Lubrizol Wax Additives
Sustainability and PFAS Regulatory Compliance

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Lubrizol Performance Coatings

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Content

- Lubrizol Corporate Sustainability Goals & Footprint
- Lubrizol Performance Coatings – How can our products help our customers to achieve their sustainability goals?
    1) Increase renewable content
        - Bio-based vs. Biomass Balance (BMB)
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        - Lubrizol Traditional vs. Bio-based Wax Additives portfolio
        - Lubrizol Novel Bio-based and BMB Wax Additves
    2) Removing Chemistry of Concern – PFAS
        - PTFE – regulatory situation
        - PTFE – alternatives
        - Performance data

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Lubrizol Sustainability Goals

Emissions

Reduce Scope 1* and Scope 2* greenhouse gas emissions by **20% by 2030** (compared to a 2018 baseline).

Waste

Decrease our waste by **10% by 2030** (compared to a 2018 baseline). This includes reducing the amount of waste generated, reducing scrap and increasing recyclability.

Water

Conduct water risk assessments at all Lubrizol manufacturing sites biennially to determine opportunities for additional improvements. We will also sponsor annual waterbody restoration or clean-up activities in the communities we call home.

Community Giving

Giving at least $20,280,000 to organizations that are aligned with our community investment priorities.

Volunteering

Giving at least 80,000 volunteer hours to activities that are aligned with our community investment priorities.

Supplier Sustainability

Complete EcoVadis assessments on 80% of key suppliers by 2028.

Supplier Ethics

Complete an annual performance evaluation of all key suppliers and ensure all key suppliers agree to Lubrizol's Supplier Code of Conduct (or demonstrate equivalency).

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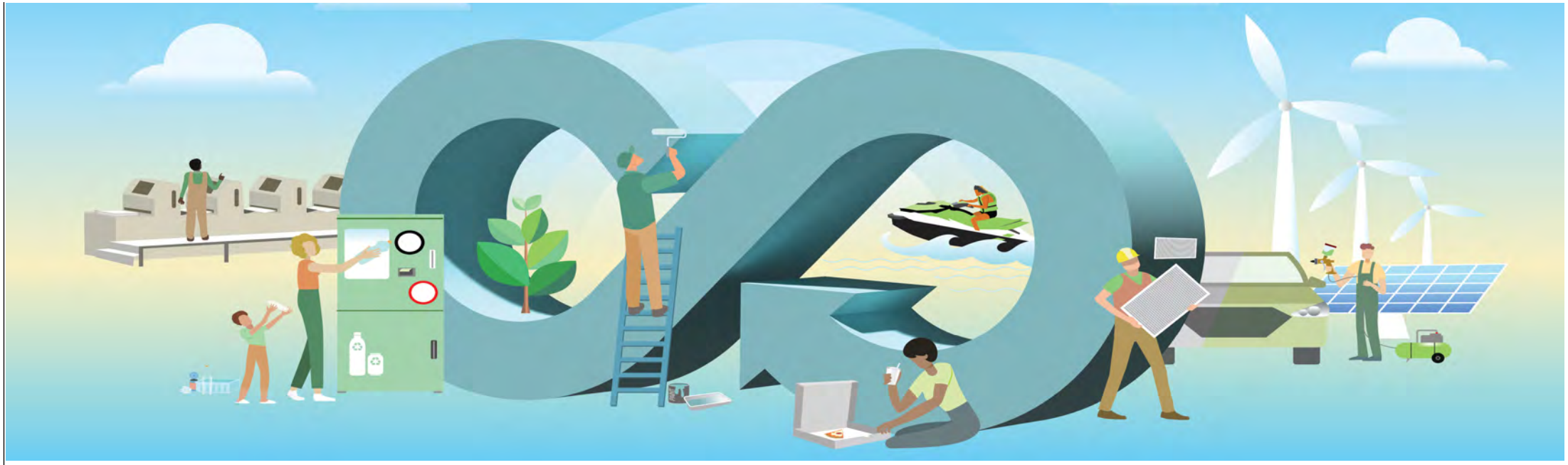

Delivering maximum value by enabling customers to achieve performance & sustainability goals through **responsible design** focused on:

- Emissions reduction and elimination of chemicals of concern
- Productivity, process efficiency, energy & waste reduction

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Lubrizol Performance Coatings – How can our products help our customers to achieve their sustainability goals?

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1) Increase Renewable Content

Circularity – Design – Sourcing

Reviewing Bio-Based Raw Material Options

Lubrizol Performance Coatings would like to replace scarce resources with renewable bio-based resources wherever possible.

- Bio-based raw materials
  - → Bio-derived dispersants and polymers
  - → Bio-derived waxes

MINIMIZING
OUR FOOTPRINT

MAXIMIZING
OUR HANDPRINT

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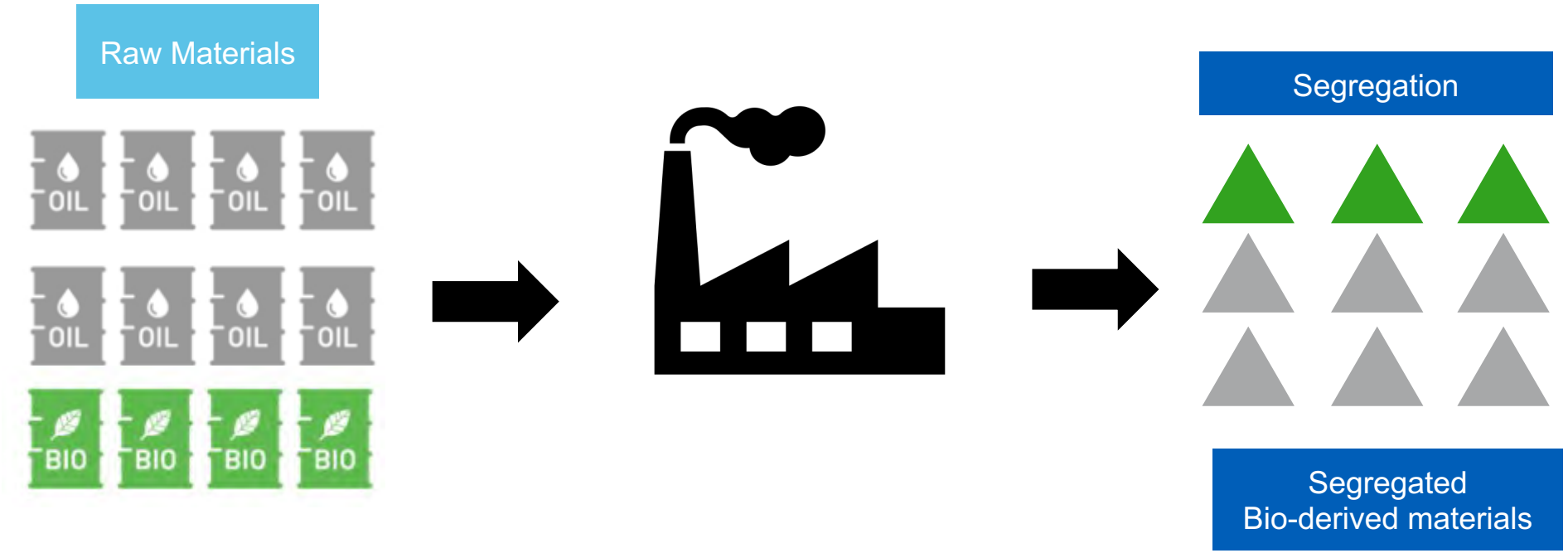
Renewable Carbon Sources: Bio-Based

- ✓ Refers to, **products that mainly consist of a substance (or substances) derived from living matter** (biomass) and either occur naturally or refer to products made by processes that use biomass.



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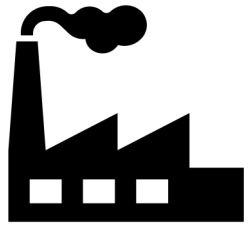
Renewable Carbon Sources: Biomass balance (BMB)

Filling the gap between traditional and dedicated production

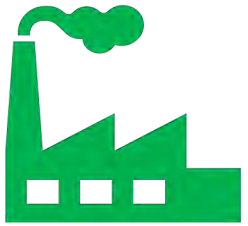


Traditional Production

- ❑ Fossil feedstock
- ❑ Products available in production scale
- ❑ High Product Carbon Footprint

Biomass balance approach

- ❑ Biomass used at the very beginning of the value chain.
- ❑ 3rd party certified: fossil savings
- ❑ Same performance as fossil based: drop-ins
- ❑ Higher availability
- ❑ No changing in the processes



Dedicated Production

- ❑ Bio-Based carbon content (identified with ^{14}C method)
- ❑ Limited drop-ins
- ❑ Limited new building blocks.
- ❑ Often different product properties
- ❑ Reduced availability

