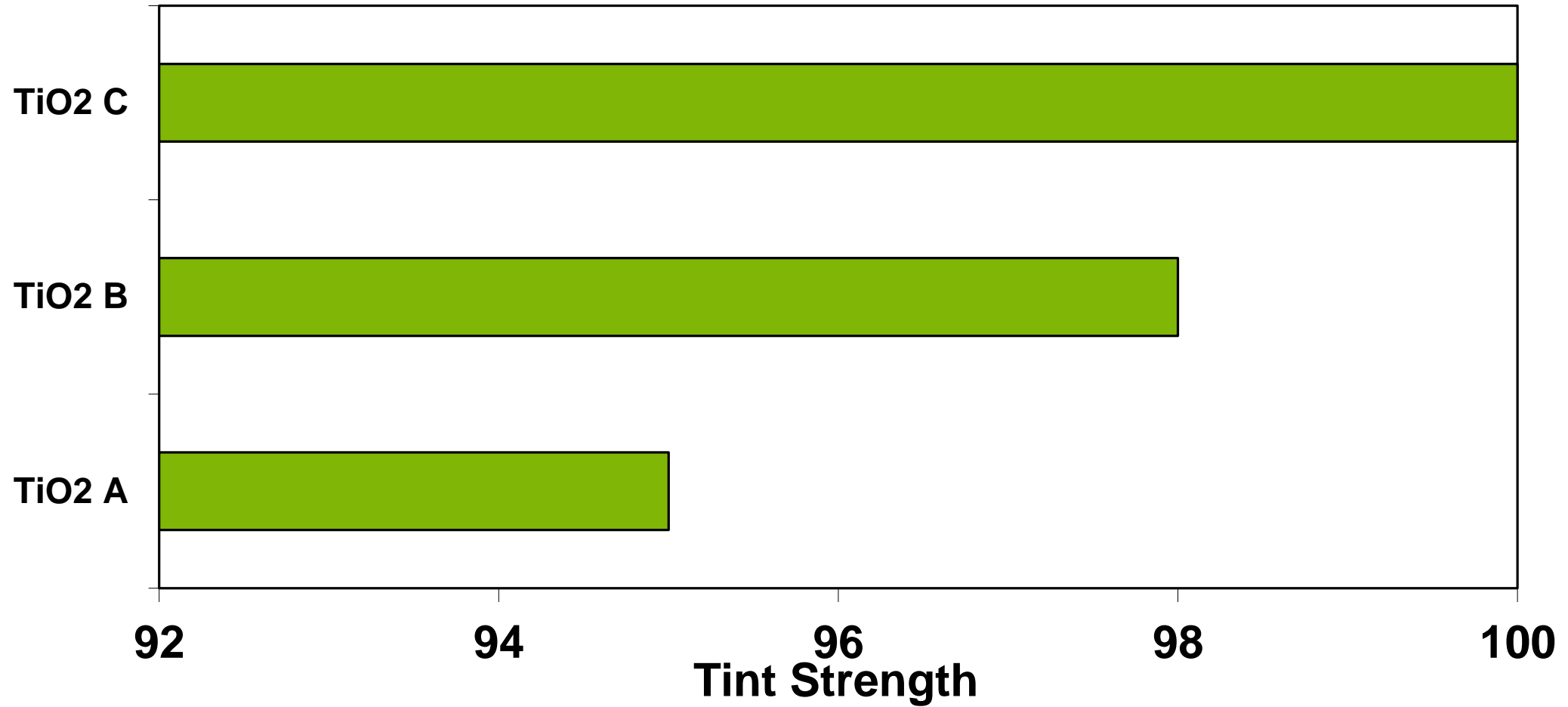
Rutile TiO₂ grades – Not all the same!

- Color/Undertone
- Opacity
- Processability
- Lacing resistance / heat stability
- Durability
- Dispersion
- Light stability
- Crystal structure

