A Defect is not an Effect!

Solutions
from Evonik Coating Additives
for Architectural Coatings

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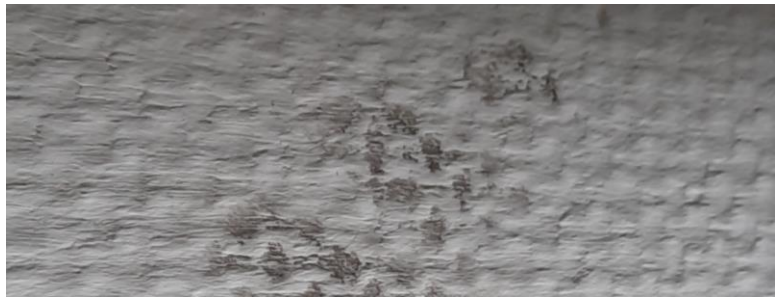
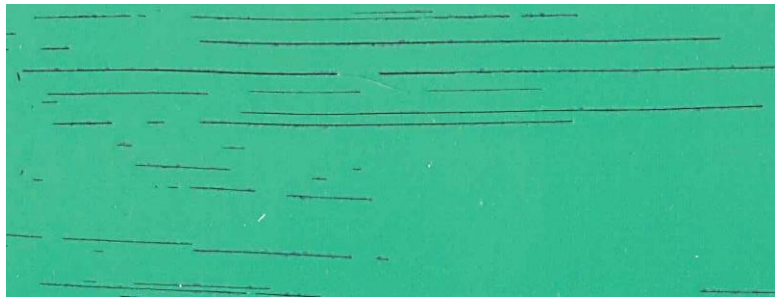
Defects & recommendations addressed today

Defects can occur at different stages of paint production & use conditions – the following topics are covered today:

- Mechanical resistance of the coating surface
- Rheological effects
- Foam
- Defects @ exterior paints (Snail trails, Blistering, Efflorescence)
- Cratering / Cissing
- Pigment stabilization challenges
- Weakness in hiding Power





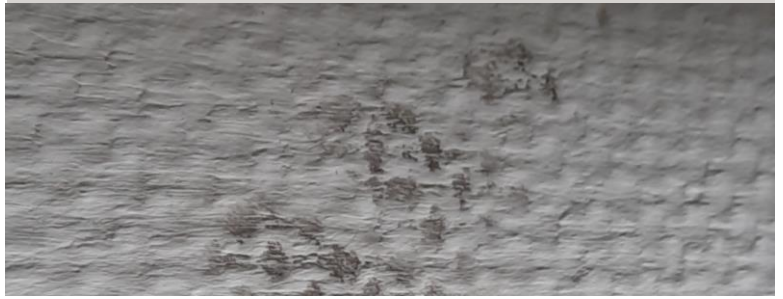
Test Methods for Mechanical Resistance of Interior Wall Paints

(Wet) abrasion resistance

- describes the durability and resistance to abrasive cleaning of a dried wall paint and is a measure of resistance to mechanical abrasion.
- DIN EN 11998
- ASTM D 2486

Scuff resistance

- Coatings´ ability to withstand scuffs and marks on the surface and/or easy removal of marks without scrubbing
- Specific test methods



