Substance for Success.

Lehet-e nedvesitö-és diszpergáló-szerekkel a festékek tartósságát javítani ?

Can Wetting and Dispersing Additives Improve the Durability of Coatings ?

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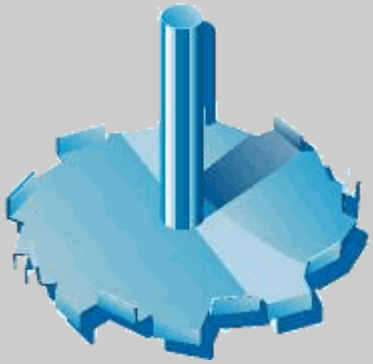
Wetting and Dispersing Process

1

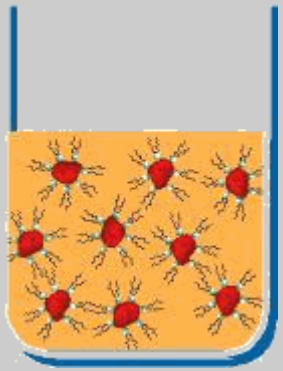
Wetting

2



Dispersing

3



Stabilizing

Impact of Wetting and Dispersing Additives on Durability-related Properties

- Gloss retention of topcoats
- Homogeneous distribution of pigments and fillers
- Synergistic interaction with anti-corrosive pigments
- More hydrophobic or hydrophilic film
- Adhesion to substrate
- Anti-corrosion performance

Titanium Dioxide for Coatings

Rutile type, high purity TiO_2

Primary particle size 0.25-0.3 µm

Surface treatment: to improve durability and dispersibility, handling…

- Inorganic: Alumina, silica, zirconia...
- Organic: TMP, NPG, surfactants, silicones...

Negative Side Effects by Using Additives to Disperse Titanium Dioxide

Side effects are rare due to low dosage level (~ 2 %)

Most common negative side effects:

- Cationic additives can be limited in epoxy systems and in acid catalyzed coatings
- Very polar structures (non-ionic wetting agents) may cause worse humidity and water resistance

Can Additives Improve Gloss Retention of Coatings with Titanium Dioxide ?

Gloss retention in high gloss topcoats can be gradually improved by using selected additive chemistries (organic phosphates).

This statement has been confirmed since 1996 by many coating companies, and TiO_2 manufacturers use in recent titanium dioxide developments organic phosphates as part of the organic treatment !

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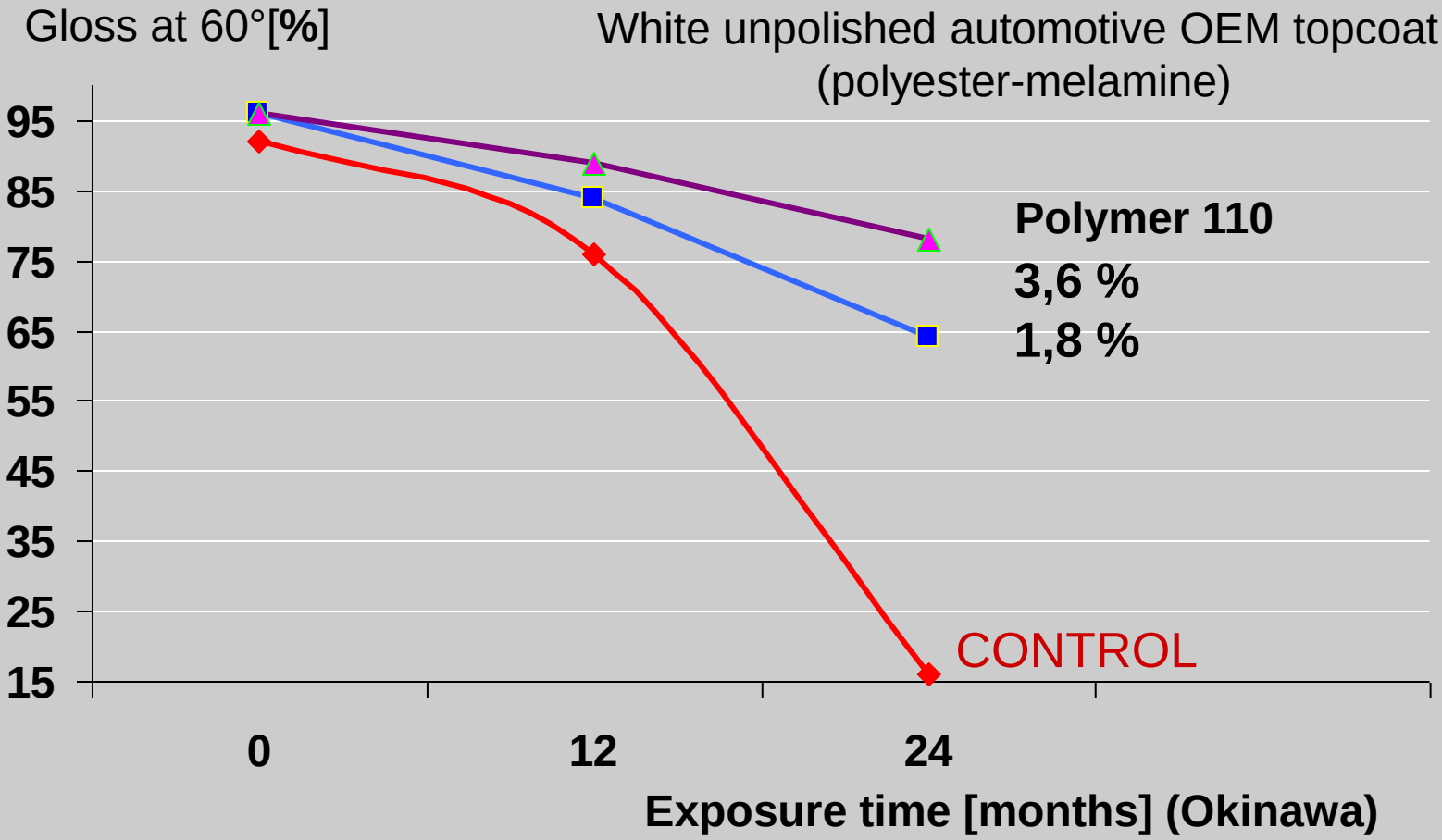
Can Additives Improve Gloss Retention ?



