Coatings Trends & Technologies SUMMIT

Improving Durability in Alkyd Coatings with Novel Catalyst Technology

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Agenda

- Alkyd Coatings Overview
- High-Performance Catalyst (HPC) Introduction
- Application Data & Formulation Examples
- Summary & Questions

PERFORMANCE BENEFITS OF ALKYD RESINS

- Bio-renewable
- Provide relatively hard films
- Stable with long shelf lives
- Cost effective
- Good stain block properties

CAN BE USED ACROSS A VARIETY OF APPLICATIONS

Architectural

Wood

Industrial

CATALYSTS AND DRIERS IN ALKYD FORMULATIONS

- **Alkyd-based coatings cure via oxidative drying**
  - Occurs when certain unsaturated film formers crosslink in the presence of atmospheric oxygen
- **To accelerate this process, either traditional driers or high-performance catalysts (HPCs) are used**
- **With the appropriate catalyst selection, it is possible to positively impact crucial properties**
  - Examples: durability, weatherability, hardness, and corrosion protection

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Paint Durability

- Epoxies
- 2K PU Paints

Expensive / Complex Formulas

- Alkyds

Cost Effective/ Straightforward Formulas

Paint Durability

Important parameters:

- ✓ Hardness
- ✓ Resistance to discoloration
- ✓ Improved impact resistance
- ✓ Gloss retention
- ✓ Corrosion resistance
- ✓ Adhesion
- ✓ Chemical/Stain resistance
- ✓ Washability/Scrubability

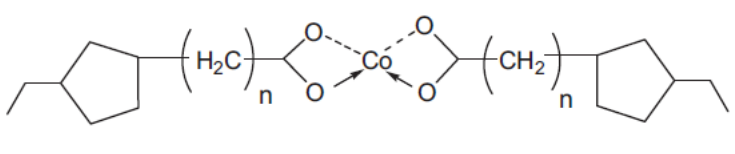
ALKYD PRIMARY CATALYST CHOICE

Traditional Cobalt Drier

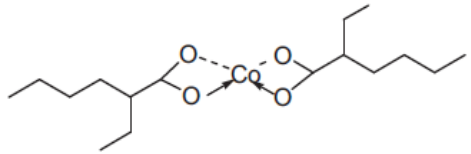
- Widely known and commonly used
- × Classified as a 1b human carcinogen
- × Some cobalt mining linked with human rights abuse
- × Unstable pricing and availability due to use in batteries

Novel Catalyst Technology, High-Performance Catalyst (HPC)

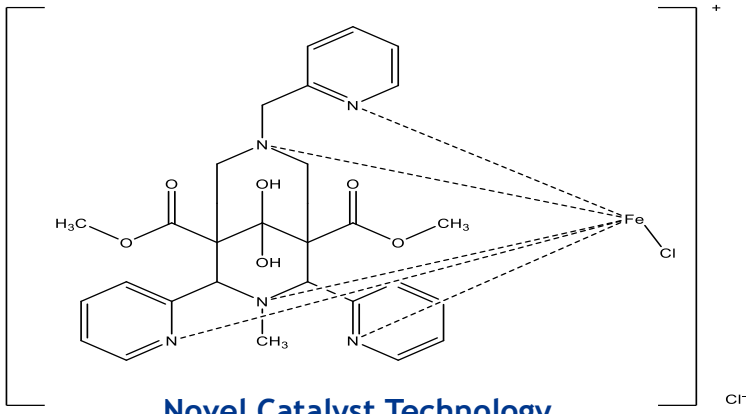
- New patented technology with growing adoption
- ✓ No risk to human health
  - Cobalt-free, CMR-Free, APEO-Free
- ✓ Higher performance potential
- ✓ Stable pricing and availability



Cobalt naphthenate



Cobalt octoate



Novel Catalyst Technology

HIGH-PERFORMANCE CATALYST (HPC) BENEFITS

- Quicker dry times
- Excellent performance in adverse conditions
- Better color initially and non-yellowing over time
- Better adhesion
- Improved corrosion resistance
- Better gloss retention
- and more!

