Lubrizol

PERFORMANCE COATINGS

SURFACE MODIFIER PRODUCTS

Technology Introduction

Confidential, only for internal use

WHAT WE ADD MAKES THE DIFFERENCE.™

Lubrizol Surface Modifiers

- Trademarks
- Applications
- End-use Markets
- Technology
  - Definition – Origin – Functions
  - Product Lines – Industry application
  - Fundamental properties and mechanisms
  - Production methods
- Appendix - Nomenclature

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SURFACE MODIFIER PRODUCT LINES & TRADEMARKS

Surface Modifiers

Micronized Waxes

Wax Dispersions

Wax Emulsions

Specialty Additives

Lanco™
Lanco™Glidd
Aquaslip™
Lanco™Matt
Lanco™LiquiMatt
Lanco™ Flow
Lanco™ Antimar
Carbocure™
Liquitron™
Pinnacle™
Liquilube™

SURFACE MODIFIER APPLICATIONS

- Slip Control – reduce Coefficient of Friction of film surface
- Resistance vs. Mechanical Impact on film surface – Scratch, Mar, Abrasion, Burnishing, Rub etc. Resistance
- Modification of Surface Appearance – Gloss/Matting & Texture
- Modification of Surface Feel – „soft“, „silky“, „smooth“
- Anti Blocking
- Release Effects in Packaging Coatings & Inks
- Water Repellency
- Metal Marking Resistance
- Degassing in Powder Coatings
- Softening of Silica Sedimentation
- Other, e.g. rheological, flow & leveling effects etc.

SURFACE MODIFIER END-USE MARKETS

- Wood Coatings
- Powder Coatings
- Can & Coil Coatings
- Printing Inks
- General Industrial Coatings
- Architectural/ Decorative Paints

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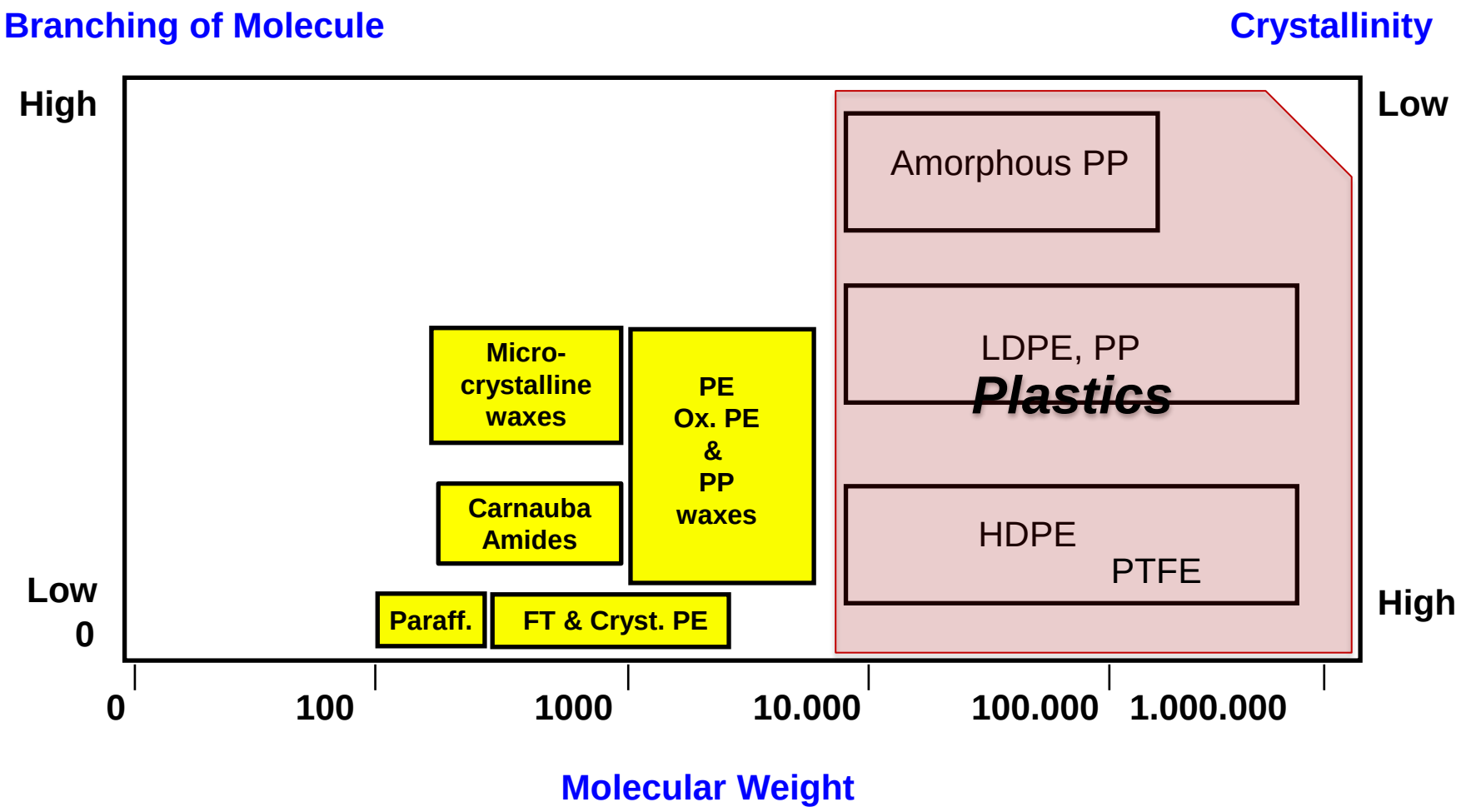
SM / WAX DEFINITION