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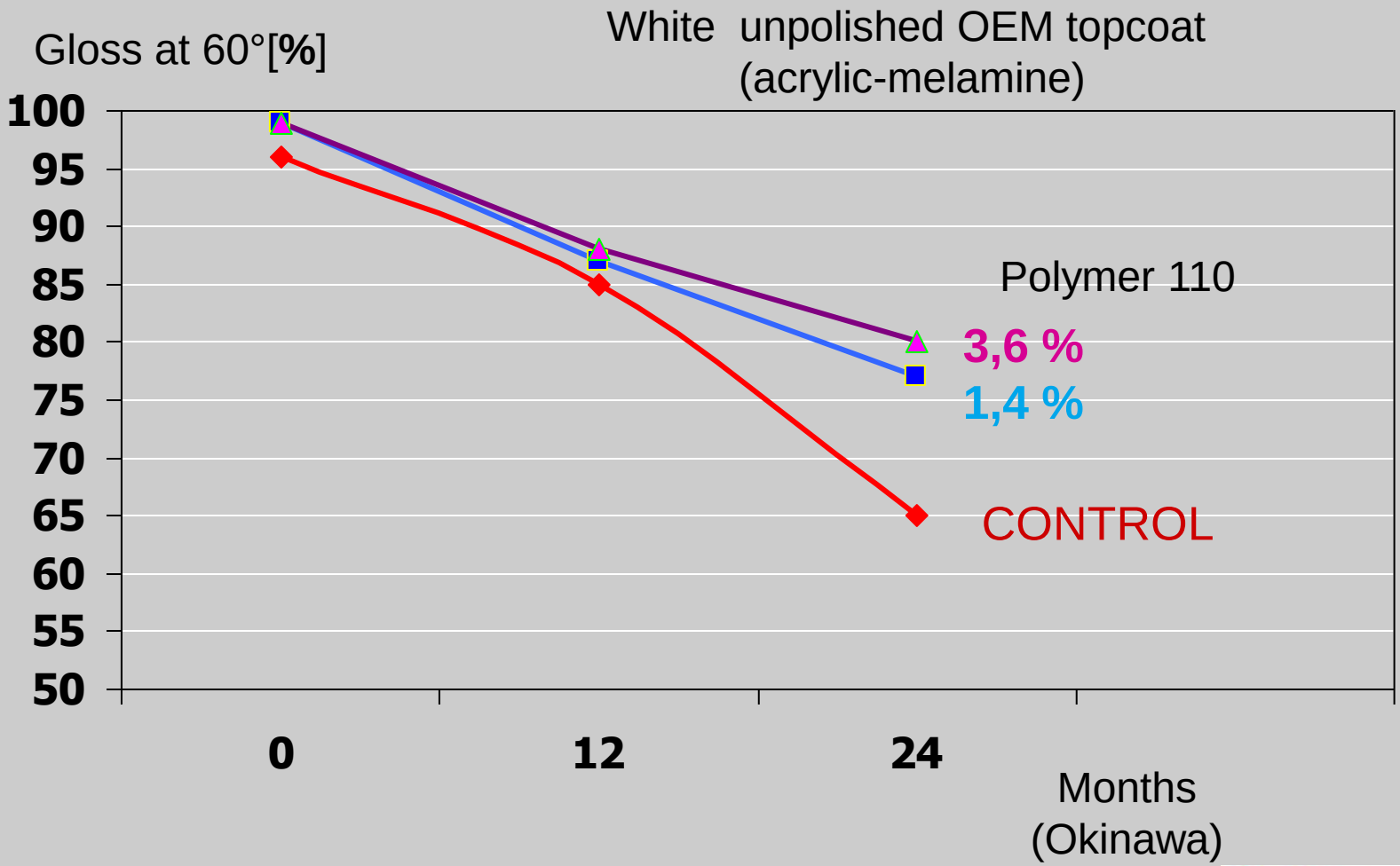
Do Additives Improve Gloss Retention ?



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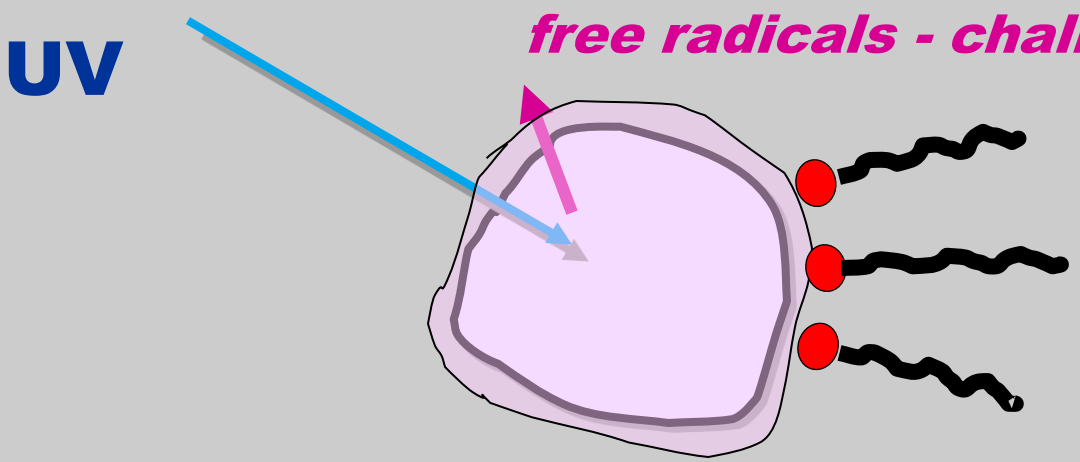
Why Do Phosphates Improve Gloss Retention ?

1. Better deflocculation of TiO_2 provides more UV protection to the resin matrix

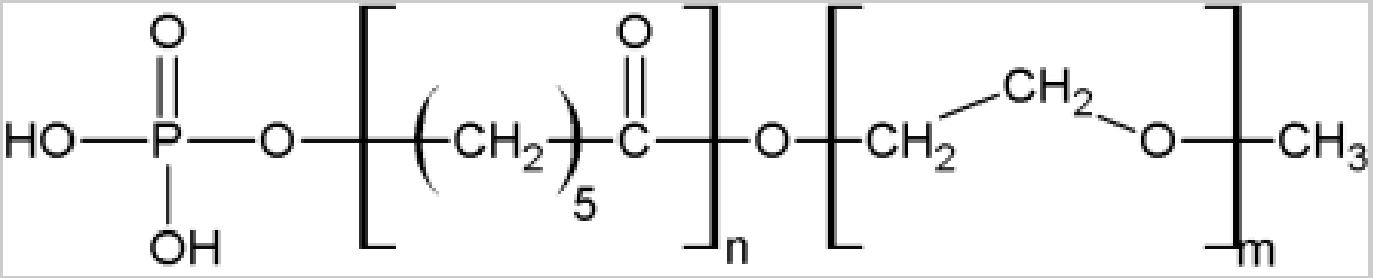
2. Phosphate functional wetting agents provide additional protection against free radicals



Suitable structures capture free radicals -
- less chalking

Structure of Phosphate Type Wetting and Dispersing Additives

(Acidic phosphoric acid monoester)



Phosphate | **Polyester tail** | **Polyether tail**

UV-induced Chalking in White Topcoats

UV light causes chalking in presence of water and oxygen near the TiO_2 surface by oxidation of the organic binder
Proposed mechanism [Du Pont et.al.]:

$$H_2O + O_2 \xrightarrow{UV,\ TiO_2} OH^* + HO_2^*$$

$$OH^* + HO_2^* + -(CH_2)- \longrightarrow CO_2 + H_2O$$

Conclusion: Gloss Retention in Topcoats Can Be Improved !