Application Data

SYSTEMS EVALUATED

•General Industrial

- **Primer** - Short oil alkyd
- **Direct-to-Metal (DTM), Do-it-Yourself (DIY) Paint** – Modified, medium oil

Architectural (Decorative)

- **Trim Paint** - Long oil alkyd

EVALUATIONS INCLUDED IN THE STUDY

•Drying Times

- Drawdowns applied on Mylar sheets
- Drying time measured with Circular Drying Recorders
- ASTM D 5895

•Hardness

- Drawdowns on glass plates (150 × 90 × 3 mm)
- König hardness according to ASTM D 4366 after up to 14 days

•Corrosion Resistance and Gloss

- Drawdowns on steel panels (Q-Lab, smooth finish, 305 × 152 × 0.5 mm), edges and rear side masked, cross scribed in the lower part
- Q-FOG corrosion tester run according to ASTM B117 up to 1000 hours
- Gloss measured according to ASTM D 523

•Color

- Applied using a bar or frame applicator to clear Mylar sheets
- Measured L*a*b* values over black using X-Rite Color Spectrometer

General Industrial Coatings

LIGHT INDUSTRIAL PRIMER

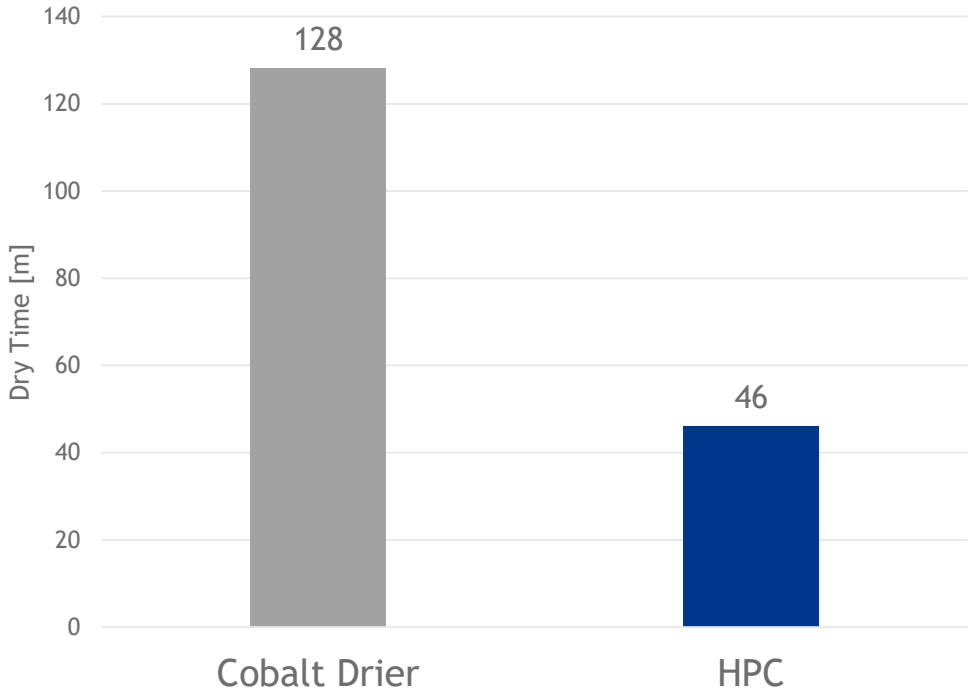
- Short oil alkyd, linseed & tung oil type
- Pigmented system (anti-corrosive pigments)
- 14.95% resin solids in the paint
- Solvent borne, DTM, WFT 150 µm

Cobalt- and Anti-skin-free

Ingredient	Cobalt Drier	HPC
Alkyd Primer	100.00	100.00
Polymeric Cobalt	0.270	—
15% Zirconium	0.797	—
8% Manganese	0.360	—
MEKO	0.400	—
High-Performance Catalyst (HPC)	—	**0.075**
Total	101.826	100.075