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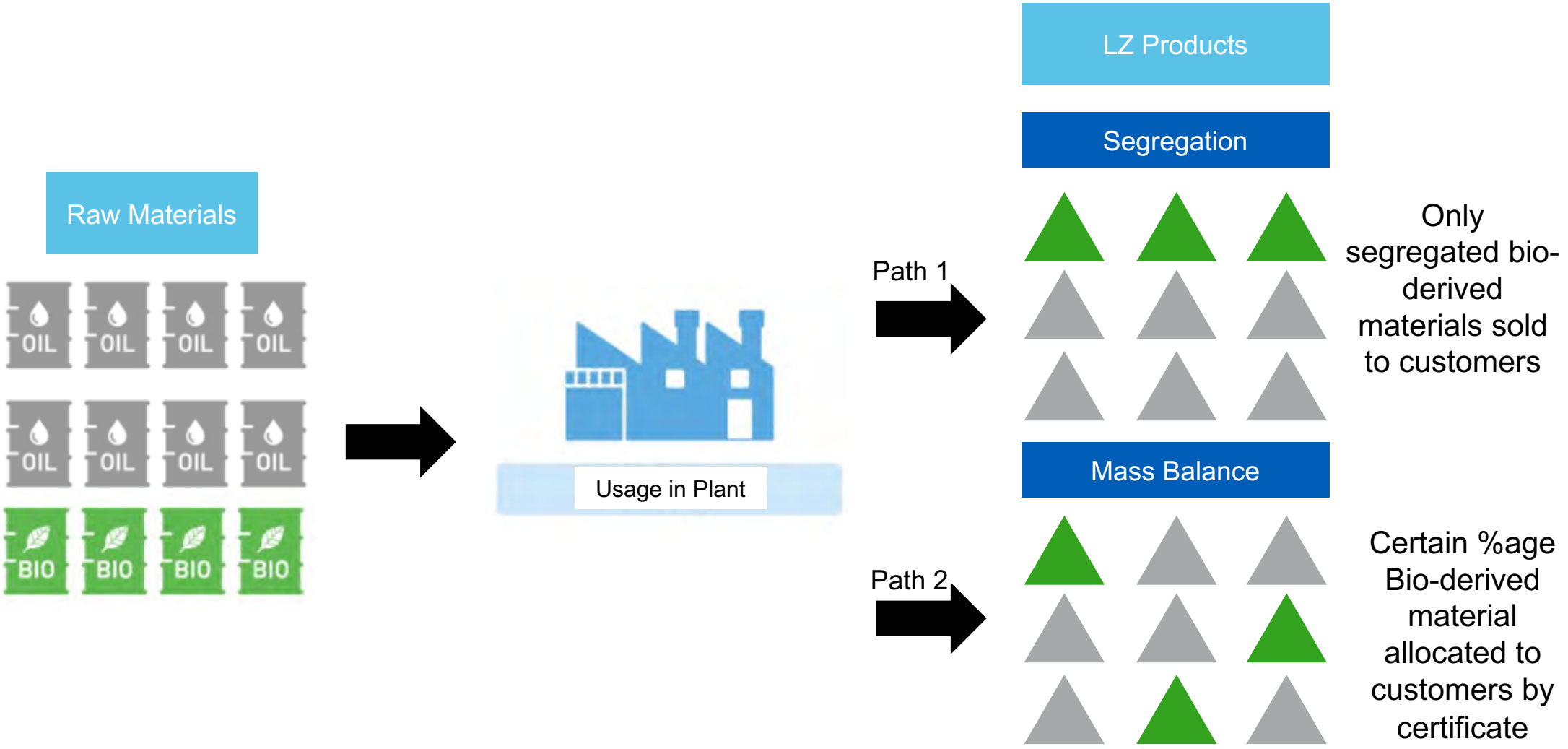
High-Level Overview – Biomass Balance vs Biobased



Biobased vs Biomass

Measurement vs Certification

Bio-based composition

ASTM D-6866
EN16640
EN16785

USDA
DIN CERTCO
Vinçotte/TUV Austria
NEN

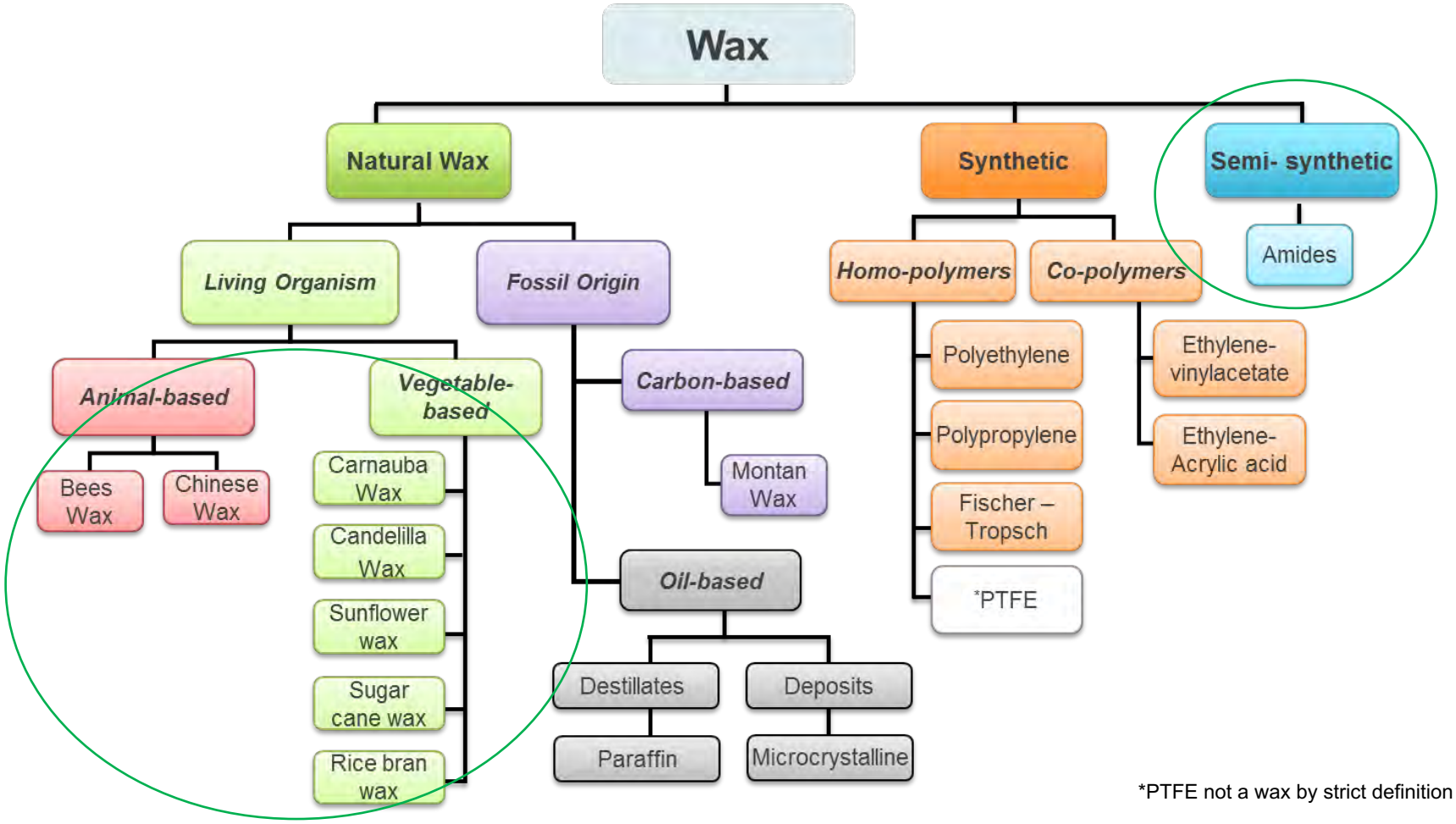
Material mass balance method

Value Chain

ISCC PLUS
REDcert
RSB

This allows companies to demonstrate the sustainable origin of bio-based and/or circular feedstock in all production and supply chains in the food, packaging, feed and chemical industries on a voluntary basis.

Raw Materials – “World of Waxes”



*PTFE not a wax by strict definition

Traditional Bio-based waxes

- Carnauba
  - High Slip Properties
  - Scratch Resistance
  - Good Film Clarity
  - Minimal Matting
  - T1 Grade – whiter, younger
  - T3 Grade – older, more yellow

- Fatty Acid Amide
  - Excellent Antiblock and Release Properties
  - Provides Silky Feel
  - Some Matting
  - Limited Scratch Protection
  - Sandability
  - Plant and Animal Sources

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Bio-based % of Lubrizol commercial products