1. Phosphate based polymeric dispersants may significantly improve gloss retention in TiO_2 pigmented topcoats
2. Strongest effects can be achieved in alkyd/melamine, polyester/melamine and in two-pack PU binders
3. In highly durable acrylic/melamine and fluorinated binders the effect is less pronounced (gloss improvement of 10-15 % after 2 years) but still measurable !

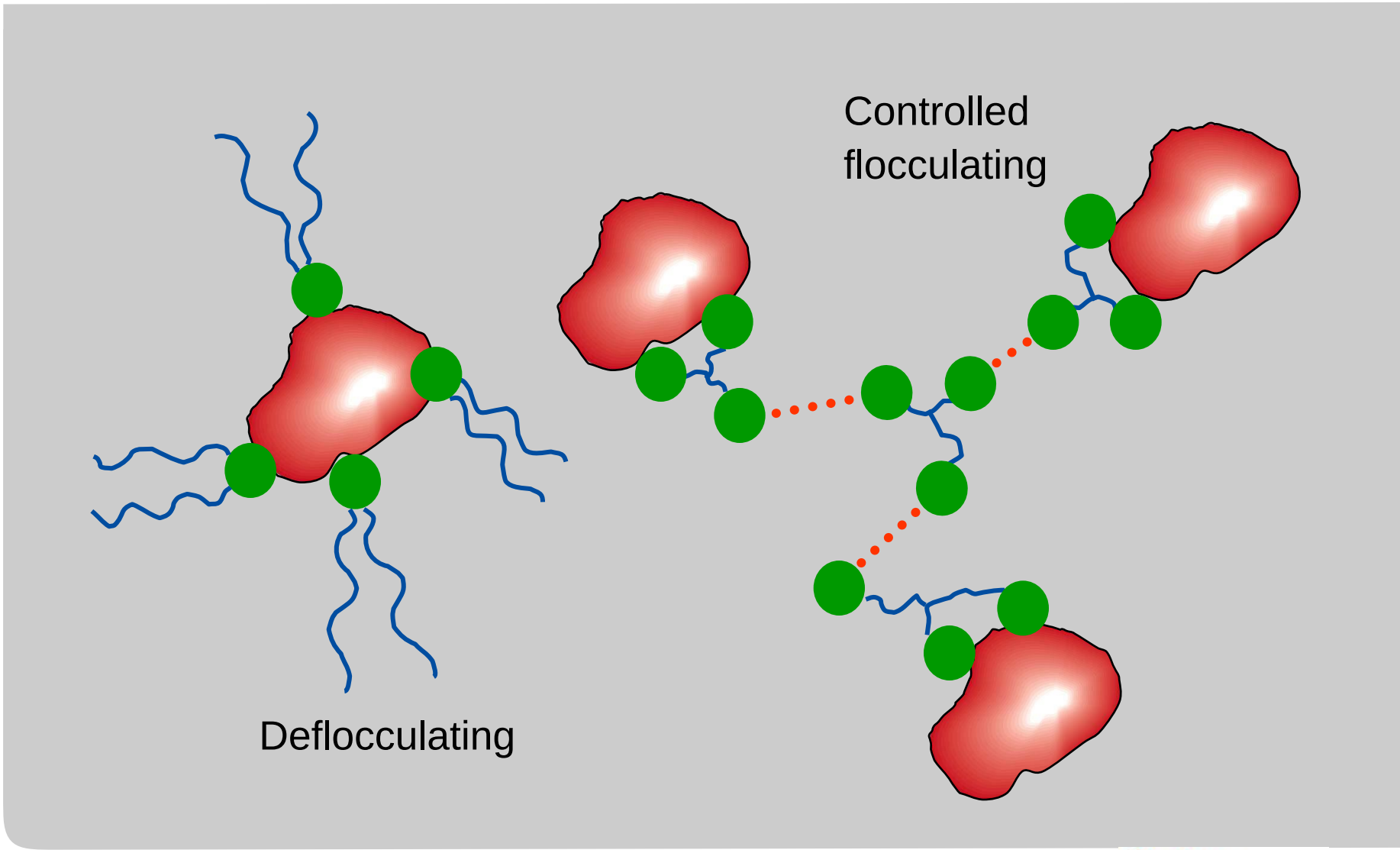
Impact of Wetting and Dispersing Additives on the Corrosion Resistance

Impact of Wetting and Dispersing Additives on Corrosion Resistance in Non-Aqueous Systems

- **Anti-corrosion performance:**

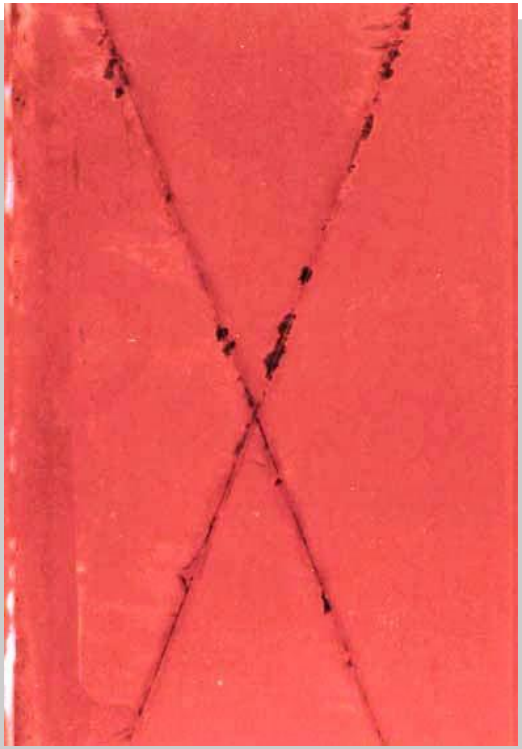
- **~ 70 % of the tested solvent-borne additives don´t have a positive impact on corrosion resistance of the coating film !**