No anti-skin or secondary driers

Faster Drying Times with HPC



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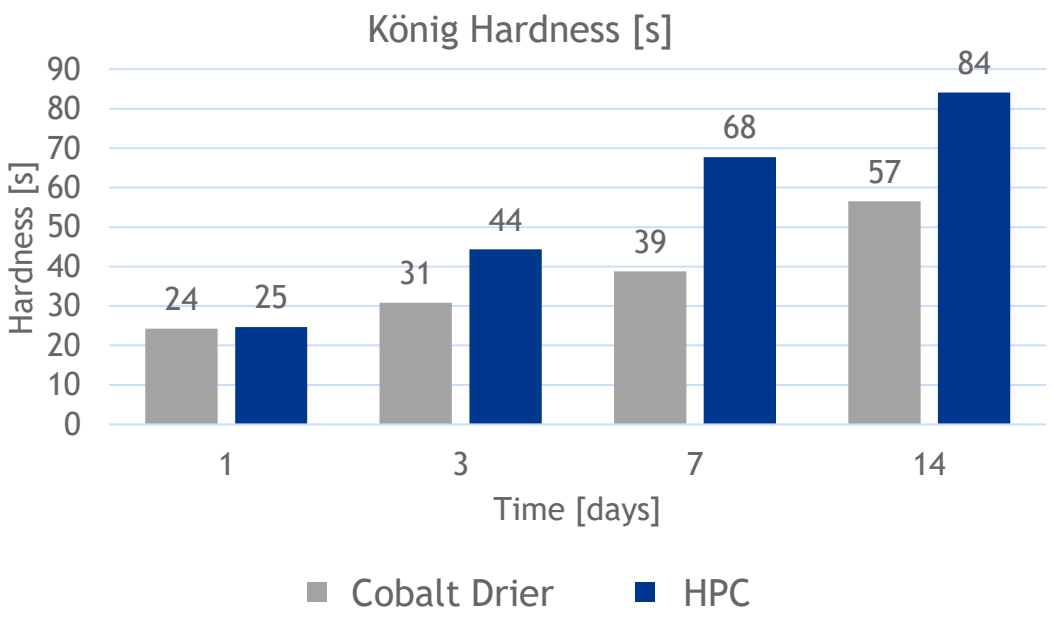
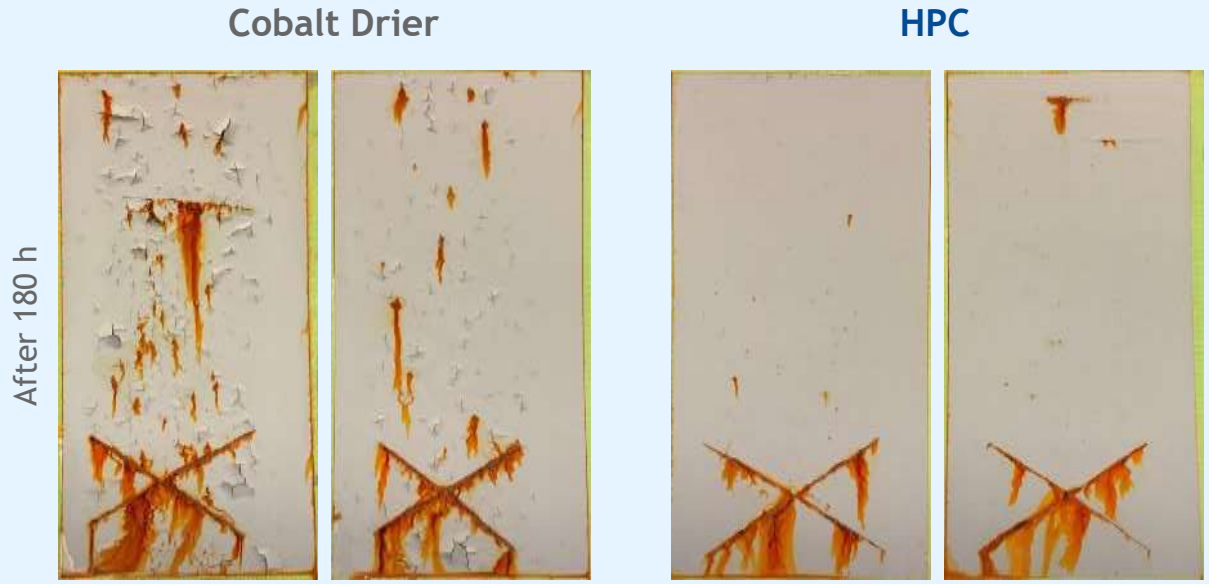
LIGHT INDUSTRIAL PRIMER