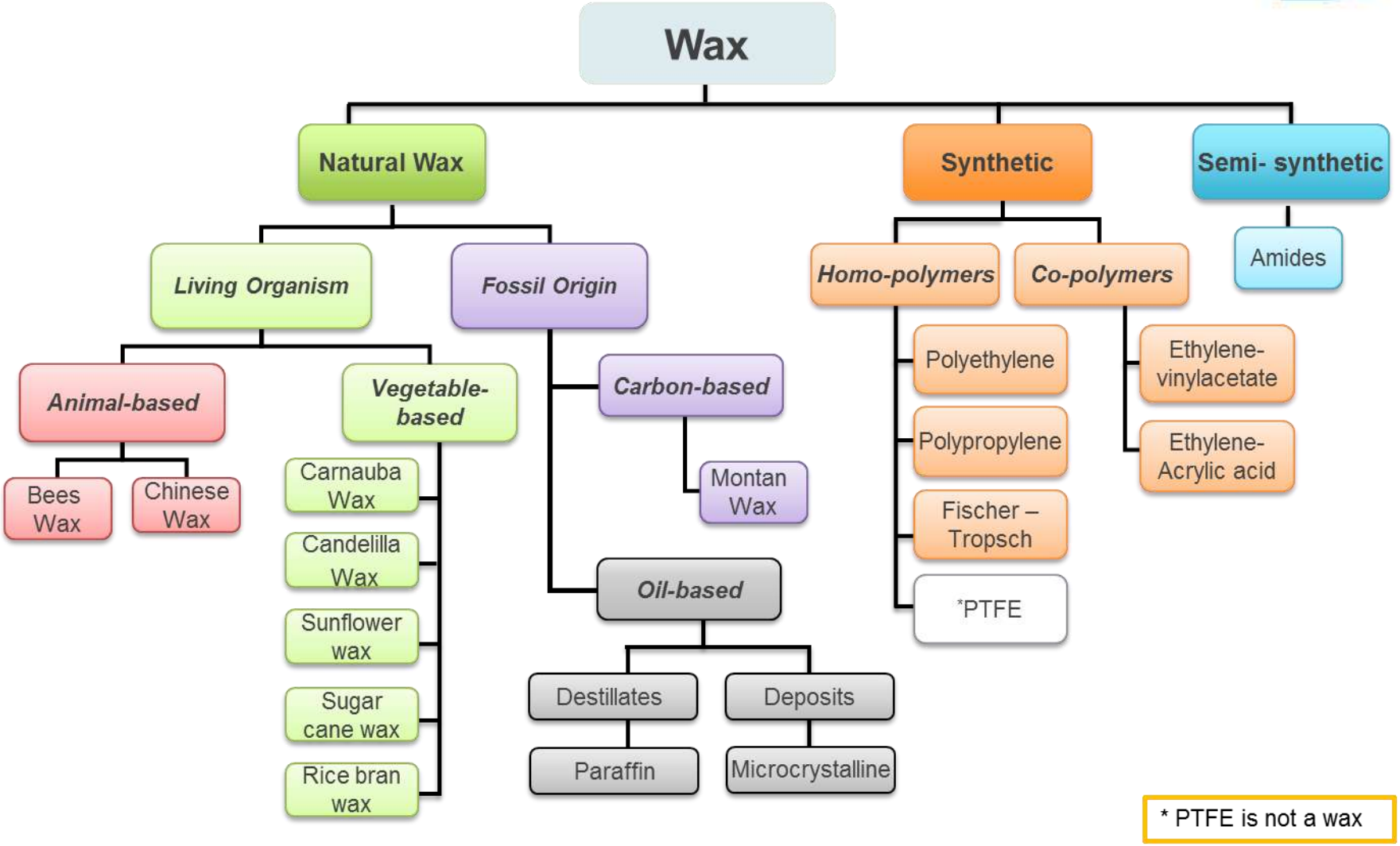
Surface Modifier ↔ Wax

- A wax is a low melting organic material or compound which is solid at 40° C
- Chemically waxes may be hydrocarbons, alcohols, esters of fatty acids etc…
- Waxes are insoluble in water.
- Waxes are soluble in organic solvents. Depending on the wax type, elevated temperatures (~50-100° C) are necessary.
- Waxes have a sharp melting point. Only a few degrees beyond the melting point their melt viscosity reaches its minimum.