Wetting and Dispersing Additives



Salt Spray Resistance

Control



Product 204

Soya lecithine

System: Long oil alkyd primer/ with Ca-modified silica AC pigment

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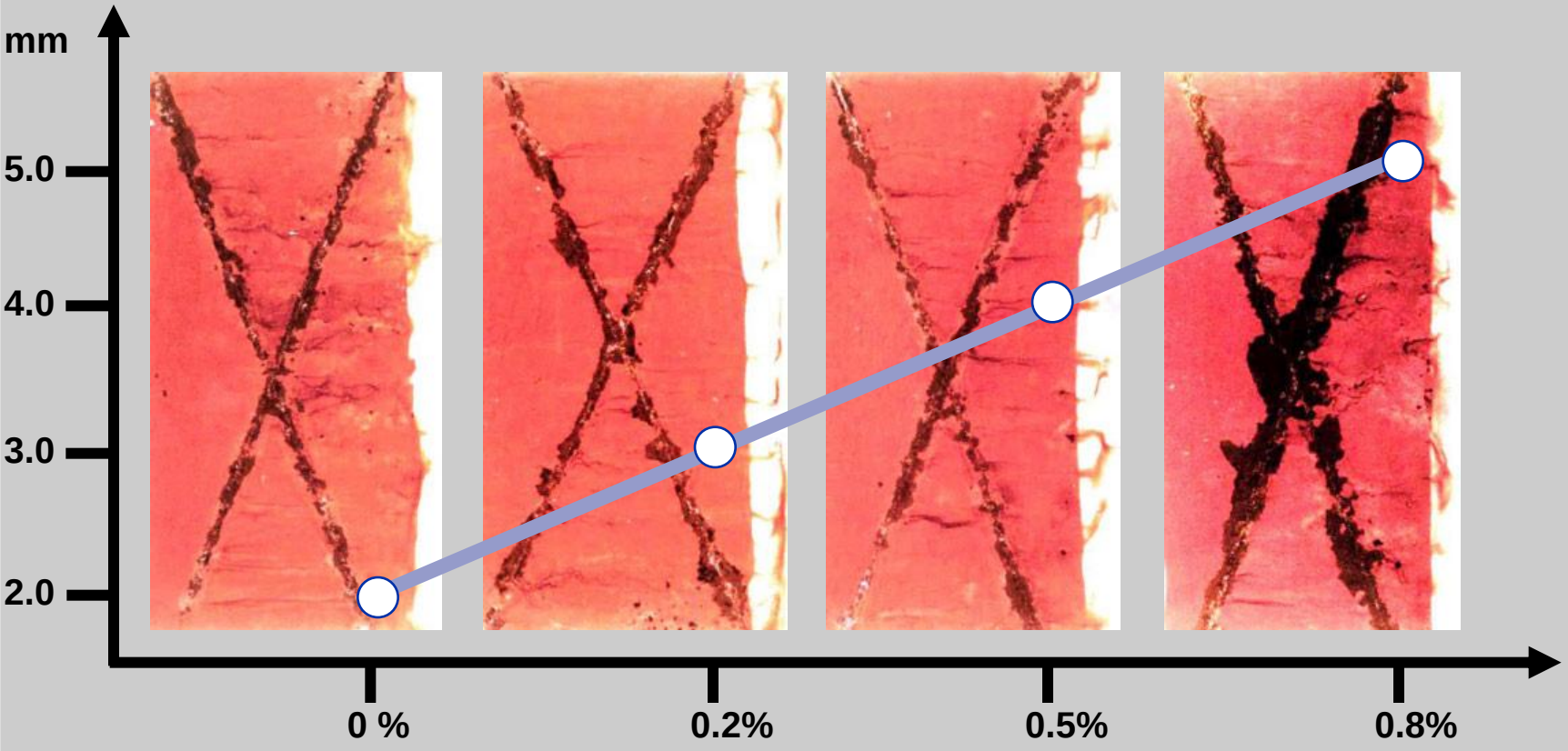
Undercut Corrosion



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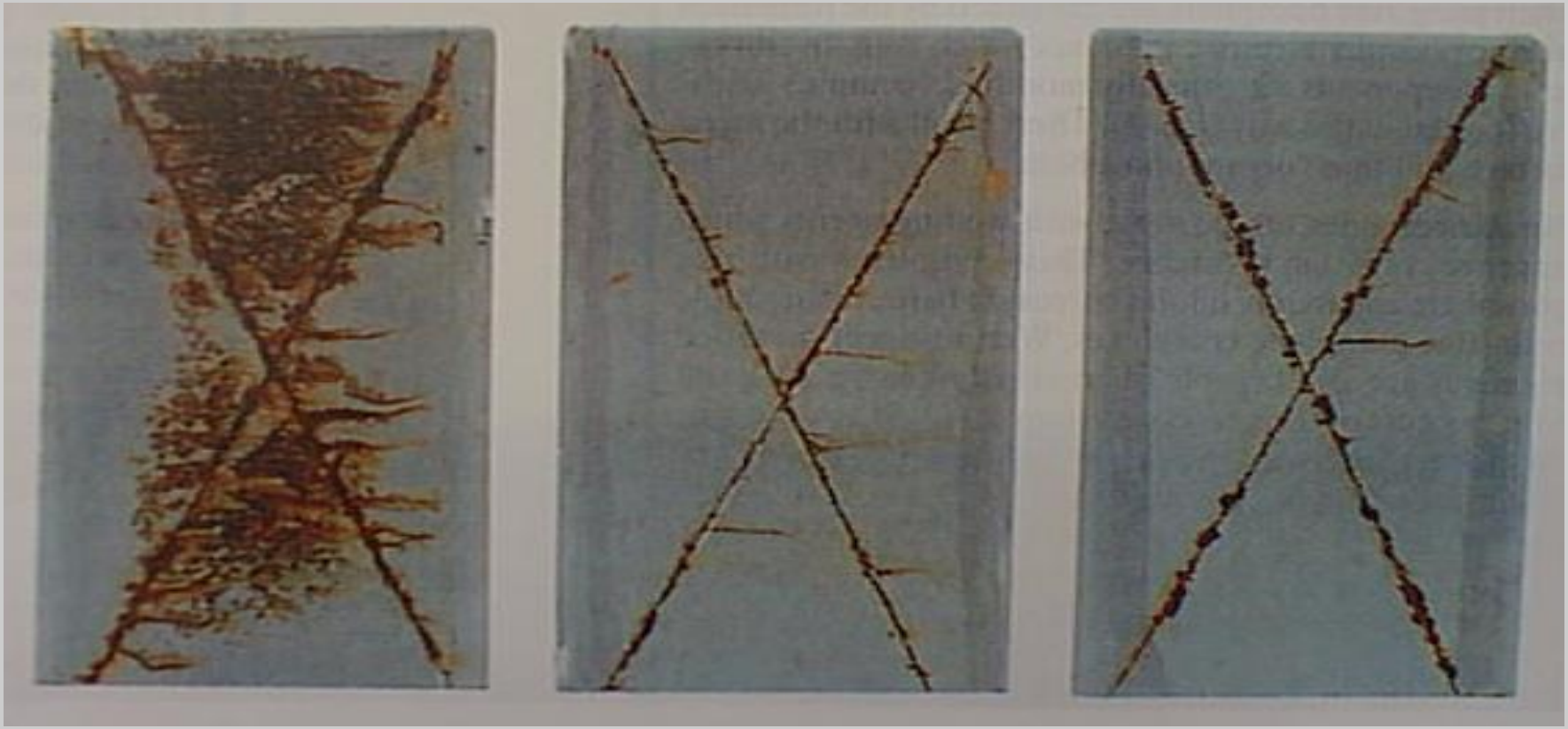
Additive Influence on Salt Spray Resistance