Higher Hardness with HPC



Product with a matte finish - **Gloss was not measured during corrosion exposure**

Significantly Improved Corrosion Resistance with HPC



Corrosion panels after 180 h in Q-Fog

x **Cobalt drier sample is heavily corroded, the coating is delaminating, and there is no adhesion to metal**

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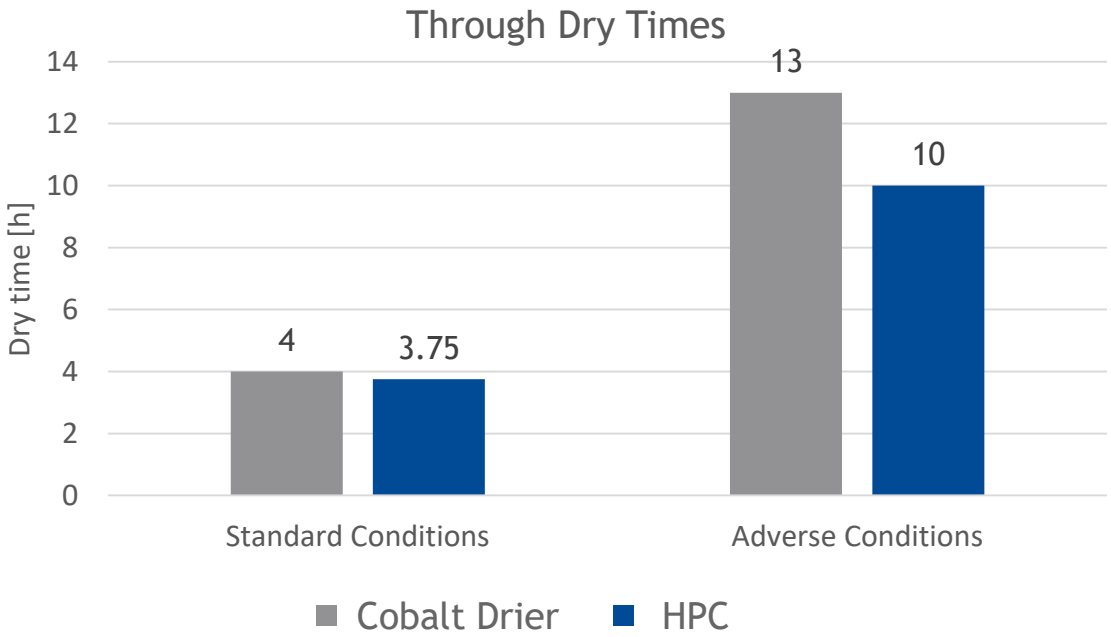
LIGHT INDUSTRIAL - DTM, DIY

- Medium oil alkyd, soybean oil w/ urethane modification
- Pigmented system
- 35.10% resin solids in the paint
- Solvent borne, DTM, WFT 75 µm

Cobalt-free

Ingredient	Cobalt Drier	HPC
Alkyd Paint	100.00	100.00
12% Cobalt	0.23	–
24% Zirconium	0.33	0.73
10% Calcium	0.45	0.45
MEKO	0.30	0.50
High-Performance Catalyst (HPC)	–	**0.35**
Total	101.31	102.03