POLYMER CHARACTERISTICS OF WAXES



WAX ORIGIN



* PTFE is not a wax

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PRODUCT LINES – PAINTS & COATINGS

Lubrizol offer a wide variety of surface modification agents

Dry powders

Lanco™
- *Micronized wax powders*

Lanco™ Matt
- *Wax treated silica matting agents*

PowderAdd™
- *Wax additives for powder coatings*

Liquid preparations

Lanco™ Glidd
- *Wax dispersions (water- and solvent based)*

Lanco™ LiquiMatt
- *Matting dispersions (water- and solvent based)*

Aquaslip™
- *Wax emulsions*

Lanco™ Antimar
- *Silicone based surface modifiers*

Carbocure™
- *Matting agent for 100% UV coatings*

Addressable markets

Wood / Industrial	General Industrial	Powder Coatings
Can- Coatings	Architectural / Decorative	Coil- Coatings

PRODUCT LINES – INKS & OPV'S

Lubrizol offer a wide variety of surface modification agents

Dry powders

Lanco™
- *Micronized wax powders*

Pinnacle™
- *Micronized wax powders*

Liquid preparations

Lanco™ Glidd & Liquitron™
- *Wax dispersions (water & solvent based)*

Liquilube™ & Aquaslip™
- *Wax emulsions*

Fluotron™
- *Pure PTFE preparations in water*

Carbocure™
- *Matting and processing agents for 100% UV systems*

Addressable markets

Offset
Flexo
Gravure
Screen
Screen

FURTHER PRODUCT LINES

Lubrizol offer a wide variety of surface modification agents

Specialties

Lanco™ Flow

- *Flow & Levelling Agents for Liquid and Powder Coatings*

Lanco™ Stat

- *Conductivity Promoters for Liquid and Powder Coatings*

Addressable markets

Wood / Industrial	General Industrial	Powder Coatings
Can- Coatings	Architectural / Decorative	Coil- Coatings

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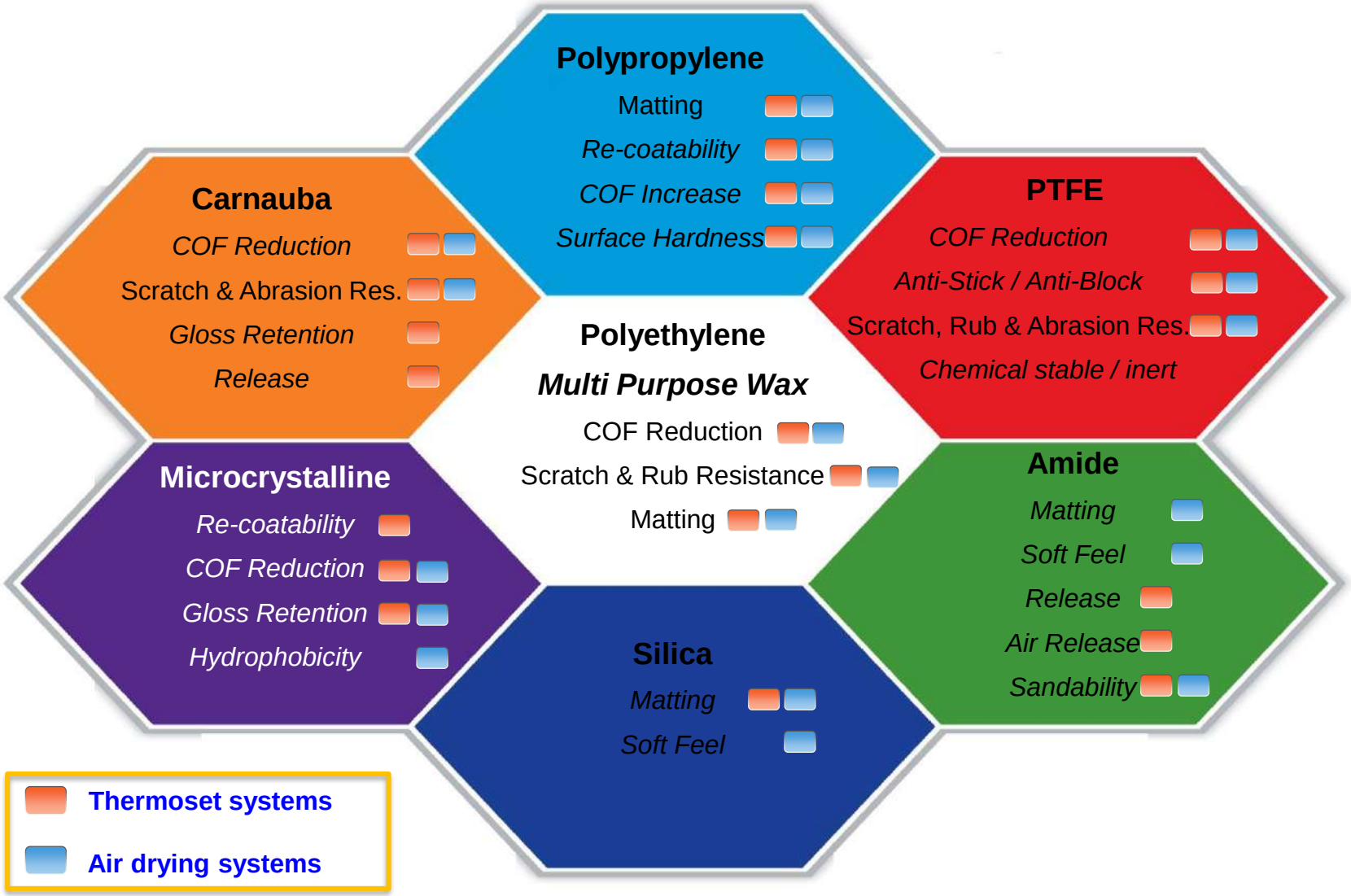
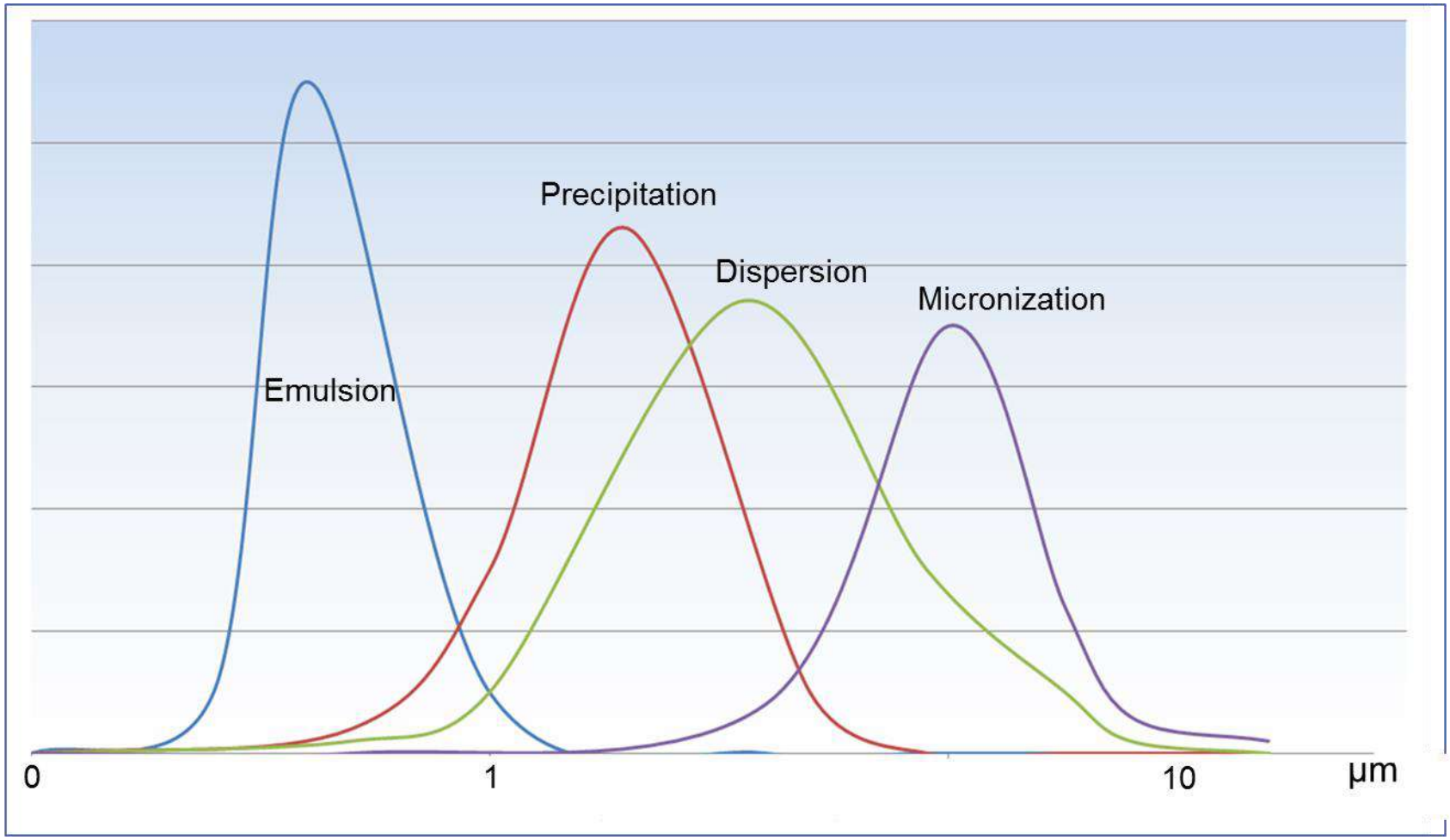
SURFACE MODIFIER BUILDING BLOCKS