Micronized

Product Name	Polymer Type	Bio-Based % of Solids	Particle Size µm DV50	Particle Size µm DV90	Melting Point °C (°F)	Density g/cm³ @ 20°C	Coating Types: Water-Borne	Coating Types: Solvent-Borne	Coating Types: Powder	Coating Types: Radiation-Cured
Lanco™ 1380 F	Modified Polypropylene Wax	25-50	≤9	≤22	150 (302)	0.95	●	●	○	●
Lanco™ 1380 SF	Modified Polypropylene Wax	25-50	≤6	≤14	150 (302)	0.95	●	●	○	●
Lanco™ 1400 SF	Modified Amide Wax	25-50	≤6	≤14	140 (284)	0.97	○	●	●	○
Lanco™ 1410 LF	Modified Amide Wax	25-50	≤9	≤19	140 (284)	0.97	●	●	●	○
Lanco™ 1955 SF	Carnauba Wax	≥ 90	≤6	≤14	82 (190)	0.99	●	●	○	○
Lanco™ 2510 SF	Inorganically Modified Wax Compound	25-50	≤6	≤14	105(221)	1.05	●	●	○	○
Lanco™ 2520 SF	Inorganically Modified Wax Compound	25-50	≤6	≤14	105(221)	1.07	●	●	○	○
Lanco™ 2520 EF	Inorganically Modified Wax Compound	25-50	≤5	≤10	105(221)	1.07	●	●	○	○
Lanco™ A 1602	Fatty Acid Amide Wax	≥ 90	≤9	≤22	142 (288)	0.99	○	●	●	○
Lanco™ A 1603	Vegetable Based Amide Wax	≥ 90	≤6	≤14	142 (288)	0.99	○	●	●	○
Lanco™ Flow P 30	Oleo-Based Modified Wax	≥ 90	≤20	≤80	87 (189)	1.00			●	
Lanco™ PE 1544 F	Modified Polyethelyne Wax	25-50	≤9	≤22	140 (284)	0.99	●	●	●	○
Lanco™ PE 1554 SF	Modified Carnauba Wax	25-50	≤6	≤14	104 (219)	0.96	○	●		
Lanco™ PP 1362 D	Modified Polypropylene Wax	25-50	≤9	≤22	140 (284)	0.94	●	●		●
Lanco™ PP 1362 SF	Modified Polypropylene Wax	25-50	≤6	≤14	140 (284)	0.94	●	●		●
Lanco™ SM 2003	Modified Amide Wax	25-50	≤9	≤22	140 (284)	0.97	○	●	●	○
Pinnacle™ 2531	Amide Wax	≥ 90	≤10	≤24	83 (181)			●		
PowderAdd™ 9060	Amide Wax	≥ 90	≤9	≤22	140 (284)	0.99			●	
PowderAdd™ 9062	Modified Amide Wax	25-50	≤25		140 (284)	0.97			●	
PowderAdd™ 9421	Proprietary Polymer	51-89	≤7	≤16	80 (176)	0.097			●	
PowderAdd™ 9423	Proprietary Polymer	51-89	≤7.5	425	140 (284)	0.094			●	

● Premium performance ○ Good performance

Micronized

Product Name	Performance Benefits: COF Reduction (Slip)	Scratch & Abrasion Resistance	Matting	Silky Feel	Anti-Blocking Non-Sticking	Other Properties/Benefits
Lanco™ 1380 F	○	●	●	○	●	Burnish resistance.
Lanco™ 1380 SF	○	○	○	●	●	For thin film applications.
Lanco™ 1400 SF	●	○	○	●	○	Excellent surface feel.
Lanco™ 1410 LF	○	○	○	●	●	Good compatability in water-based systems.
Lanco™ 1955 SF	●	●			●	Good release properties. Acid value <15.
Lanco™ 2510 SF	○	●	○		○	Excellent abrasion resistance for PTFE-free formulations.
Lanco™ 2520 SF	○	●	○		○	Excellent abrasion resistance for PTFE-free formulations.
Lanco™ 2520 EF	●	●	○		○	Excellent abrasion resistance for PTFE-free formulations.
Lanco™ A 1602	○	○	●	○	●	Good sanding properties for wood coatings.
Lanco™ A 1603	○	○	○	●	●	Excellent release in can coatings.
Lanco™ Flow P 30						Degassing and wetting aid for powder coatings.
Lanco™ PE 1544 F	○	○	●		○	Very good release properties.
Lanco™ PE 1554 SF	●	●			○	Suitable for coil coatings.
Lanco™ PP 1362 D	○	●	●	○	●	Excellent multi-purpose wax.
Lanco™ PP 1362 SF	○	○	○	●	●	For thin film applications.
Lanco™ SM 2003	●	○	●	○	○	Good overall performance in wood coatings. Good degassing in powder coatings.
Pinnacle™ 2531	●	●		●	○	
PowderAdd™ 9060	○					Degassing in powder coatings.
PowderAdd™ 9062	○	○				Degassing in powder coatings.
PowderAdd™ 9421	○					Degassing in powder coatings. Suitable for low bake systems.
PowderAdd™ 9423	○					Degassing in powder coatings.

Please contact your local account manager or customer service member to find out about availability and specific properties of new grades in development.

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Novel Bio-based and BMB waxes

Product Name	Polymer Type	Bio-based %	BMB* %	Combined sustainable %	Melting Point °C	Particle Size µm
TPW-752	Mod. Rice Bran wax	100	-	100	80	≤ 8
TPW-770	Wax compound	40	30	70	~145	≤ 6
TPW-771	Wax compound	40	30	70	~145	≤ 9
TPW-772	Wax compound	60	-	60	~145	≤ 6
TPW-773	Wax compound	60	-	60	~145	≤ 9
TPW-819	Polymer	100	-	100	~250	≤ 10

* *Wax made from mass-balanced certified renewable ethylene according to REDcert² mass balance*

Balancing sustainable content for optimized performance in terms of:
Scratch resistance, Slip, Matting & Soft Feel

→ Experimental – available for sampling

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2) Removing Chemistry of Concern
-
PFAS

Circularity – Design

Creating Safer More Sustainable Chemistry

- Eliminating chemicals of concern

- Formulating “beyond compliance” through integrated regulatory monitoring & risk assessment

MAXIMIZING
OUR HANDPRINT

Enabling a safer, healthier workplace & environment

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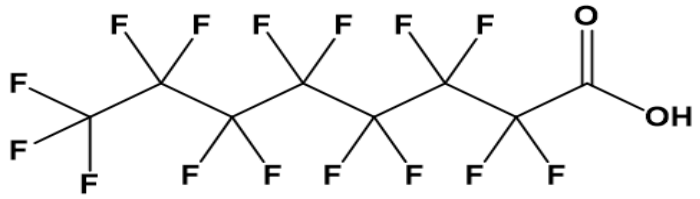
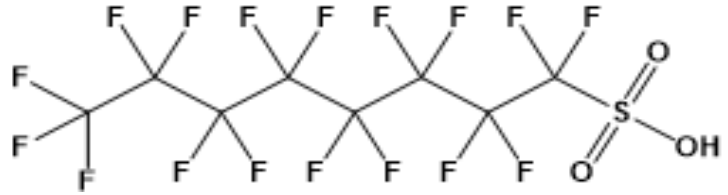
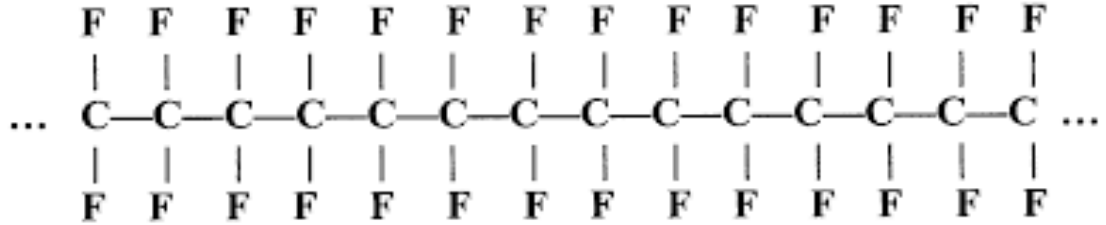
What are Per- & Polyfluoroalkyl Substances (PFAS)?

Broad term describing **9,000+ chemical substances** containing at least 1 Carbon-Fluorine bond [from small molecules to polymers]

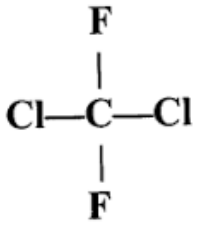




Perfluoroalkyl Substances – e.g., PFOA, PFOS



Fluoropolymers (Carbon only backbone) – e.g., PTFE



Freon 12

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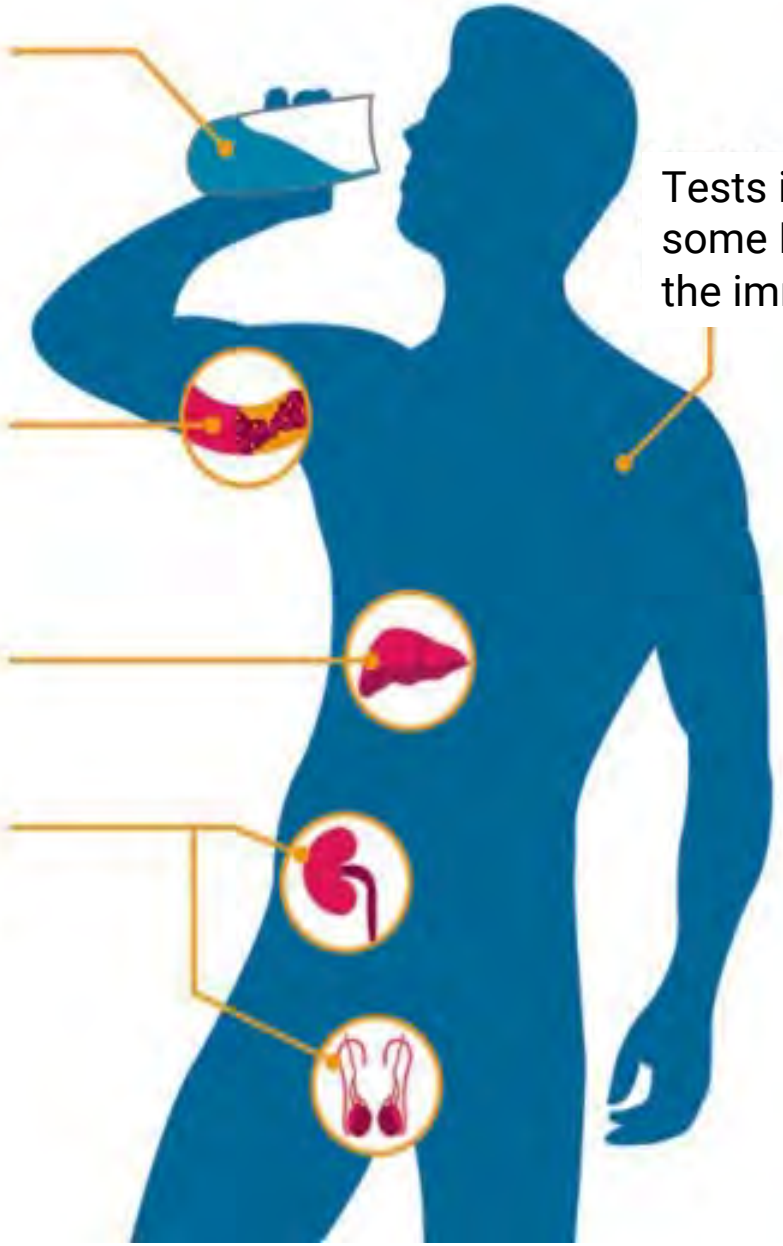
What is the concern?