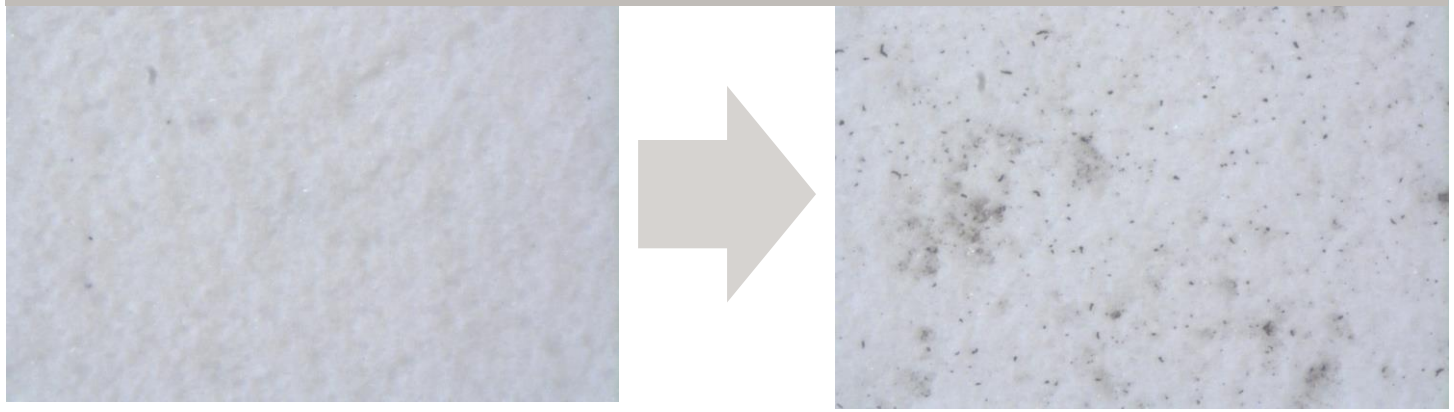
Burnish resistance

- Coatings' ability to maintain its visual appearance after being rubbed by soft types of objects like leather, sponges, cloth or human hands
- ASTM D6736 (Cheesecloth)
- Evonik internal test methods

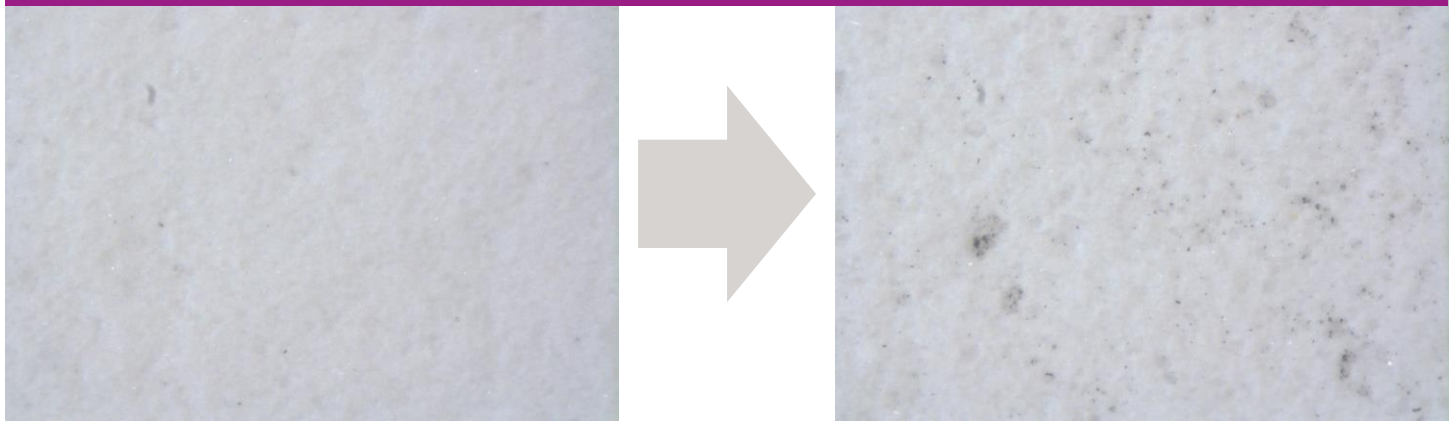
Scuff Resistance Test Method: Pendulum Test