PARTICLE SIZE

Examples for typical particle size distributions from different production methods



PARTICLE SIZE

Typical particle size ranges/borders for Lubrizol's micronized waxes

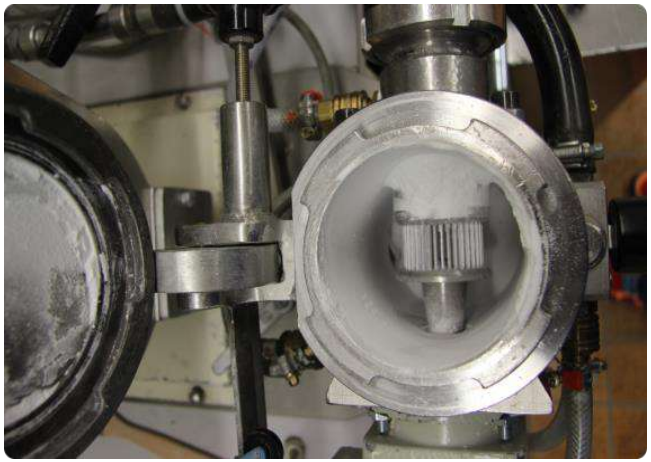
(Lanco, Pinnacle and PowderAdd range)

Dv50 ≤ 15µm,	Dv90 ≤ 30µm – powder coatings
Dv50 ≤ 9µm,	Dv90 ≤ 22µm
Dv50 ≤ 9µm,	Dv90 ≤ 18µm – narrow distribution
Dv50 ≤ 6µm,	Dv90 ≤ 14µm
Dv50 ≤ 5µm,	Dv90 ≤ 9.5µm – *very fine specialties*