Studies have shown that PFAS have contaminated rainwater, drinking water and ground water

PFAS can also be found in most people's blood and is linked to elevated cholesterol levels

Some PFAS can damage the liver

Studies show that some PFAS contribute to the development of kidney and testicular cancer



Tests indicate some PFAS weaken the immune system

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High MW PFAS ⟷ Low MW PFAS

Differentiation regarding toxicity and environmental impact

- Non-polymeric (small molecule) PFAS → Substances of Very High Concern (SVHC)
- Polymeric PFAS (Fluoropolymers like PTFE) → are typically safe
  - Fluoropolymers meeting OECD Polymer of Low Concern (PLC) criteria:
    - Non-toxic
    - Non-bio accumulative
    - Non-mobile
    - Insoluble in water
    - Thermally, chemically & biologically stable

    → Not a SVHC

    → Have a long-lasting history of safe use in the industry in many applications

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PTFE – Regulatory Situation

Short and simplified history of regulatory actions on PTFE

- **PFOA** (*Perfluorooctanoic acid*) recognized as a chemical from the group of **PFAS** (*Per and Polyfluoro Alkyl Substances*) which is toxic and known as a “forever chemical”
  - Reproductive Toxin and Suspect Carcinogen
  - Resistant to typical degradation processes in the environment
  - Extremely high persistence
- In 2017 EU published and proposed regulations on PFOA, its salts & related substances under Annex XVII of REACH
- Since July 5th, 2022 these restrictions are in place:
  - < 25 ppb for PFOA and its salts
  - < 1000 ppb (1 ppm or 1mg/kg) for one or a combination of PFOA-related substances
- Since H1 2023 same restrictions in place for the sum of C9-C14 PFCA’s and PFHxA (C6)
- In parallel the Stockholm Convention added these substances to their list of “POP’s” (persistent organic pollutants) making this nearly a global standard (ratified by ~180 countries).

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PTFE – Regulatory Situation

Industry reaction on PFOA restrictions

- PTFE manufacturers established post treatment processes to reduce PFOA to the 25 ppb level
- Increased use of PTFE grades based on feedstock which has no detectable (typically <10 ppb) PFOA
  - MW reduction by specific thermal degradation process
  - Purposeful polymerization to low MW
- Transfer to PFOA compliant PTFE is completed in EU countries
- Transfer in countries outside of EU is in different stages

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Current Landscape of PFAS Efforts

- Global actions in force today addressing specific PFAS chemicals (e.g., low MW PFAS – PFOA, PFOS, PFHxA (C6 PFCA), C9-C14 PFCA's)

- Global efforts to regulate the entire PFAS chemical group is ongoing
  - Most strict definition comprises chemistry with "at least one CF2 or CF3 moiety" (e.g., fluoropolymers like PTFE)
  - Deviations in scope emerging (e.g., UK seeks to separate fluoropolymers from other concerning PFAS)

- Legislative uncertainty exists across U.S. states around scope, definition or practicalities of enforcement.

- Voluntary transition to 'PFAS-free' chemistry expected and taking place in various countries and end use applications (e.g., can, inks, powder, metals)

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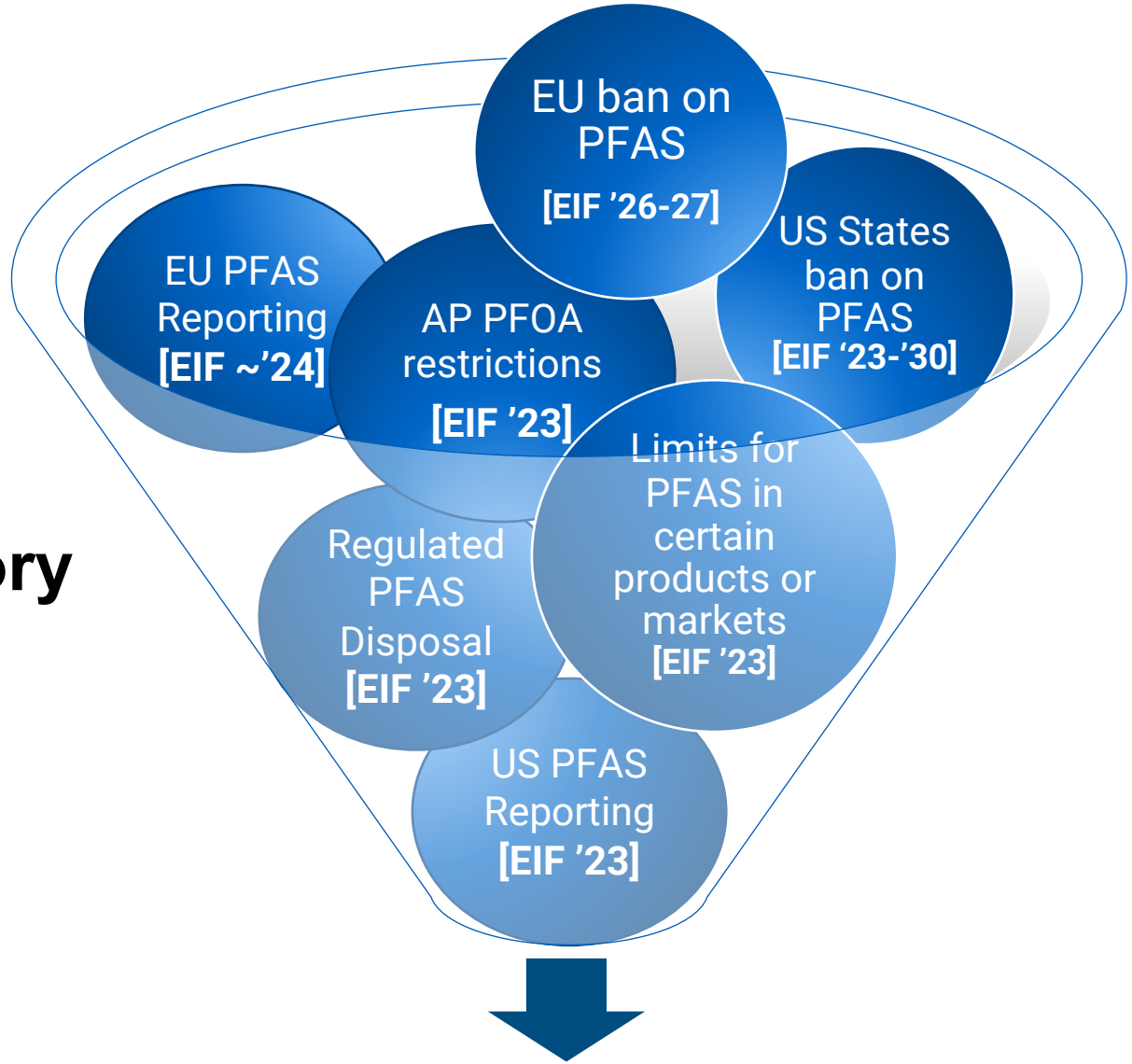
Future PFAS Regulatory Landscape 2023+

Global patchwork targeting entire PFAS family

EIF = Entry into Force



Potential broad (EU & US) Phase-Out of PFAS in many applications

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Global Impact

- Withdrawals of certain PTFE raw materials
- Price increases
- Potential shortages
- Shifting from PTFE containing additives

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Lubrizol PTFE-Alternatives in Coatings