Less Residue on the Surface with Spherical Fillers

Standard formulation



5.56% SPHERILEX® DP-0115



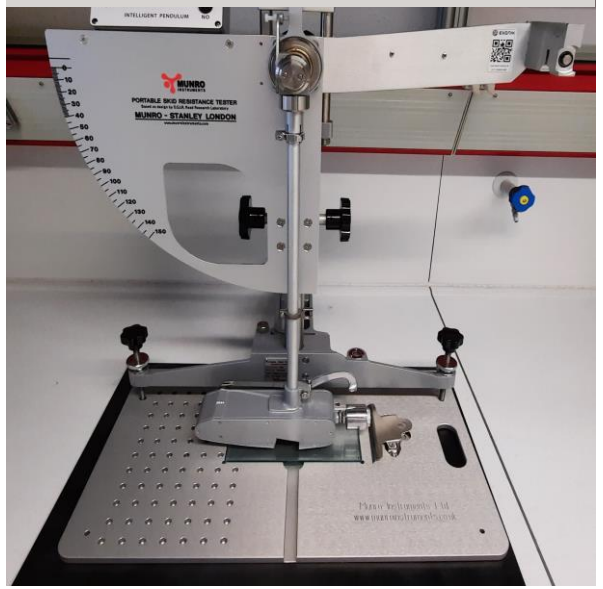
Higher surface roughness doesn´t lead to a higher residue content

Interior Wall Paint

wb Emulsion Paint

PVC 80%

Styrene Acrylic Binder



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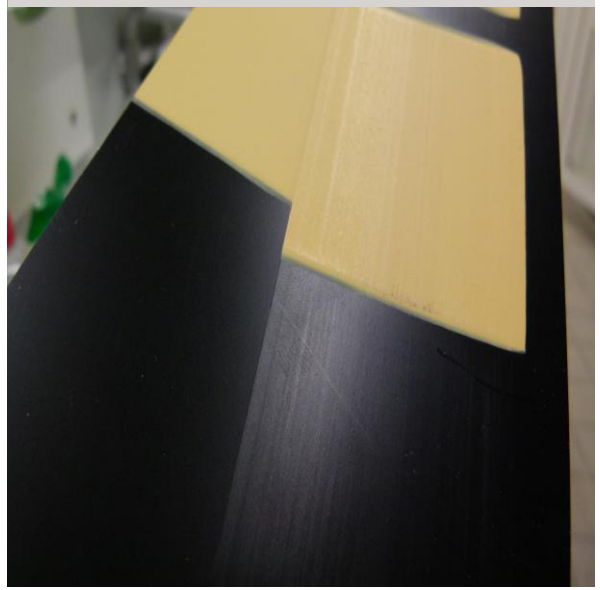
Gloss Development and Burnish Resistance