Choosing the right particle size is essential in:

I. *Ensuring proper performance in Coating/Ink system*

II. *Avoiding detrimental effects with the used application process (e.g. in gravure & flexo ink, UV, can coating)*



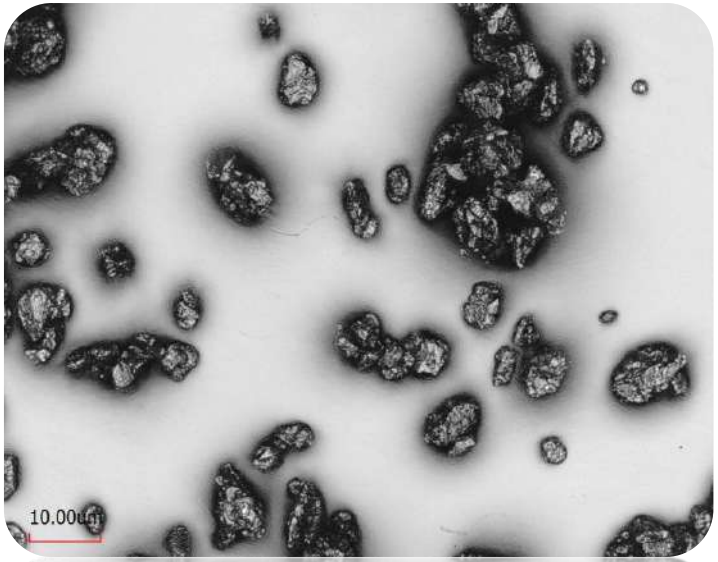
Particle size is an important factor for:

	Particle Size	
Soft feel	+	--
Smoothness	++	--
Surface protection	-	++
Gloss reduction	--	++
Anti-blocking	-	+

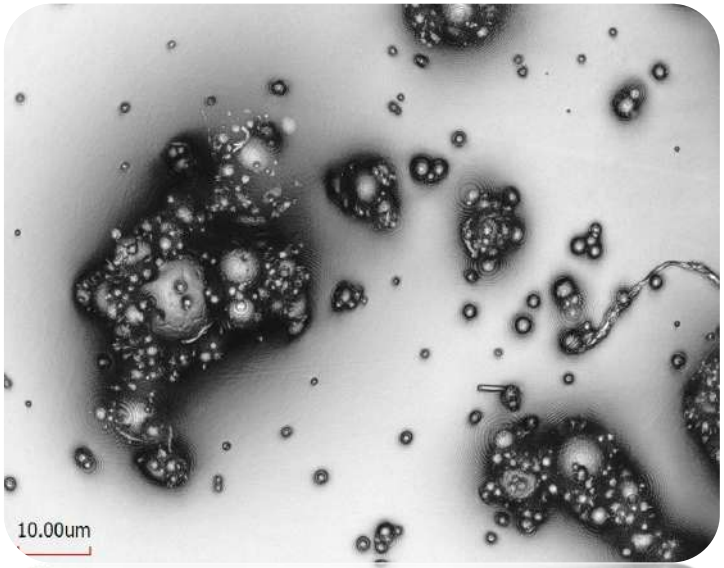
PARTICLE SHAPE

Examples for powder processing products

Air jet micronized wax
150x magnified



Spray micronized wax
150x magnified



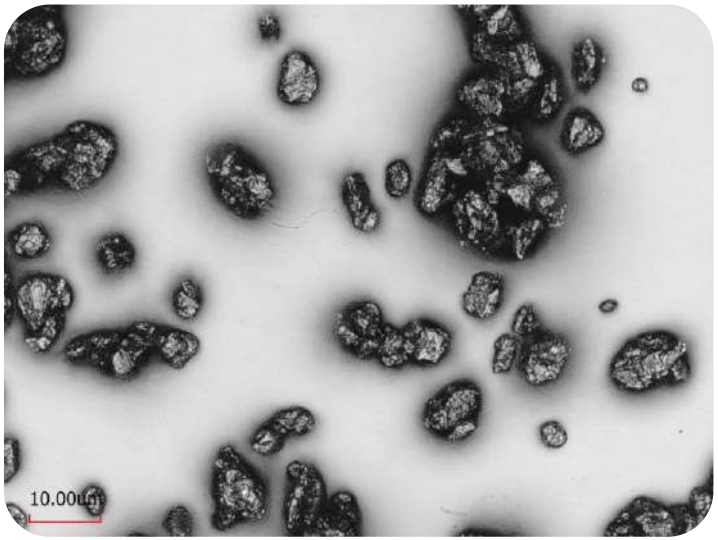
Measured Particle size (Dv50& Dv90) of both products was equal

Pictures were taken using a ***Keyence VK-X210*** confocal laser scanning microscope