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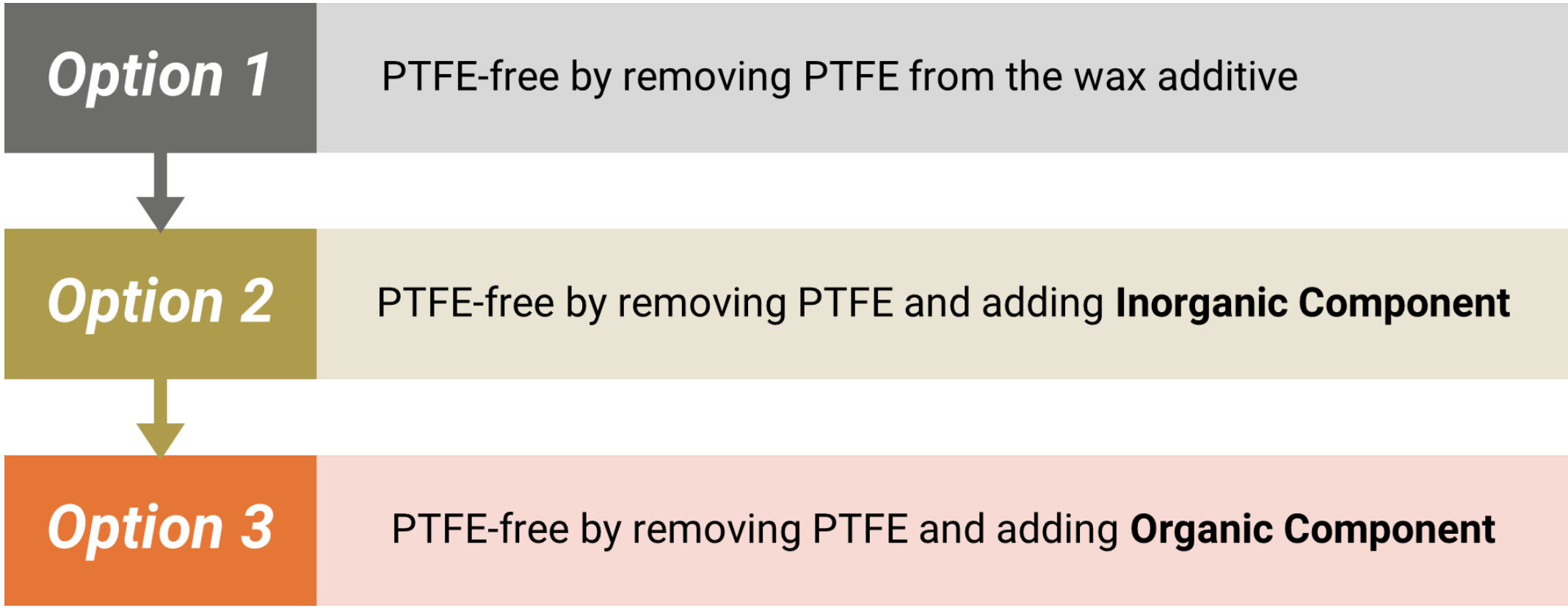
General Options for Preparing PTFE-free Surface Modifiers



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PTFE-free alternative products

Micronized Waxes

Product Name	Polymer Type	Particle Size Dv50 (µm)	Melting Point °C
Lanco™ 1510 SF	Modified polyolefin wax	≤ 6	106
Lanco™ 1510 EF	Modified polyolefin wax	≤ 5	106
Lanco™ 2510 SF	Inorganically modified polyolefin wax	≤ 6	105
Lanco™ 2520 SF	Inorganically modified polyolefin wax	≤ 6	105
Lanco™ 2520 EF	Inorganically modified polyolefin wax	≤ 5	105
Lanco™ 2530 EF	Organically modified polyolefin wax	≤ 6	116
Lanco™ 2540 SF	Modified polyolefin wax	≤ 6	128
Lanco™ 2540 EF	Modified polyolefin wax	≤ 5.2	128
Lanco™ 2541 SF	Modified polyolefin wax	≤ 6	144

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PTFE-free alternative products

Wax Dispersions

Product Name	Polymer Type	Solvent	Particle size Dv50 (µm)	Melting point °C
Lanco™ Glidd 6635	Wax combination	Water, BG	≤ 6	128
Lanco™ Glidd 6692	Wax combination	Water, BG (<30%)	≤ 3	106
Lanco™ Glidd 7605	Inorganically modified polyolefin wax	Aromatic 100, BG (<30%)	≤ 5	105
Lanco™ Glidd 7607	Inorganically modified polyolefin wax	Water, BG (<30%)	≤ 6	105
Lanco™ Glidd 7610	Inorganically mod. carnauba wax	BG	≤ 3.5	82
Lanco™ Glidd 7612	Inorganically mod. polyolefin wax	Water, BG	≤ 6	106
Lanco™ Glidd 7678	Modified polyolefin wax	BG	≤ 3.5	106
Lanco™ Glidd 7686	Wax combination	Water, BG (<30%)	≤ 6	128
Lanco™ Glidd 7721*	Organically modified polyolefin wax	Methoxy propanol	≤ 6	116

*not fully commercial, yet

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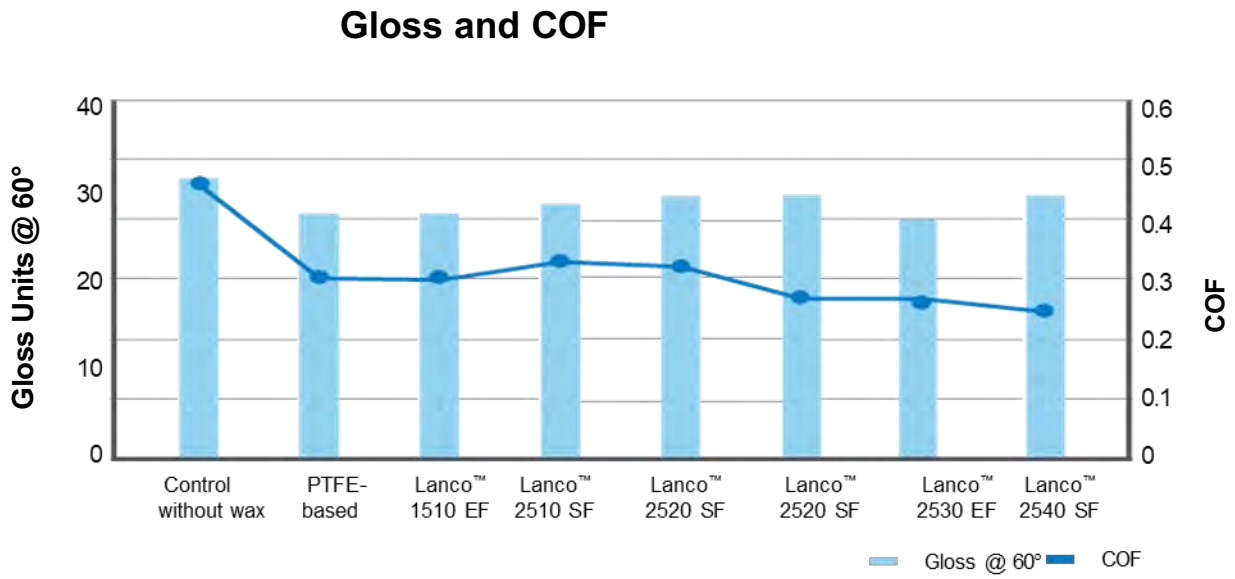
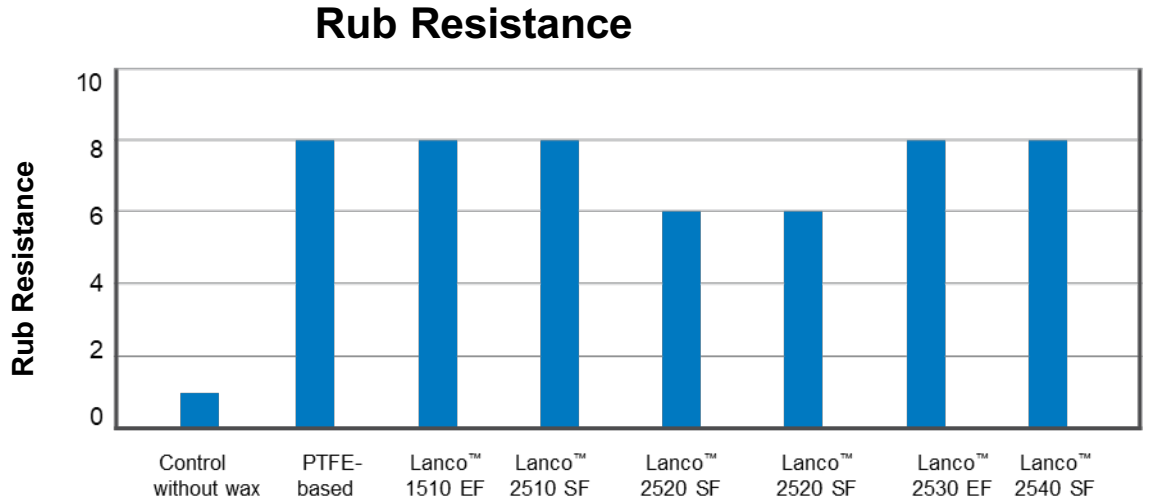
Product Performance – Printing Inks