System: short oil alkyd / phosphosilicate **168h salt spray/35°C**



CONTROL **Product P104 1 %** **Product 204 1 %**

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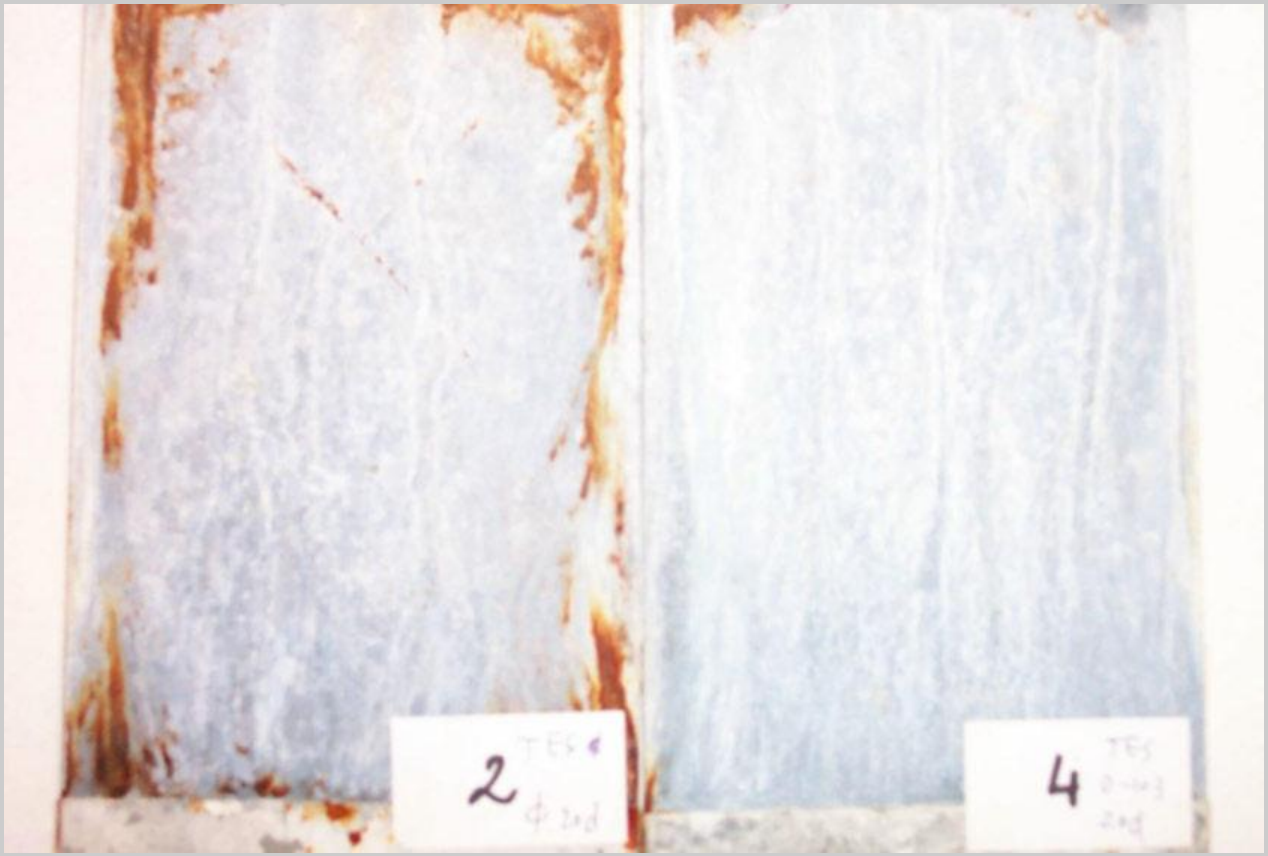
Salt Spray Test: Ethyl Silicate Zn Primer after 480 h



Control **PRODUCT 103 0.5%**

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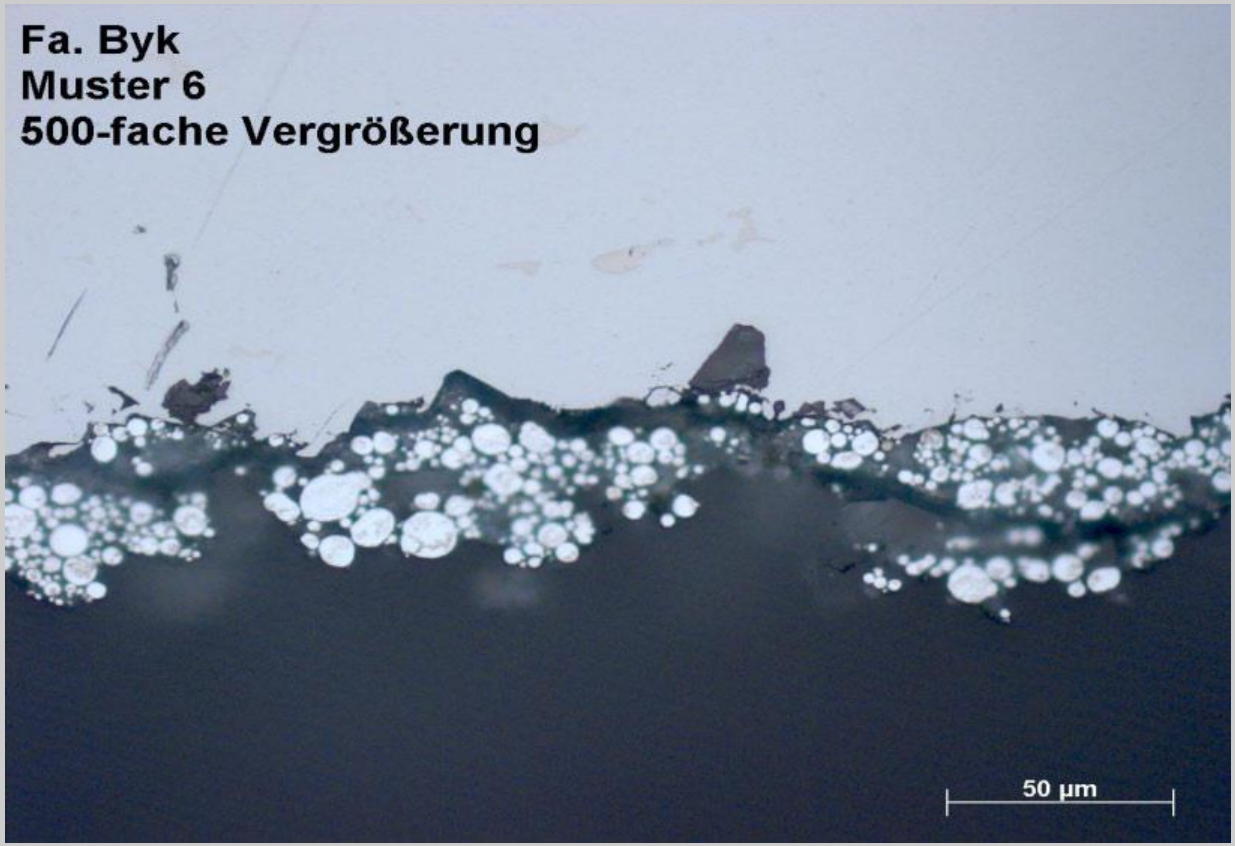
Cross-cut Section Analysis: Ethyl Silicate Zn Primer