Interior Wall Paint

wb Emulsion Paint

PVC 80%

Styrene Acrylic Binder



Larger particle sizes and higher dosages are more efficient

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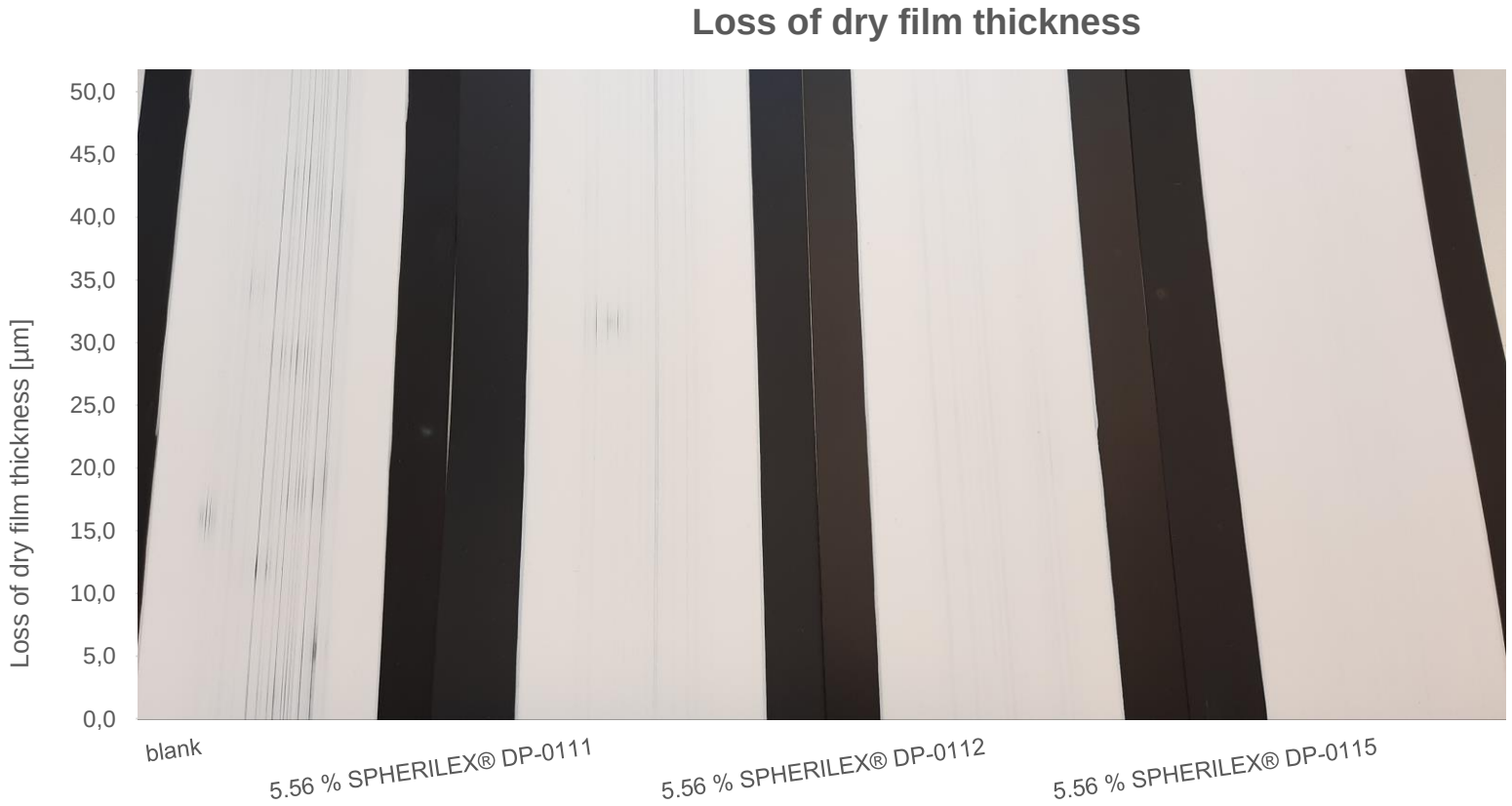
Significant Increase of Wet Scrub Resistance according to DIN EN 11998



Interior Wall Paint

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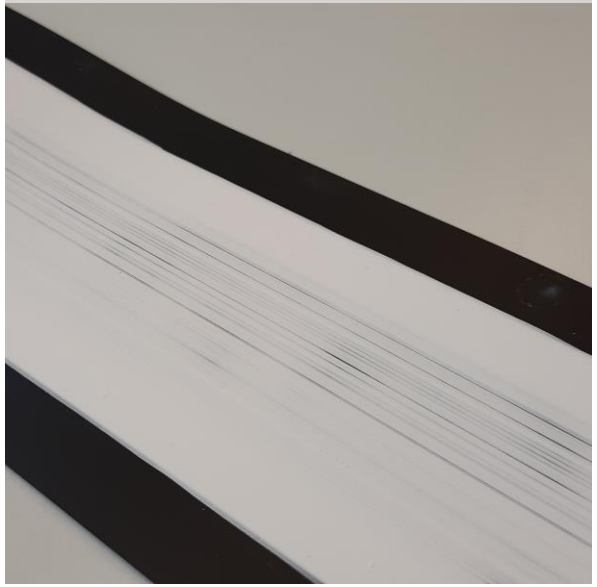

Larger particle sizes are more efficient in reducing the loss of dry film thickness