Performance Data in Water Based Ink Acrylate Resin

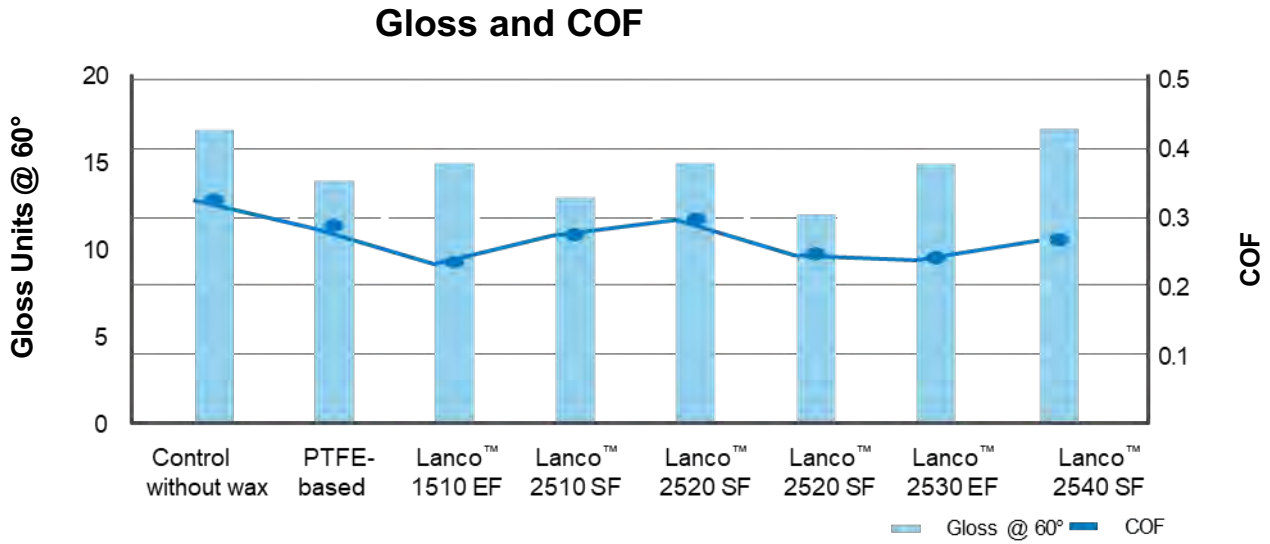


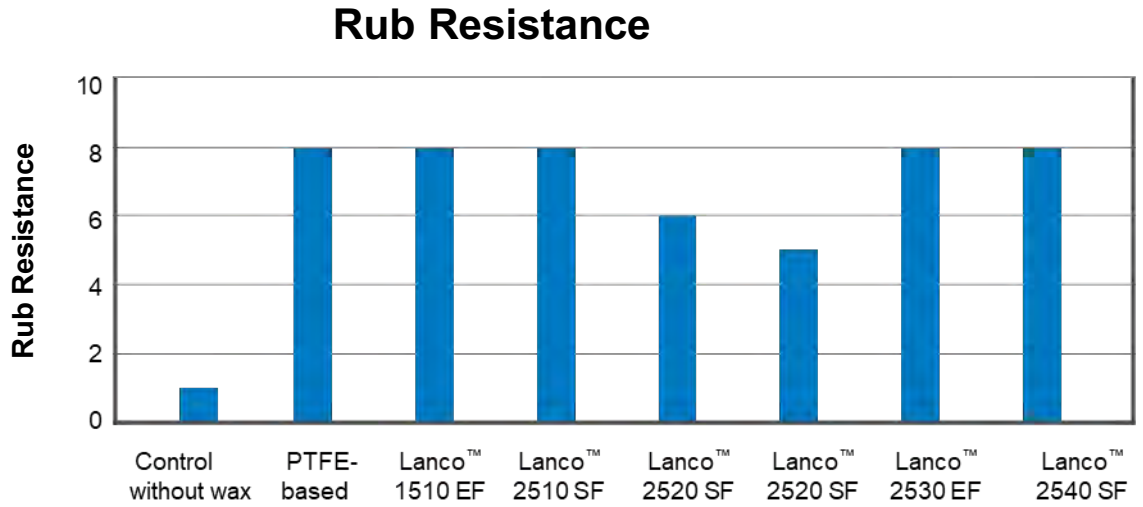


10=excellent; 0=very poor

2% active content, application on Leneta paper 3NT-31 backside, drying time 24h.

Performance Data in Solvent Based Ink NC Resin





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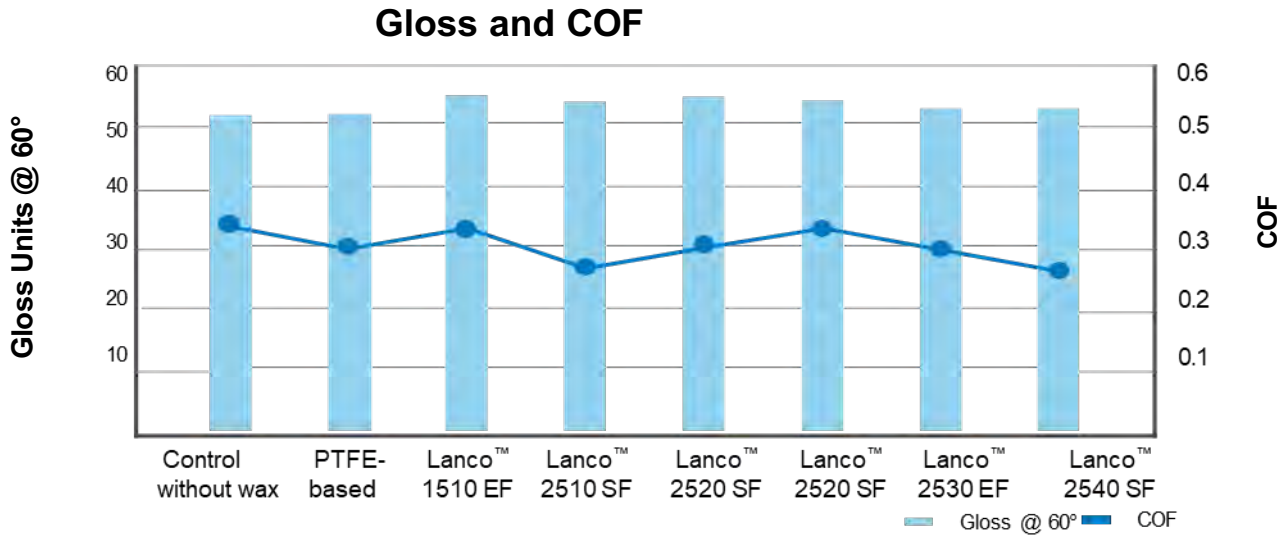
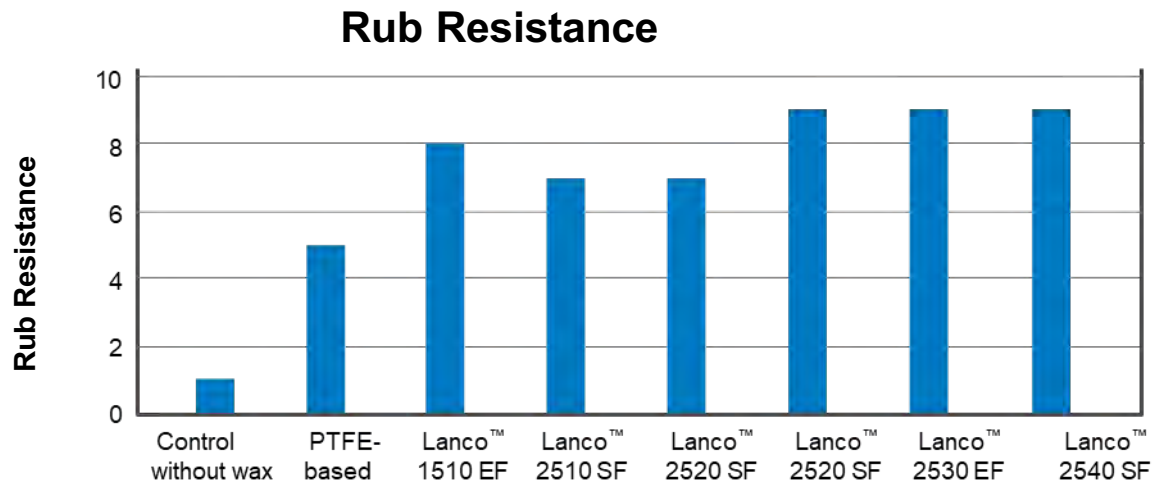
2% active content, application on Leneta paper 3NT-31 backside, drying time 24h.