Typical TiO₂ Specification

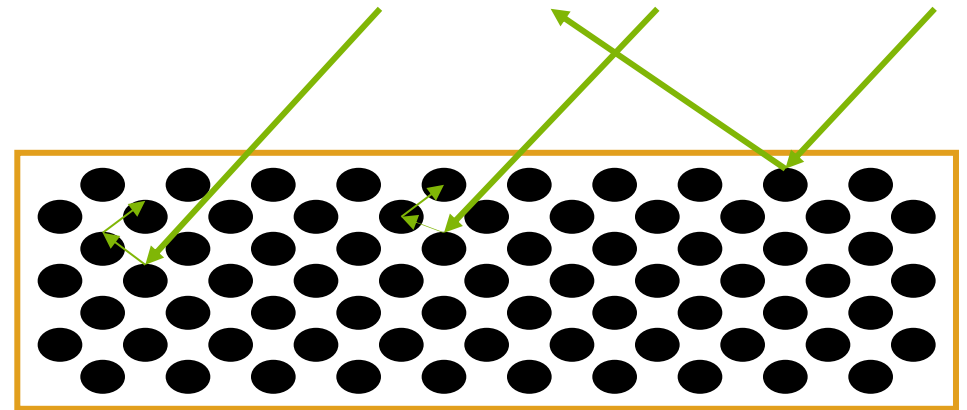
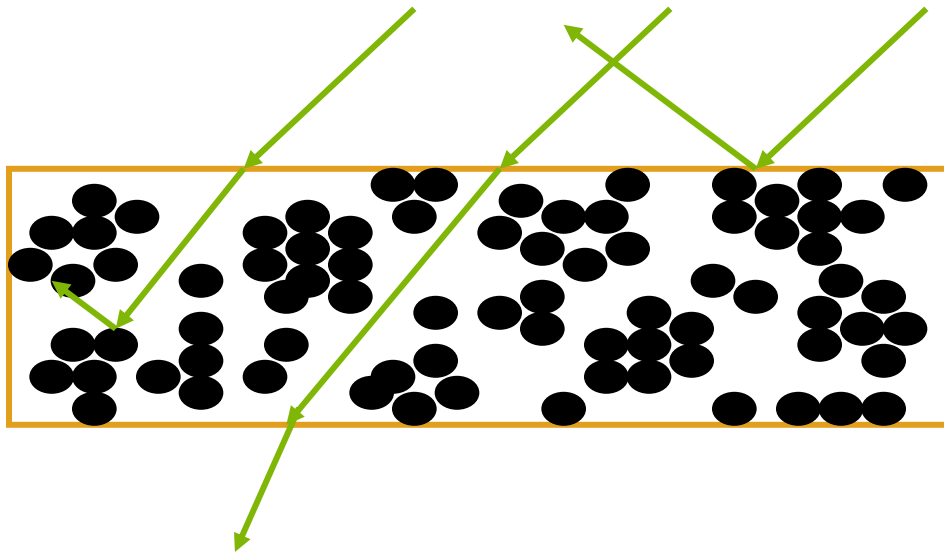
- Titanium dioxide: 97 wt % minimum
- Alumina: 1.7 wt % maximum
- Organic treatment: 0.3 wt % Carbon
- Specific gravity: 4.2 g/cm³
- Mean particle size: 0.22 micron
- Opacity strength: High
- Undertone tint: Blue
- Silica treatment for durable TiO₂