Non-uniform Zn distribution in the film

Without any W&D additive

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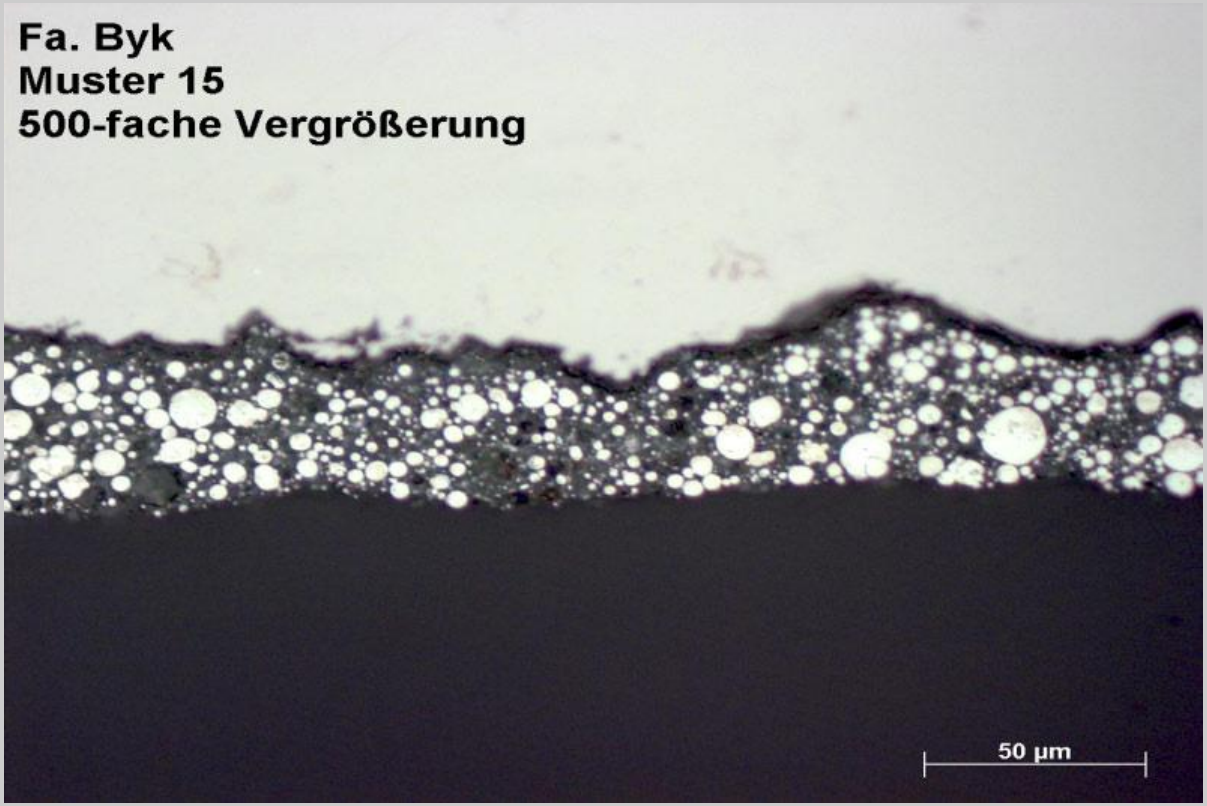
Cross-cut Section Analysis: Ethyl Silicate Zn Primer



More uniform Zn distribution in the film

With polyester-phosphate type W&D additive 0.5%

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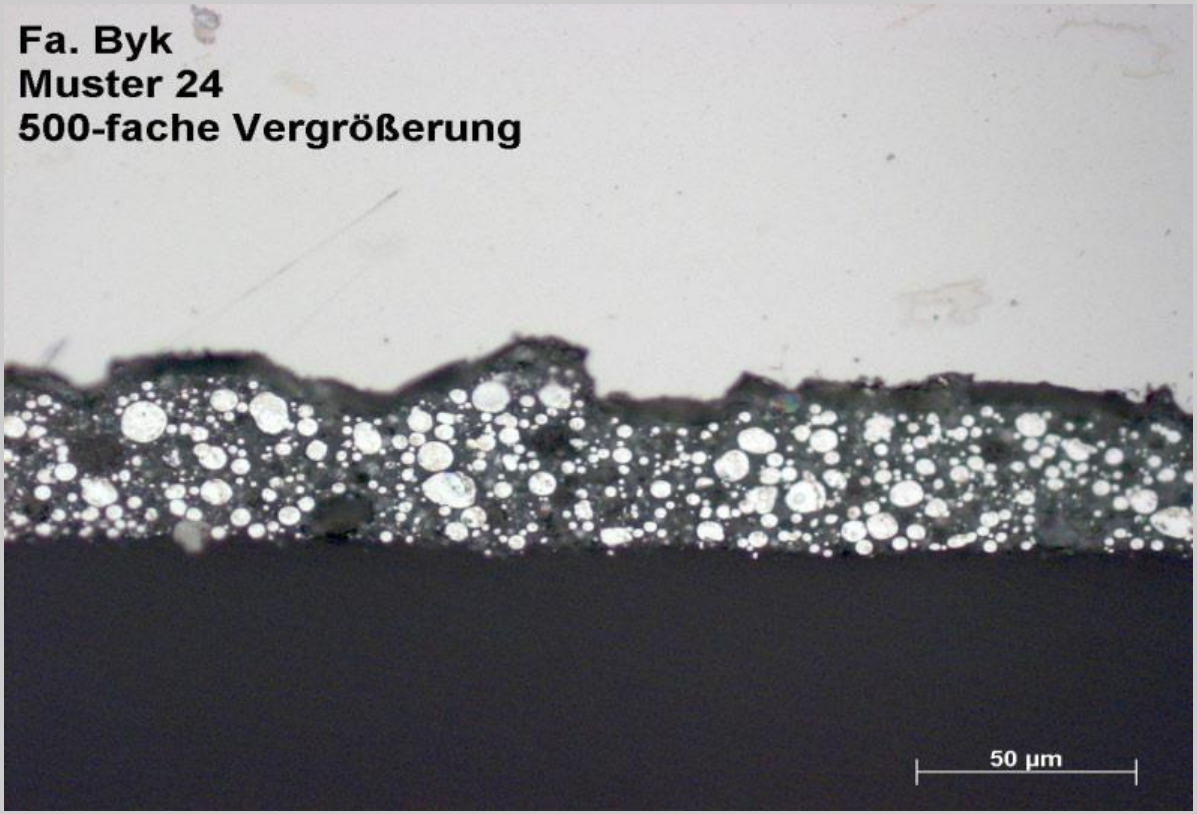
Cross-cut Section Analysis: Epoxy Zinc Rich Primer



More uniform Zn distribution in the film

With W&D additive
0.5%

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Wetting and Dispersing Additives Supporting Anti-Corrosive Properties in Solvent-borne Systems