Performance Data in UV Ink 100% Acrylate Resin

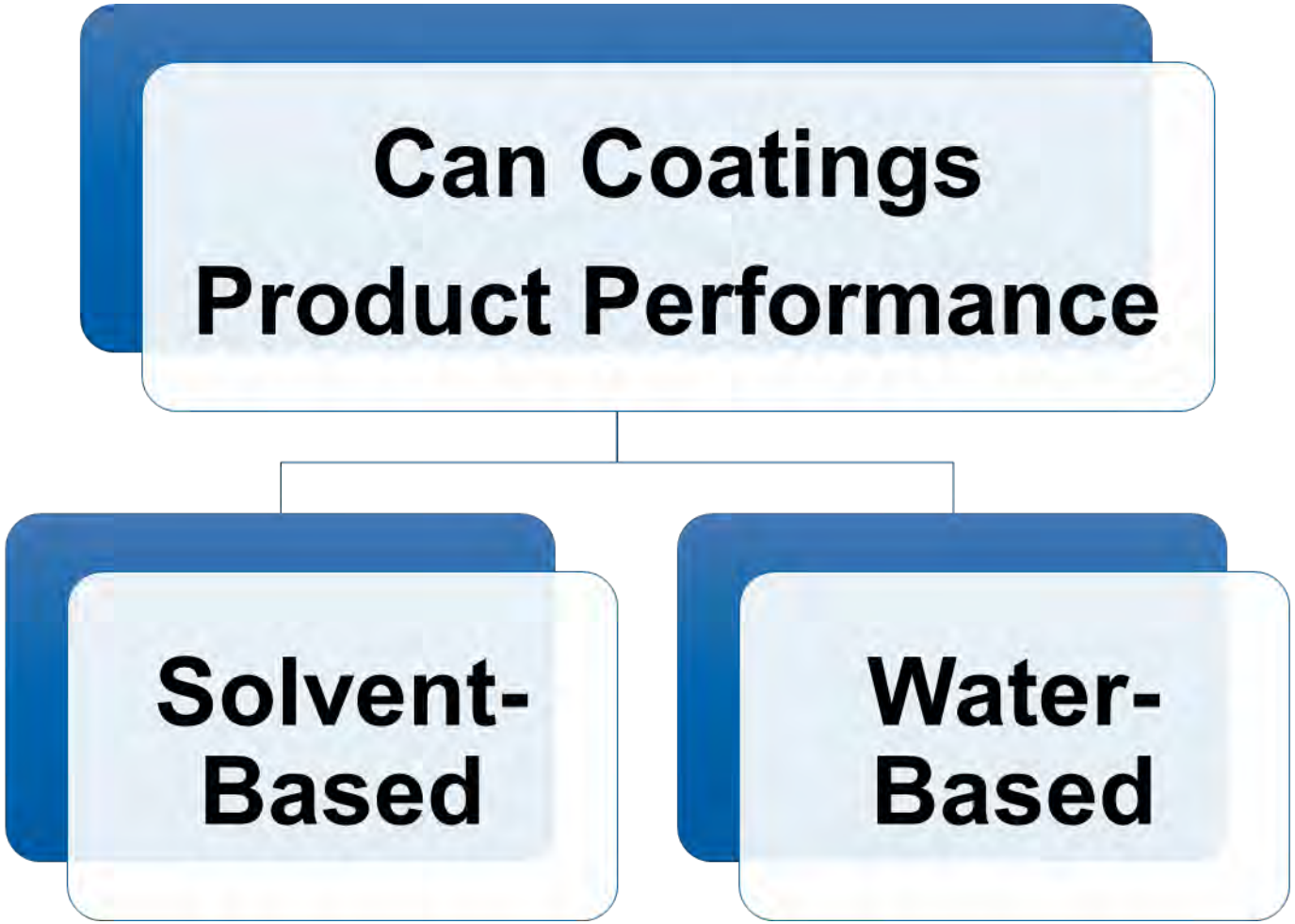




10=excellent; 0=very poor

2% active content, application on Leneta paper 3NT-31 backside, radiation drying.

Product Performance – Can Coatings



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Test Systems

PTFE-FREE ALTERNATIVES

Solvent-Based Polyester Phenolic Gold Lacquer, BPA-NI*

0.5 % active content, 20µm wet film thickness on tin plate, curing conditions 10 min @ 200°C.

* Bisphenol-A not intentionally added to the composition of this product.

Water-Based Epoxy Phenolic Melamine Gold Lacquer

0.5 % active content, 20µm wet film thickness on tin plate, curing conditions 12 min @ 200°C.

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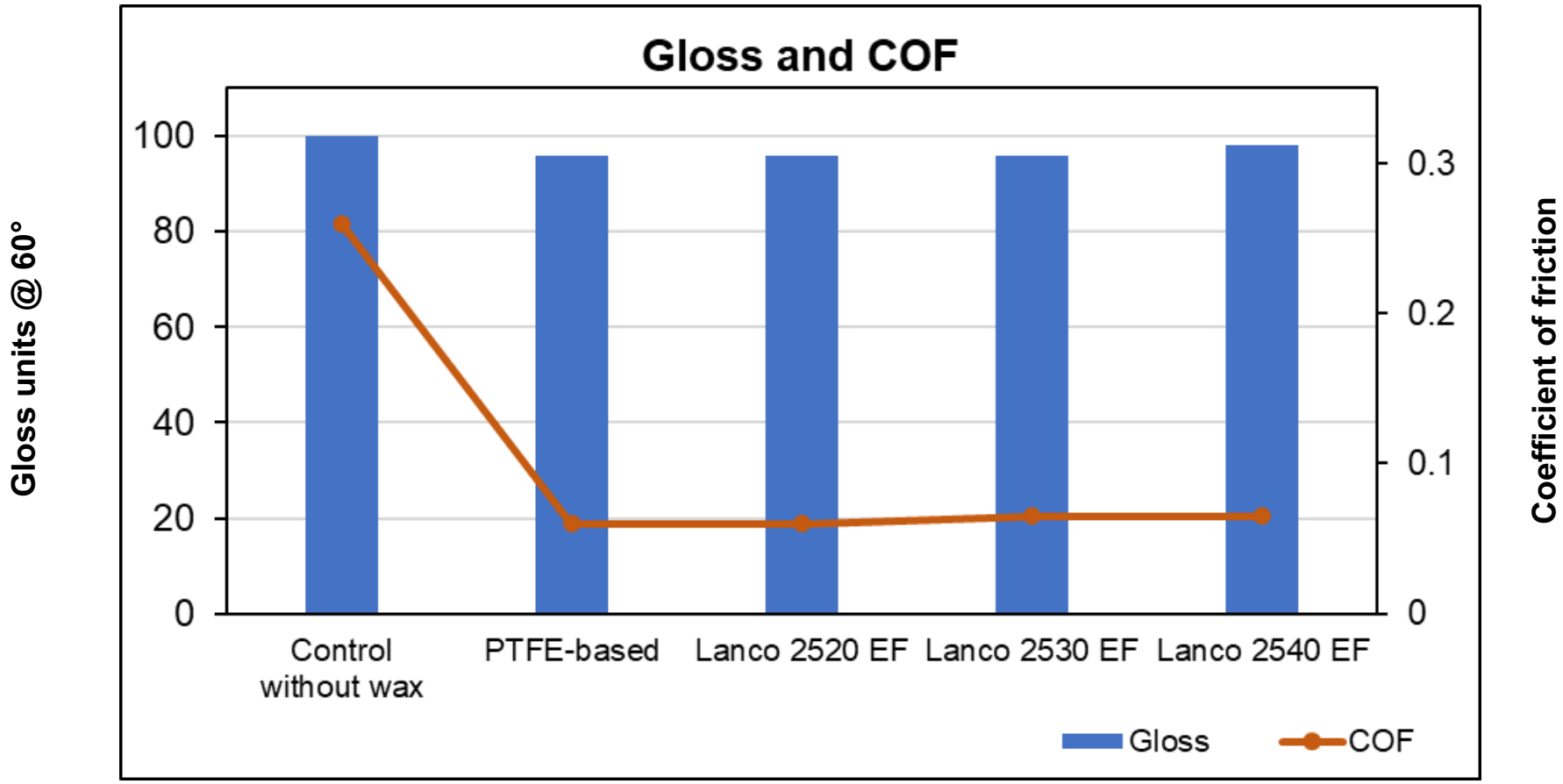
Solvent Based Can Coatings

Performance – SB Polyester Phenolic Gold Lacquer



0.5 % active content, 20µm wet film thickness on tin plate, curing conditions 10 min @ 200°C

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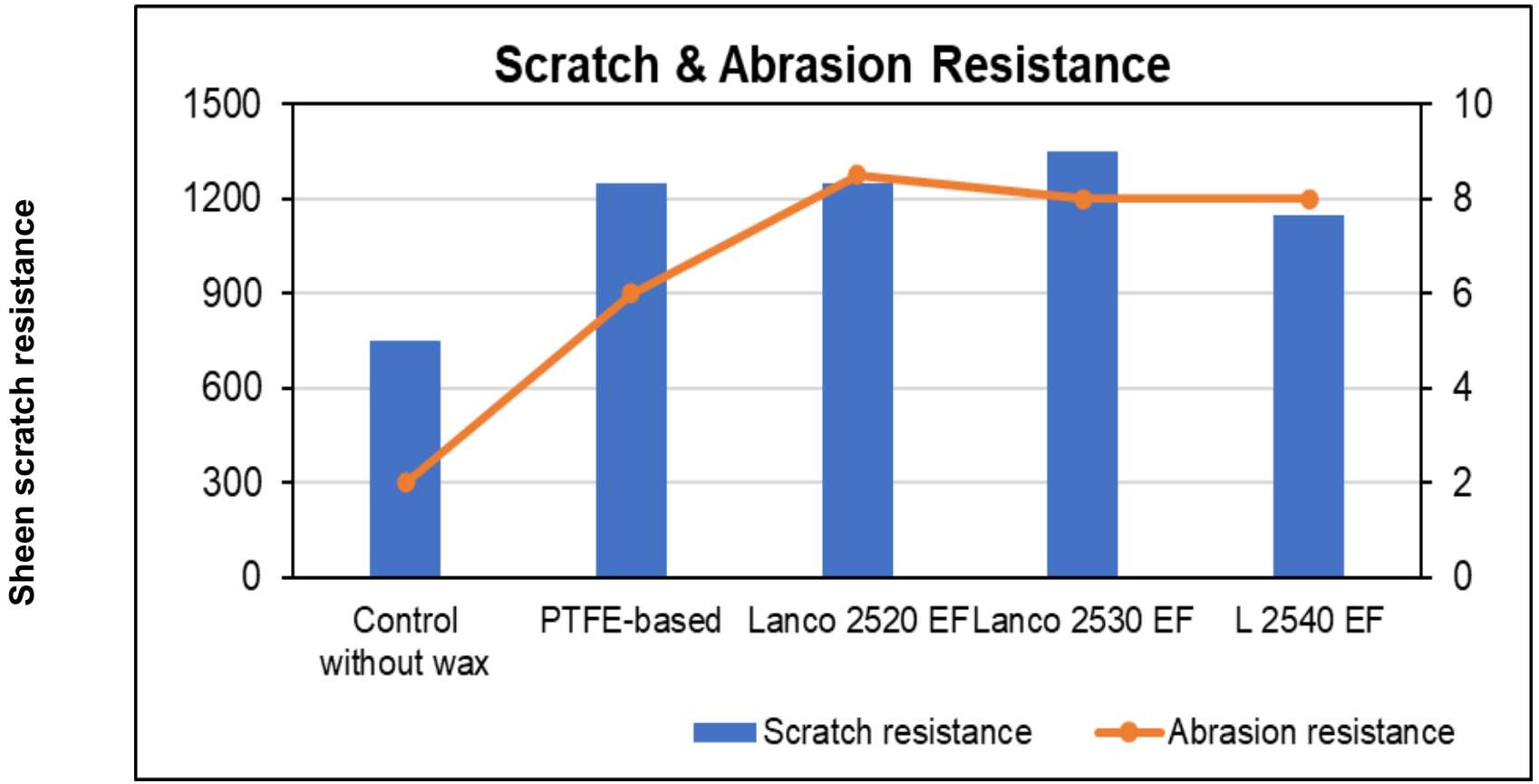
Performance – SB Polyester Phenolic Gold Lacquer