Difference in Tint Strength of TiO₂ Grades



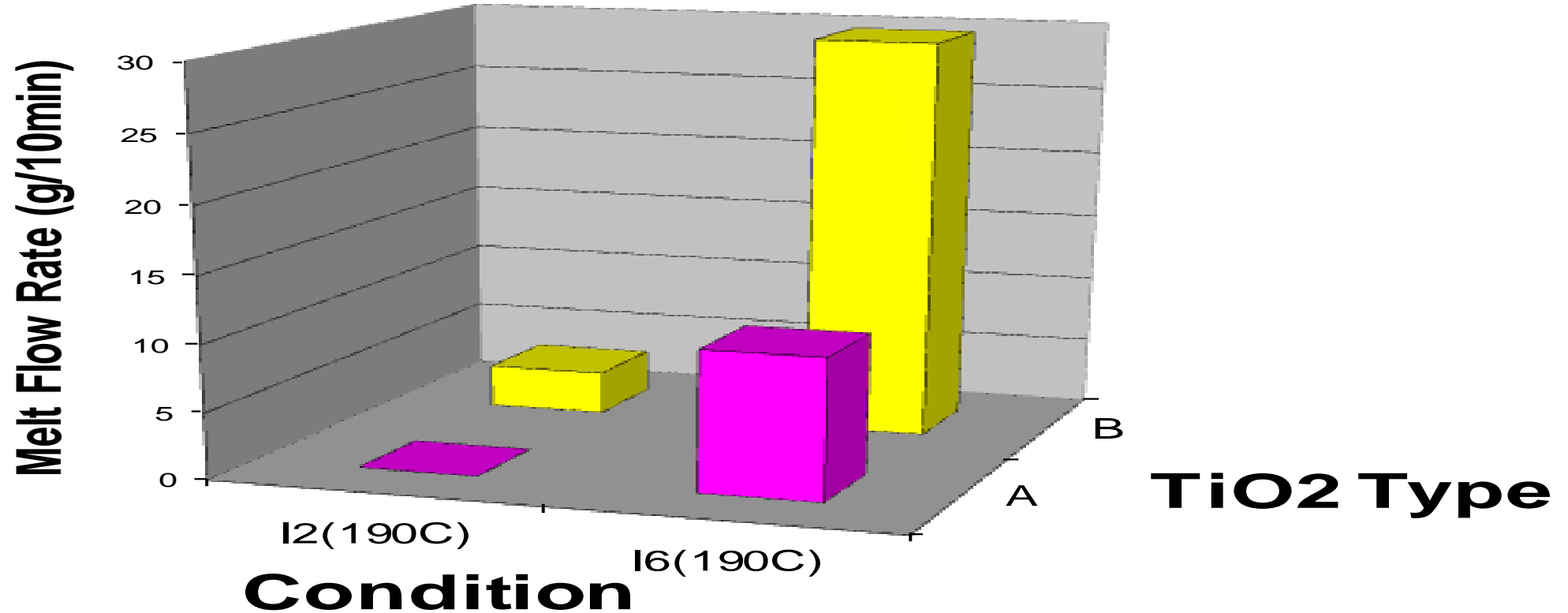
TiO₂ Light Scattering

Bad Dispersion versus Good Dispersion



Good dispersion = better opacity at lower letdown

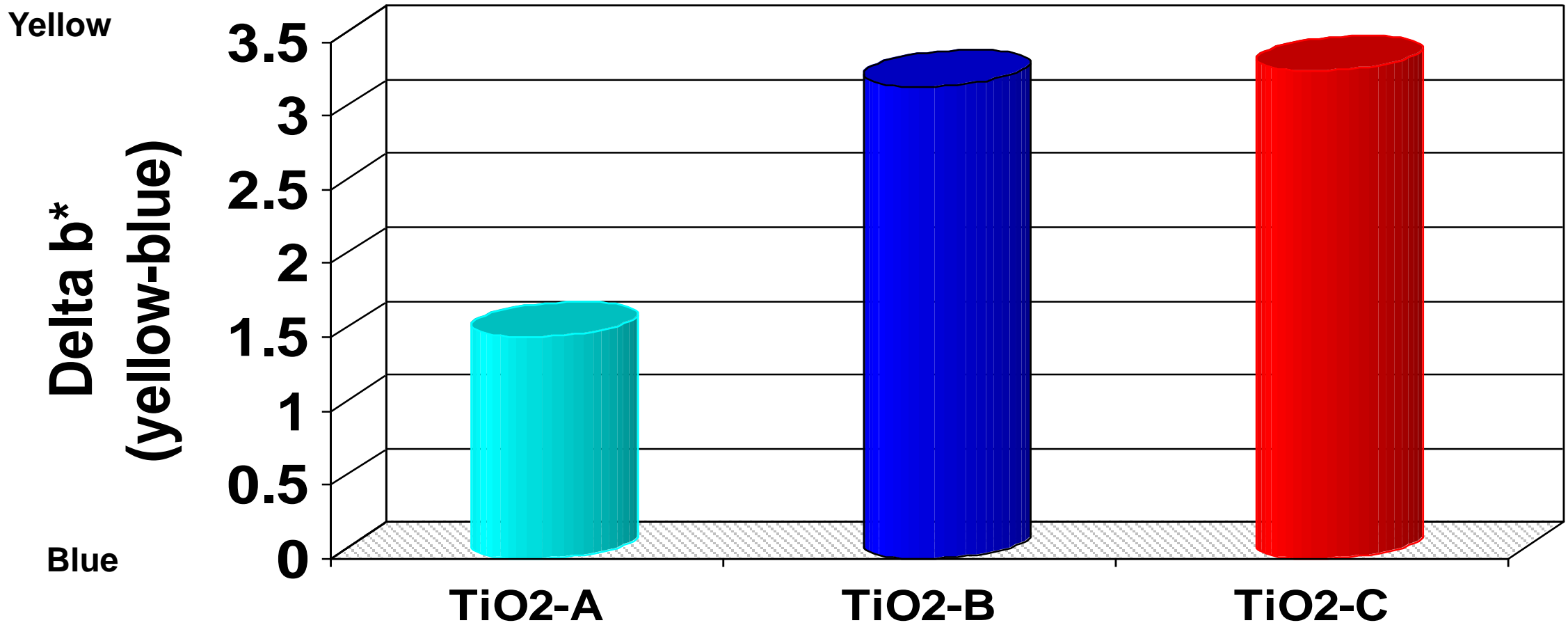
Effect Of TiO2 Type On Melt Flow



70% TiO2 in LDPE

Better surface treatment = higher melt flow = better dispersion

TiO₂ Treatment: Weatherability



TiO₂ Treatment: Lacing Resistance

- Some organic treatments volatilize at high temperatures.
- Some TiO₂ are hydrophilic. They attract moisture.
- This leads to volatile bubbles at the die exit during film extrusion causing lacing at worst, fish eyes or lensing, at lower moisture levels.
- High quality treatment prevents these issues.

White MB 101 - Conclusions

- 1) Ingenia has industry leading product offering in White MB!
 - 2) Ingenia has the knowledge, experience and expertise to provide high quality products, designed to meet your application requirements!
 - 3) Ingenia Technical Support staff are available to provide solutions to your most demanding applications!!!
- Contact Ingenia Customer Service to learn more about solutions for White MB applications.



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