Chemical structure	main application fields
Product 203 (alkyl ammonium salt of a polycarboxylic acid)	epoxies, PU, alkyds, CR, vinyl resins, epoxy esters
Product 204 (polycarboxylic acid)	epoxies, PU, alkyds
Product P104 (polycarboxylic acid)	epoxies, PU, alkyds, epoxy esters, baking systems, vinyl resins
Product D (polycarboxylic acid amine salt)	alkyds, wash primers
Product 103 (salt of a polyester phosphate)	Solvent-borne anticorr. pigment slurries Zn rich primers (epoxy , Zn silicate)

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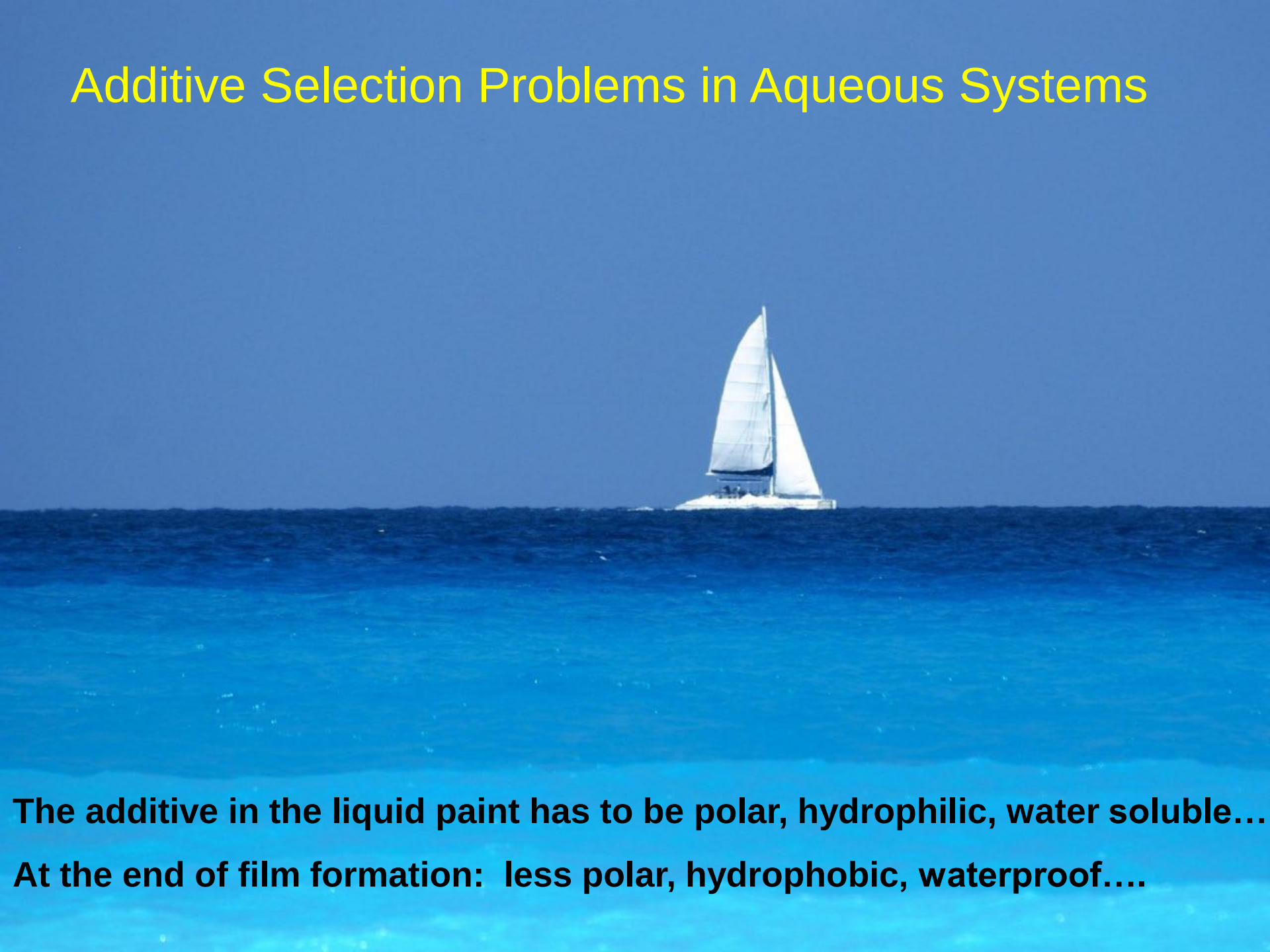
Additive Selection Problems in Aqueous Systems



The additive in the liquid paint has to be polar, hydrophilic, water soluble…

At the end of film formation: less polar, hydrophobic, waterproof….

Corrosion Resistance in an Aqueous Epoxy Primer: Wrong and Correct Additive Selection

Non-ionic
wetting agent

Product 194N (anionic hydrophobic polymer)

System: Aradur 39 BD / Araldite PZ 756/67 BD, additive dosage 0.8 %

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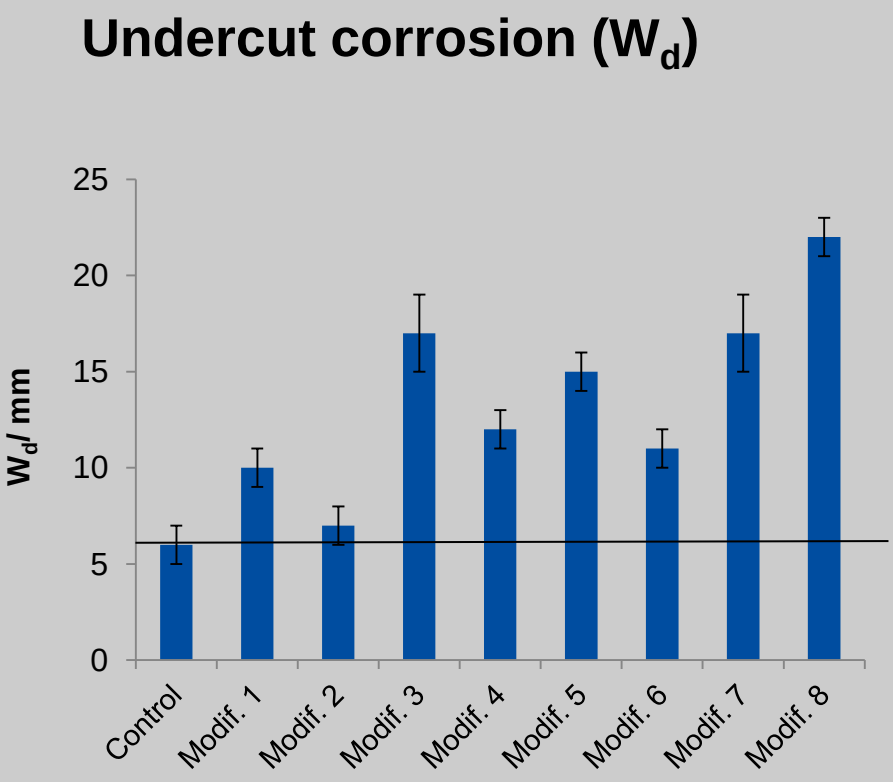
Impact of Wetting and Dispersing Additives on Corrosion resistance of Aqueous Systems