HPC Provides Comparable Dry Times to Cobalt



Adverse Conditions 10°C 80%

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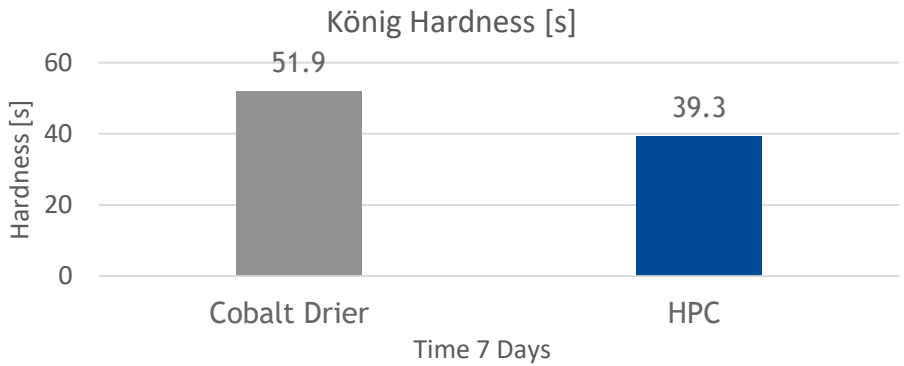
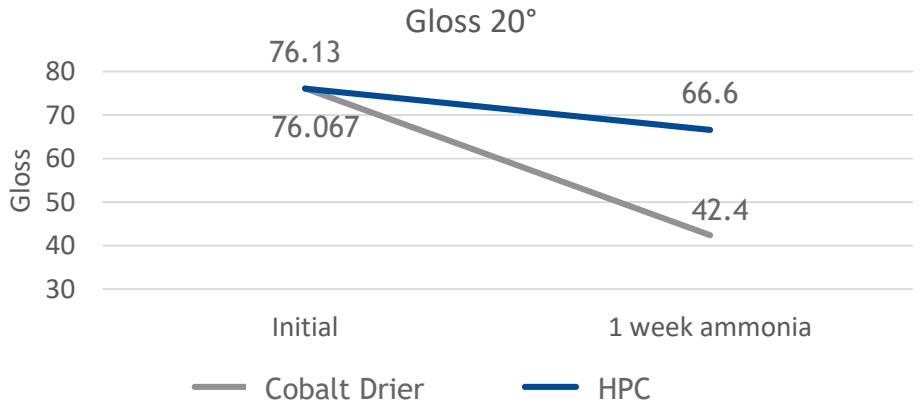
LIGHT INDUSTRIAL - DTM, DIY

Lower hardness with HPC

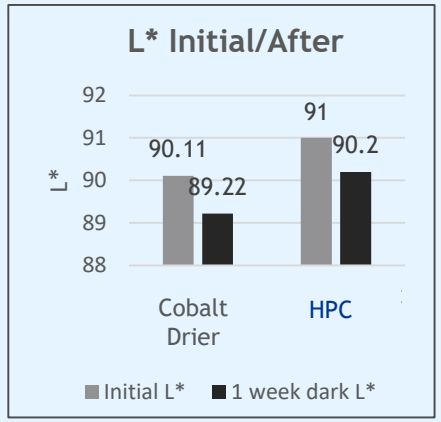


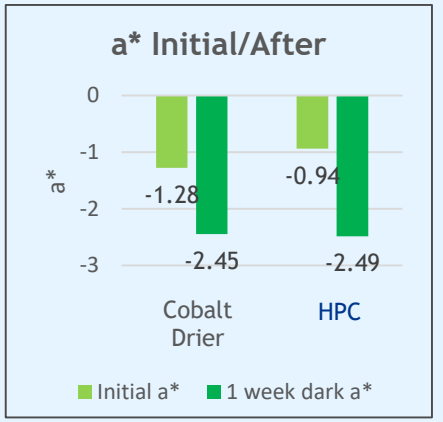
Improved Gloss Retention with HPC

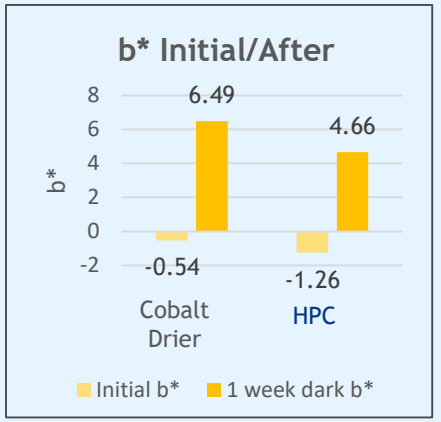


Non-Yellowing Over Dark Aging with HPC

1 week dark aged w/ ammonia







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LIGHT INDUSTRIAL - DTM, DIY

Improved Corrosion Resistance with HPC

Cobalt Drier

HPC

Corrosion panels after 500 h in Q-Fog

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Architectural Coatings

Why are ***Q-FOG salt spray*** and ***adhesion*** tests important test parameters for decorative paints and varnishes?