10=excellent; 0=very poor

0.5 % active content, 20µm wet film thickness on tin plate, curing conditions 10 min @ 200°C

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Water Based Can Coatings

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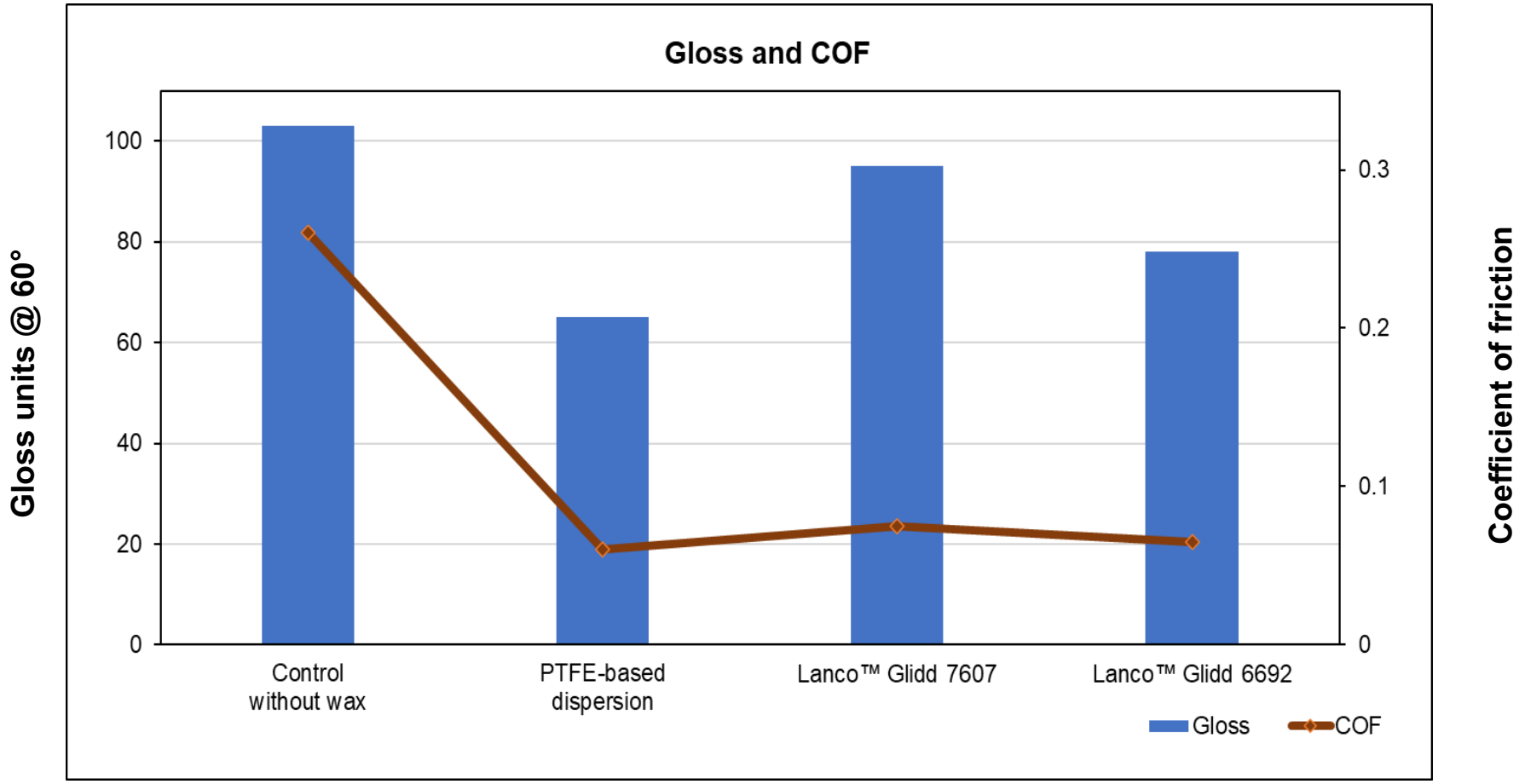
Performance – WB Epoxy Phenolic Melamine Gold Lacquer



0.5 % active content, 20µm wet film thickness on tin plate, curing conditions 12 min @ 200°C

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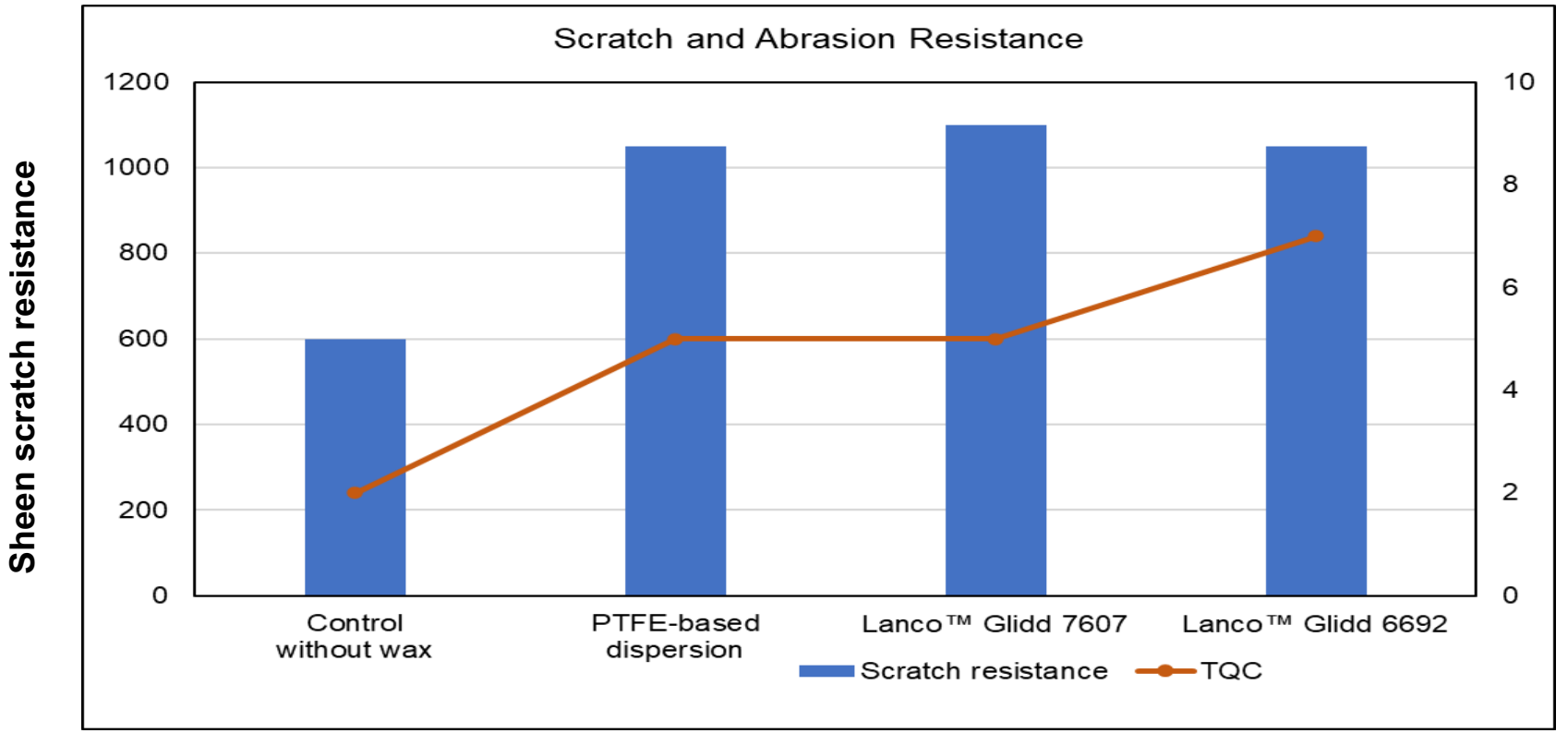

10=excellent; 0=very poor

0.5 % active content, 20µm wet film thickness on tin plate, curing conditions 12 min @ 200°C

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Thank you!

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