- **~ 90 % of all tested aqueous wetting and dispersing additives showed a negative impact on corrosion resistance of the coating film !**

Influence of the Additive Selection on Undercut Corrosion (System: Styrene-Acrylic Latex)



Evaluation after 400 h salt spray test, n=3 panels

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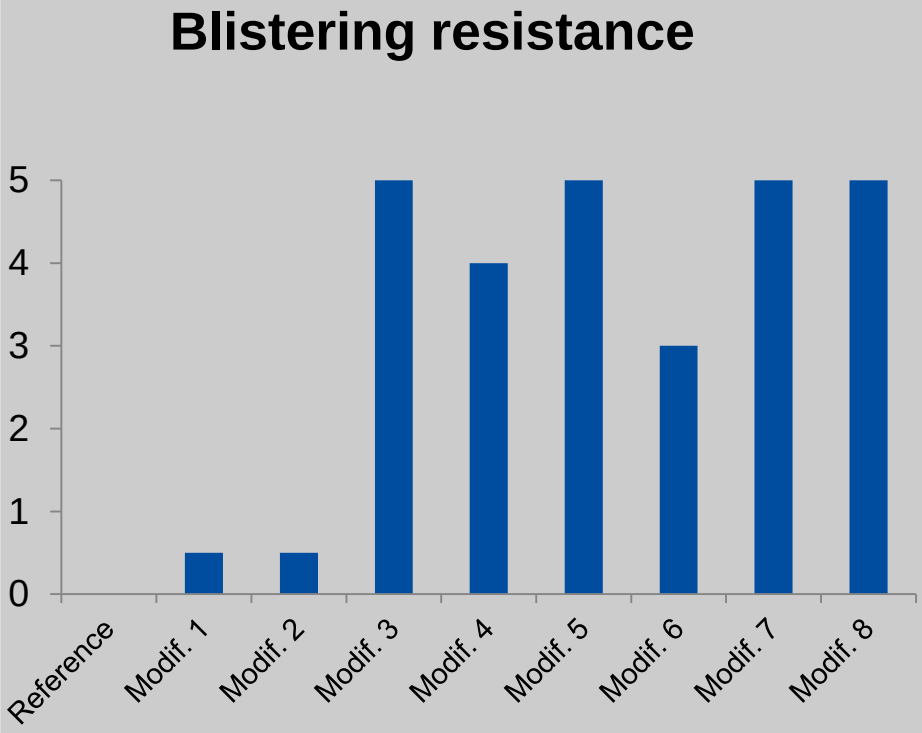
Influences of the Additive Selection on Blistering Resistance (System: Styrene-Acrylic Latex)



Determination: 0 = no blisters, 5 = many blisters

Modification 3

Evaluation after 400 h salt spray test, n=3 panels

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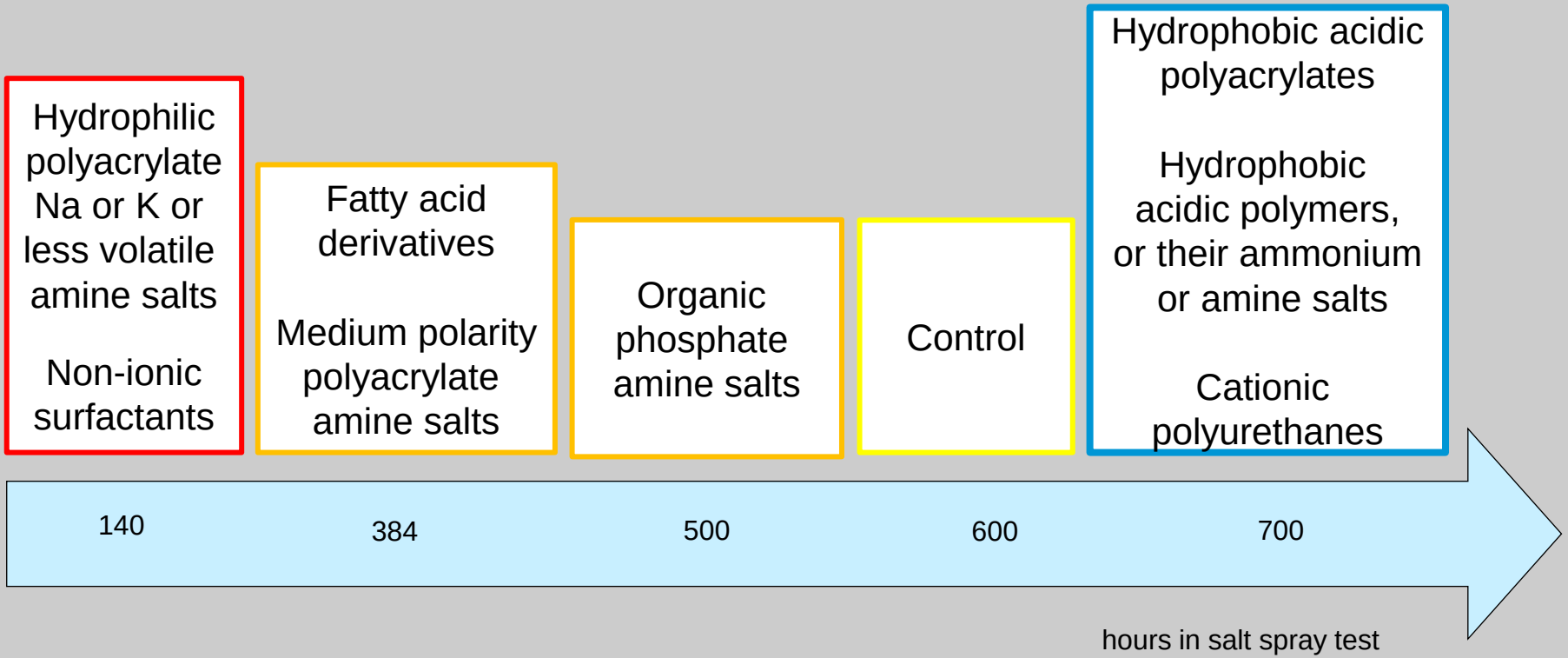
Impact of W&D Additives on Salt Spray Test Performance (Styrene-Acrylic Latex Primer)



Additive group ranking may change with every resin system, especially in epoxies and alkyds !

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Summary

The influence of wetting & dispersing additives on the corrosion resistance of a waterbased paint film is significant.

All test methods (salt spray, humidity test, water resistance, outdoor exposure…) allow a clear differentiation, but do not necessarily correlate with each other !

Conclusion: Water soluble wetting and dispersing additives impact paint film properties mostly negatively , and in a few cases positively.

NEGATIVE: hydrophilic molecules, non-ionic surfactants, Na or K salts or less volatile amine salts of anionic polymers…

POSITIVE: more hydrophobic molecules, ammonium or volatile amine salts of hydrophobic molecules, more hydrophobic cationic wetting and dispersing additives.