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Mechanical Resistance – how to improve the paint durability

Property	SPHERILEX® DP-0111	SPHERILEX® DP-0112	SPHERILEX® DP-0115
Chemistry	Silicon Dioxide	Silicon Dioxide	Silicon Dioxide
Morphology	Spherical	Spherical	Spherical
Moisture (%)	< 5	< 5	< 7
5% pH	7-8	7-8	7-8
Sodium sulfate (%)	< 1.0	< 1.0	< 1.0
BET SA (m^2/g)	< 10	< 15	< 15
Oil absorption (cc/100g)	30-50	40-60	30-50
Median particle size (µm)	4-7	9-11	11 - 14

Paint Defects depending on the Paint Rheology

Brush marks

- Marks such as lines on the paint surfaces which remain after complete drying
- Occurs due to brush application

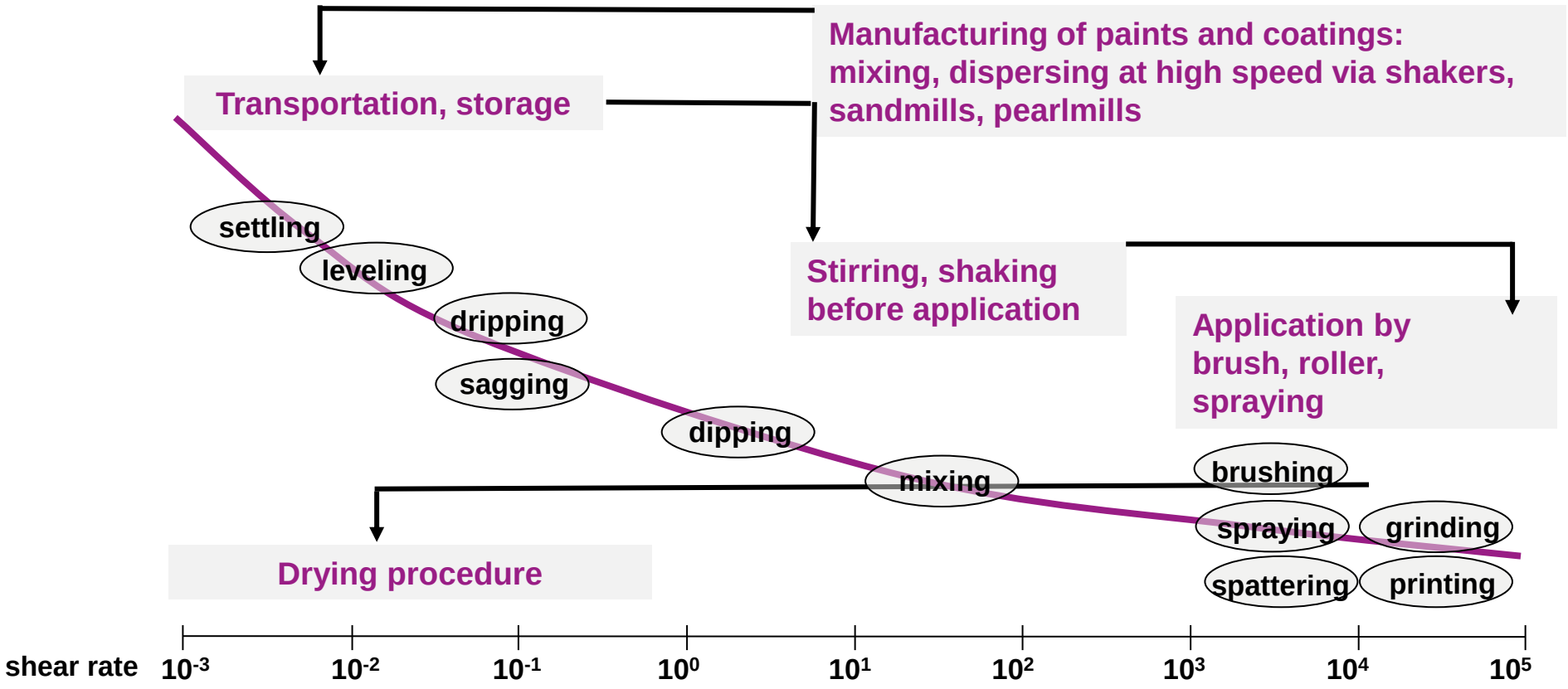
Sagging and Settling

- Sagging describes the movement of the paint especially at vertical application resulting in an uneven surface
- Settling occurs during storage and describes a low storage stability due to the formation of a sediment