- Decorative paints are often used for a wide variety of substrates
- For example, when wood is varnished, metallic fittings and nails on the substrate are also varnished
- These metallic surfaces can rust if they are not properly protected

SOLVENT BORNE HIGH GLOSS TRIM PAINT FOR DECORATIVE APPLICATIONS

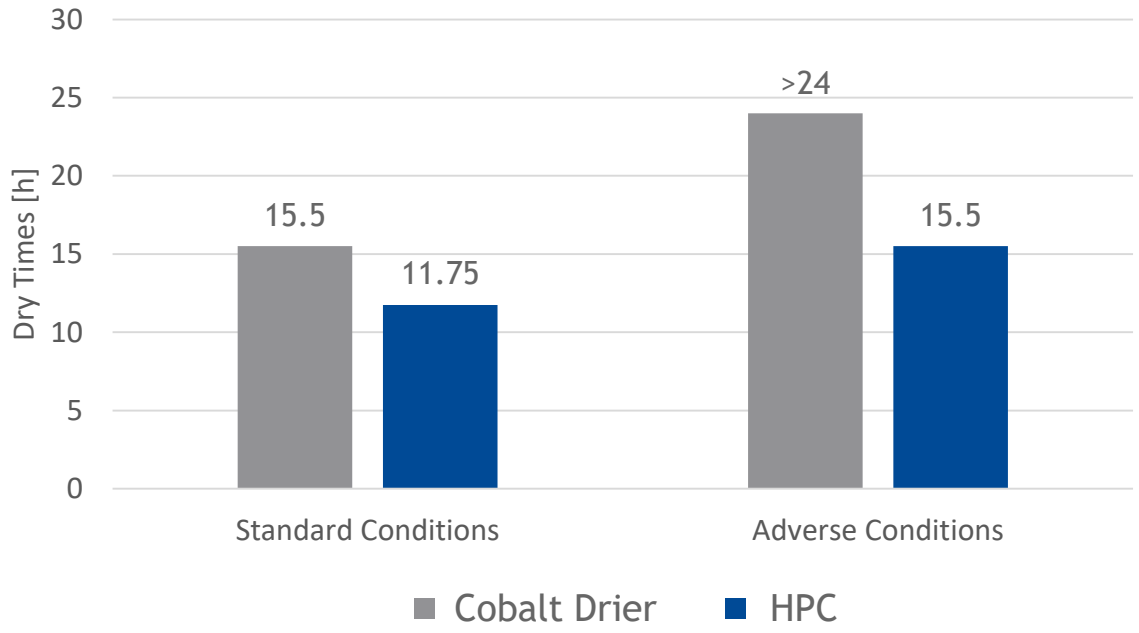
- Long oil, linoleic rich alkyd (tall oil fatty acid)
- 46% resin solids in the paint
- Substrate: Wood & Metal, WFT 100 µm

Cobalt- and MEKO-free

Ingredient	Cobalt Drier	HPC
Alkyd Paint	100	100
15% Co/Zr Blend	0.46	—
MEKO	0.30	—
High-Performance Catalyst (HPC)	—	**0.45**
Octa-Soligen® Calcium 10, basic	0.96	**0.96**
MEKO-free Anti-Skin	—	**1.00**
Total	101.72	102.41