PARTICLE SHAPE

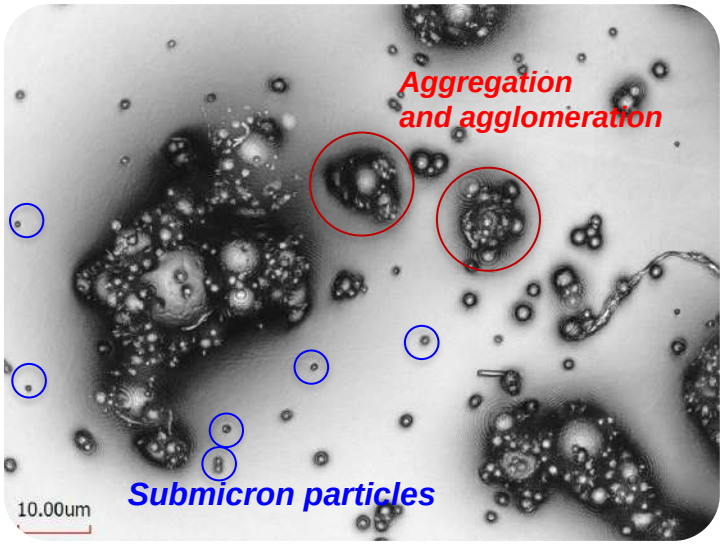
Examples for powder processing products

Air jet micronized wax
150x magnified



- Uniform/narrow distribution
- Little agglomeration or aggregation
- High surface area (due to particle morphology)

Spray micronized wax
150x magnified



- Many agglomerates and aggregates
- Low surface area (due to spherical shape)
- Many submicron particles (“ineffective material”)

MECHANISMS

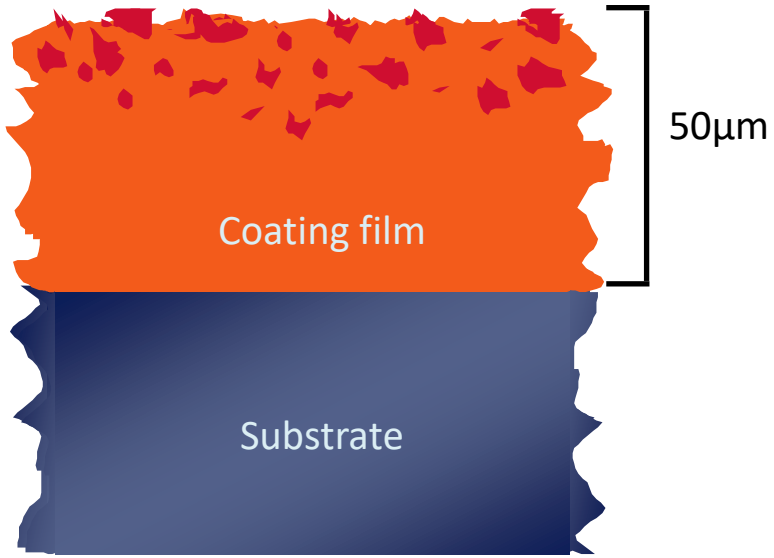
For optimum performance, a surface modifier must be at or migrate to the surface of the coating film

Parameters which affect migration:

- Chemical & physical nature of surface modifier: polarity, particle size, density
- Chemical & physical nature of coating system: which type of components involved, polarity, density, viscosity
- Curing conditions: open time, solvent evaporation, viscosity gradient
- Film thickness

MECHANISMS

Examples for **non heat curing** coatings.



„Floating“ Effect

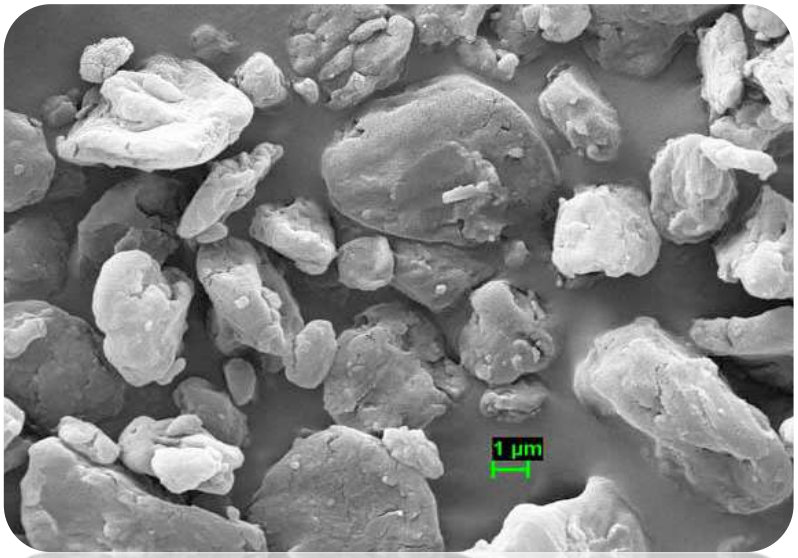
Typical for air drying systems.
wet film thickness 100 - 150µm
dry film thickness 20 - 40µm

„Overlay/Ball Bearing“ Effect

e.g. Radiation cured & ink systems.
dry film thickness 5 - 25µm

MECHANISMS

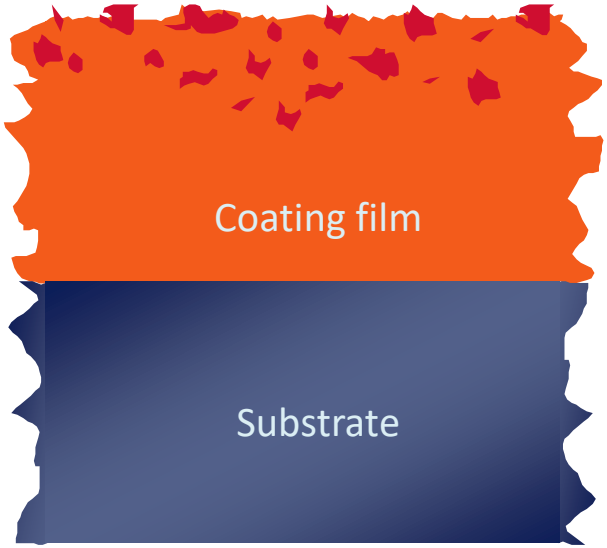
Example **„Overlay, Ball Bearing“ Effect**