Spattering

- Spattering occurs when painting a wall by roller application
- Paint droplets are thrown from the roller into the environment during application

Stages of Coatings and Paints- Rheology



Paint Defects depending on the Paint Rheology

Brush marks

- Use the right amount of paint on the brush
- Keep an eye on the drying time and humidity
- Do not exert too much pressure on the brush when painting
- Adjust the viscosity at lower shear rates

Sagging and Settling

- Do not apply too high film thicknesses
- Applying at wrong climatic conditions
- Adjust the low shear viscosity of the paint

Spattering

- Less paint on the paint roller
- Slower application speed
- Adjust the viscosity at high shear rates

Rheology – how to overcome unlevelled surfaces

Especially for anti-sagging properties

Established standard thickening and thixotropic agent

for Newtonian flow behavior

for Newtonian flow behavior especially for ICI viscosity

Very universal for pseudoplastic flow behavior

for strong pseudoplastic flow behavior

Solution

Solid/Powder

rheology

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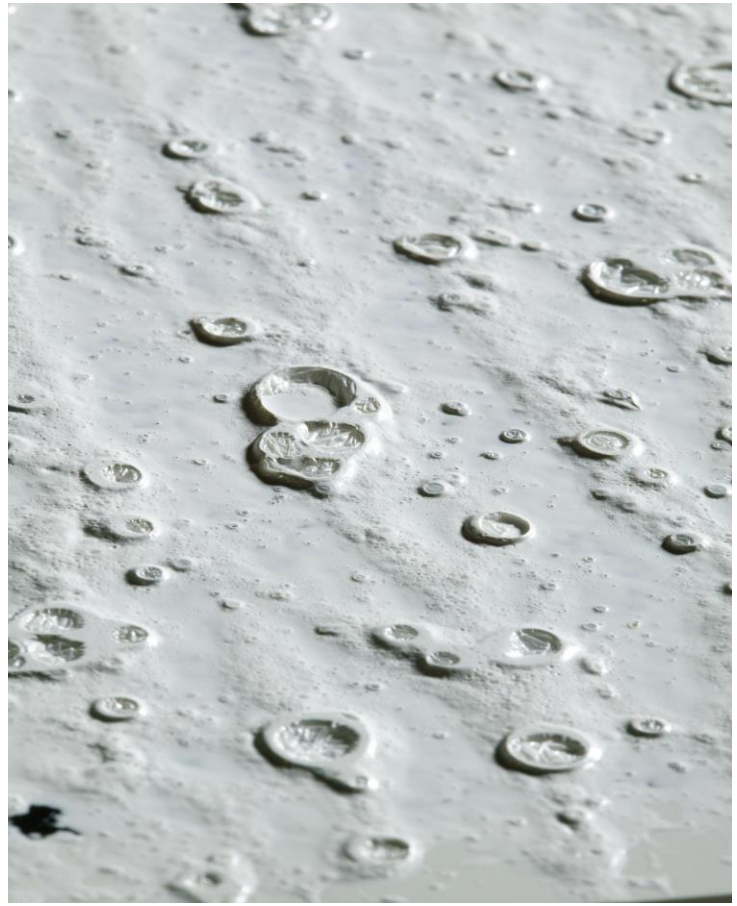
Foam – The Troublemaker