Faster Dry Times with HPC

Through Dry Times



Adverse Conditions 10°C 80%

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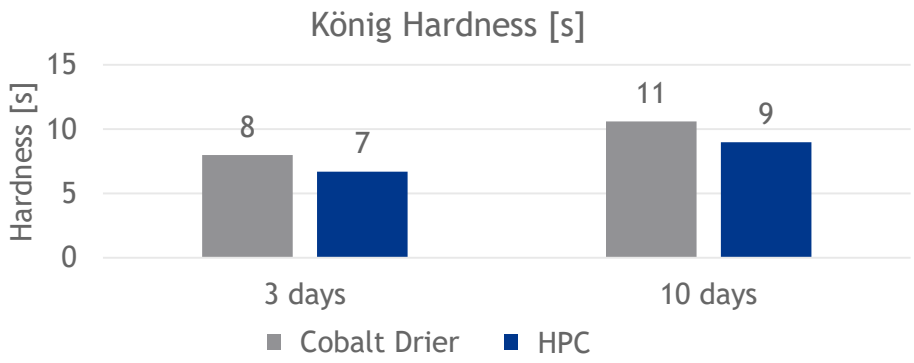
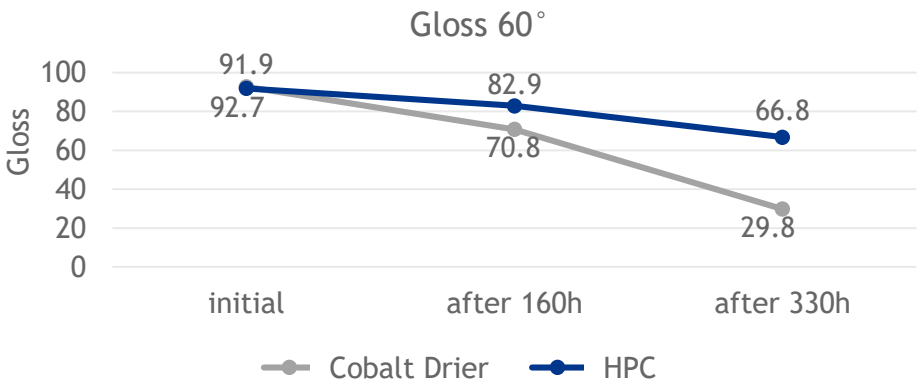
SOLVENT BORNE HIGH GLOSS TRIM PAINT FOR DECORATIVE APPLICATIONS

Comparable Hardness



Improved Gloss Retention with HPC



Significantly Improved Corrosion Resistance and Adhesion with HPC

Wet cross-hatch rating (after 300 hrs Q-FOG)
Corrosion panels after 330 h in Q-Fog

× **Cobalt drier samples were fully corroded and had a general loss of adhesion**

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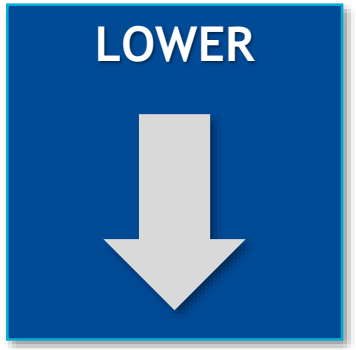
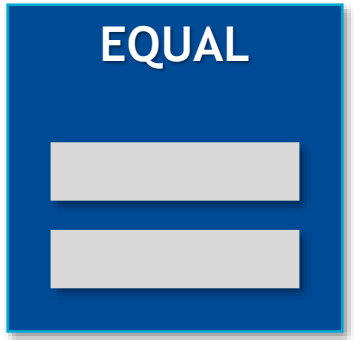
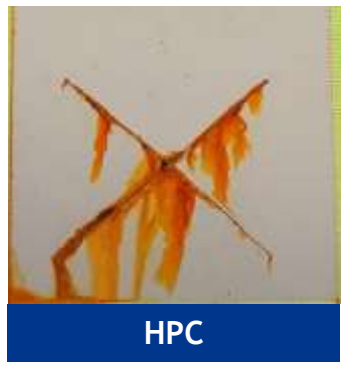
CORROSION RESISTANCE

When utilizing High-Performance Catalysts (HPCs), even when the **FINAL HARDNESS** is…





… **PAINT DURABILITY** is still improved:



By switching out traditional driers with High-Performance Catalysts (HPCs), it is possible to enhance durability in cost-effective alkyd paints

HPCs provide:

- ✓ Quicker dry performance
- ✓ Improved corrosion resistance
- ✓ Improved adhesion
- ✓ Better gloss retention
- ✓ Non-yellowing over aging
- ✓ No need for changing the resin system
- ✓ Alternative for expensive 2K PU and Epoxy systems

Sustainable formulations:

- Cobalt-free
- MEKO-free
- Bio-renewable

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