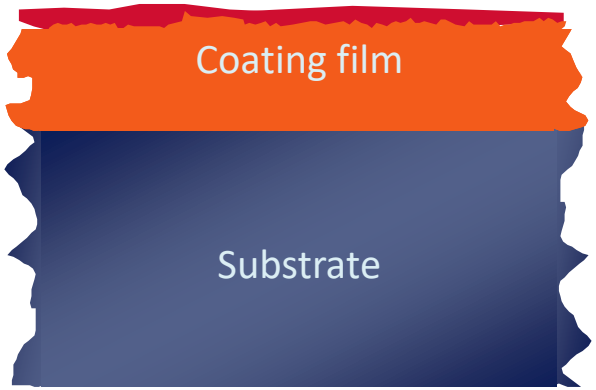


PE wax in flexo ink layer

MECHANISMS

Example for **heat curing** coatings (wax mp << curing temp.)





Prior to curing

After curing

“Flotation/Layering” Effect

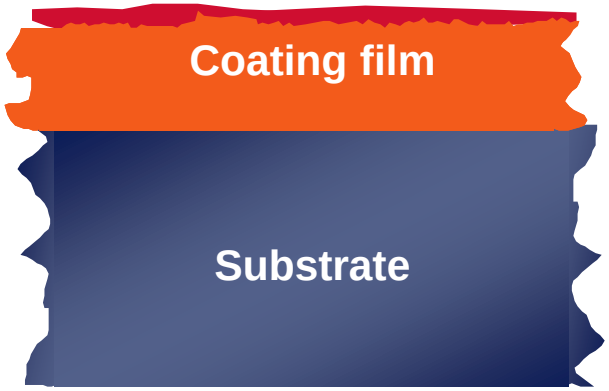
Depending on curing temperature wax particles might fully or partially melt and form a layer on the film surface.

typical wet film thickness 10 - 60µm

typical dry film thickness 6 - 20µm

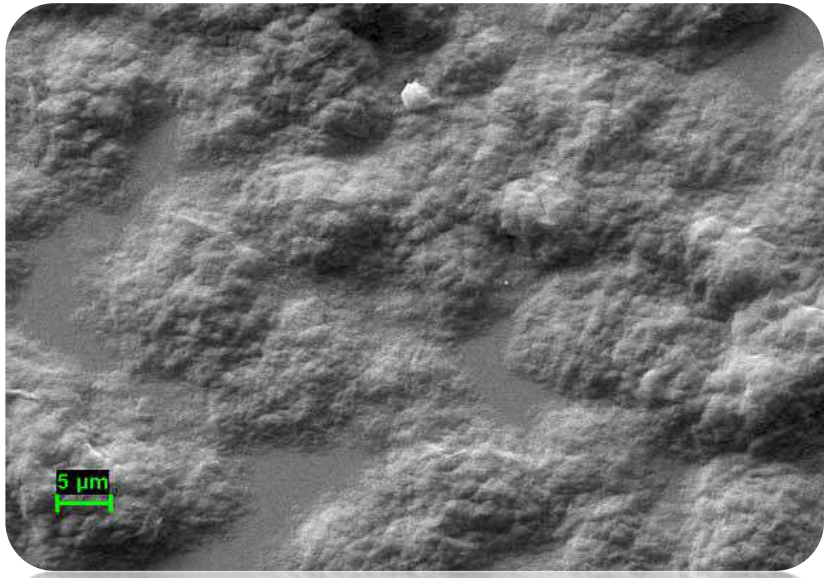
MECHANISMS

Layering effect in thermoset system



“Layering“ Effect

Typical for Heat Set inks and systems, which use soft waxes. Also valid for wax emulsions.



Low melting PE wax in offset ink layer

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LUBRIZOL SM PROCESSES

Wax processing

Chemical synthesis in various reaction vessels

Hot melt blending
Pastillizing

Dry blending

Intermediates for powder and liquid processing

Powder processing

Air jet milling (Fluidized bed counter flow collision type)

Inline classifier system

Dry blending capacity

Dry ground wax powders

Liquid processing

Different high speed stirring systems

Emulsification units

Bead mill technology
(with& without heating capacity)

Wax dispersions
Wax precipitations

LUBRIZOL SM PROCESSES

Wax processing

Chemical synthesis in various reaction vessels

Hot melt blending
Pastillizing

Dry blending

Intermediates for powder and liquid processing

Composition examples:

Melt, Physical and other blending processes

- *PTFE modified PE*
- *PE Modified PP*
- *Amide modification*
- *PP modification*
- *Other PTFE modifications*

many more options possible to meet specific customer needs…

PE | PTFE | PP | Micro | Amide

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Wax processing

Chemical synthesis in various reaction vessels

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Pastillizing

Dry blending

Intermediates for powder and liquid processing

Powder processing

Air jet milling

Inline classifier system

Dry ground wax powders

Liquid processing

High speed stirring systems

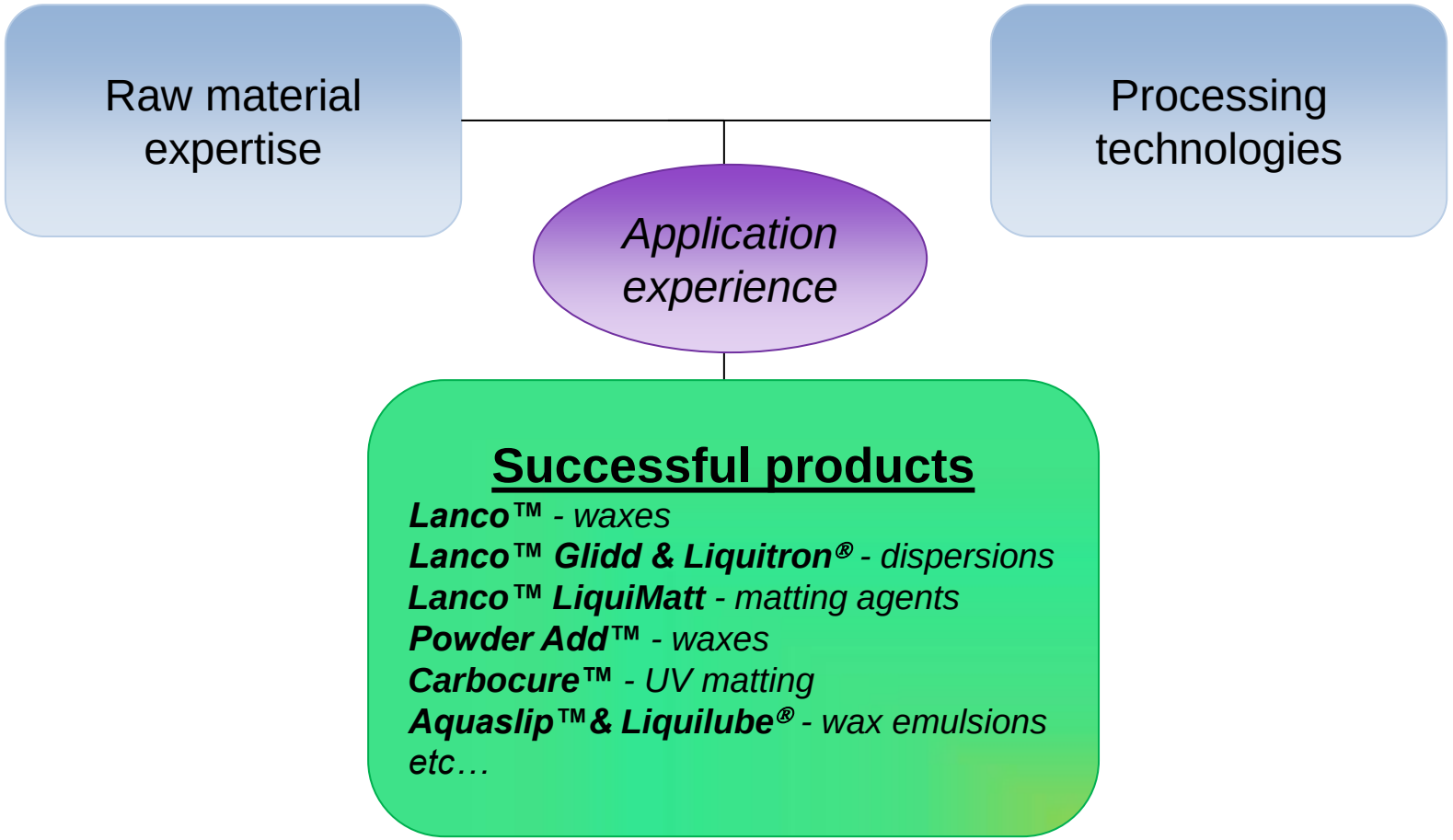
Bead milling processes

Emulsification units

Wax dispersions
Wax precipitations

TAILOR MADE SOLUTIONS FOR OUR CUSTOMERS

*We combine raw material and processing knowledge to a range of innovative products to **meet our customer's needs.***



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LANCO™ WAX NOMENCLATURE

- 1300's Series – *PP and PP-modified Waxes*
- 1400's Series – *Special Waxes*
- 1500's Series – *PE-Waxes*
- 1600's Series – *Amide-Waxes*
- 1700's Series – *PTFE-modified PE-Waxes*
- 1790's Series – *Pure PTFE's*
- 1800's Series – *Texturing Waxes for Powder Coatings*
- 1900's Series – *Special Surface Modifiers*

POWDERADD™ NOMENCLATURE

- 9010's Series – *Non-micronized PE-Waxes*
- 9020's Series – *Polyolefin Waxes*
- 9050‘s Series – *PostAdd series*
- 9060's Series – *Amide modified waxes*
- 9070's Series – *PTFE-modified PE-Waxes*
- 9080's Series – *Texturing Waxes*
- 9090's Series – *PP and PP-modified Waxes*
- 9400’s Series – *Degassing Additives*

DISCLAIMER

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