- Disrupted production process and increased production time
  - Less efficient milling process
  - Longer filling times
- Negative affected paint transfer and disturbed application
  - Longer application time
  - Inhomogeneous surface appearance
- Substantial quality loss and surface defects
  - Reduction of gloss
  - Craters or bubbles on the surface
  - Loss of protection

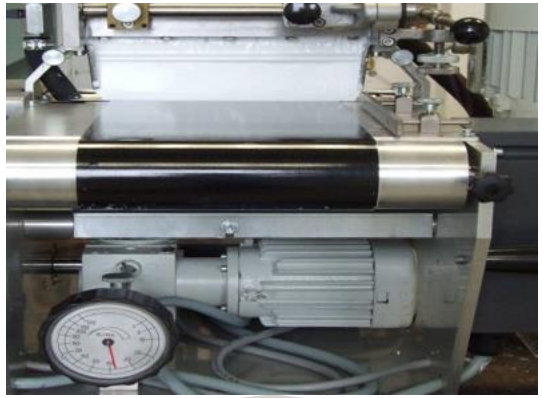


Well known Troublemakers

Pigments, fillers, etc.

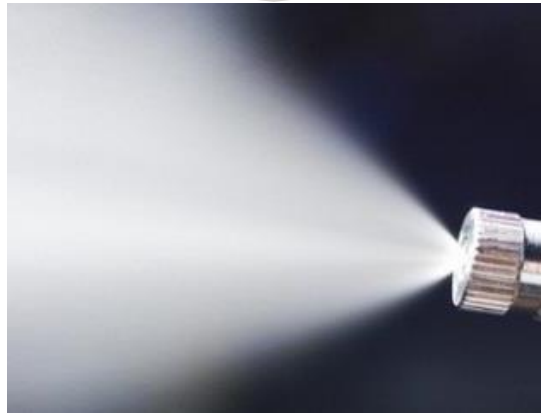
Porous substrates

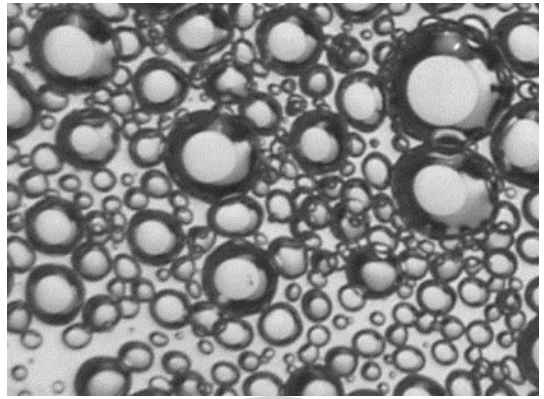
Mixing & production



Pumping processes

Application methods





Reaction gas

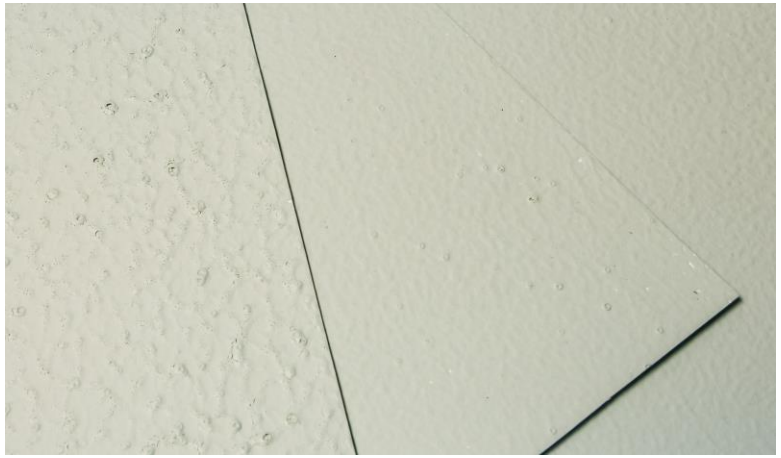
Foam – The Troublemaker

- Often the best results are achieved with a **combination of defoamers**

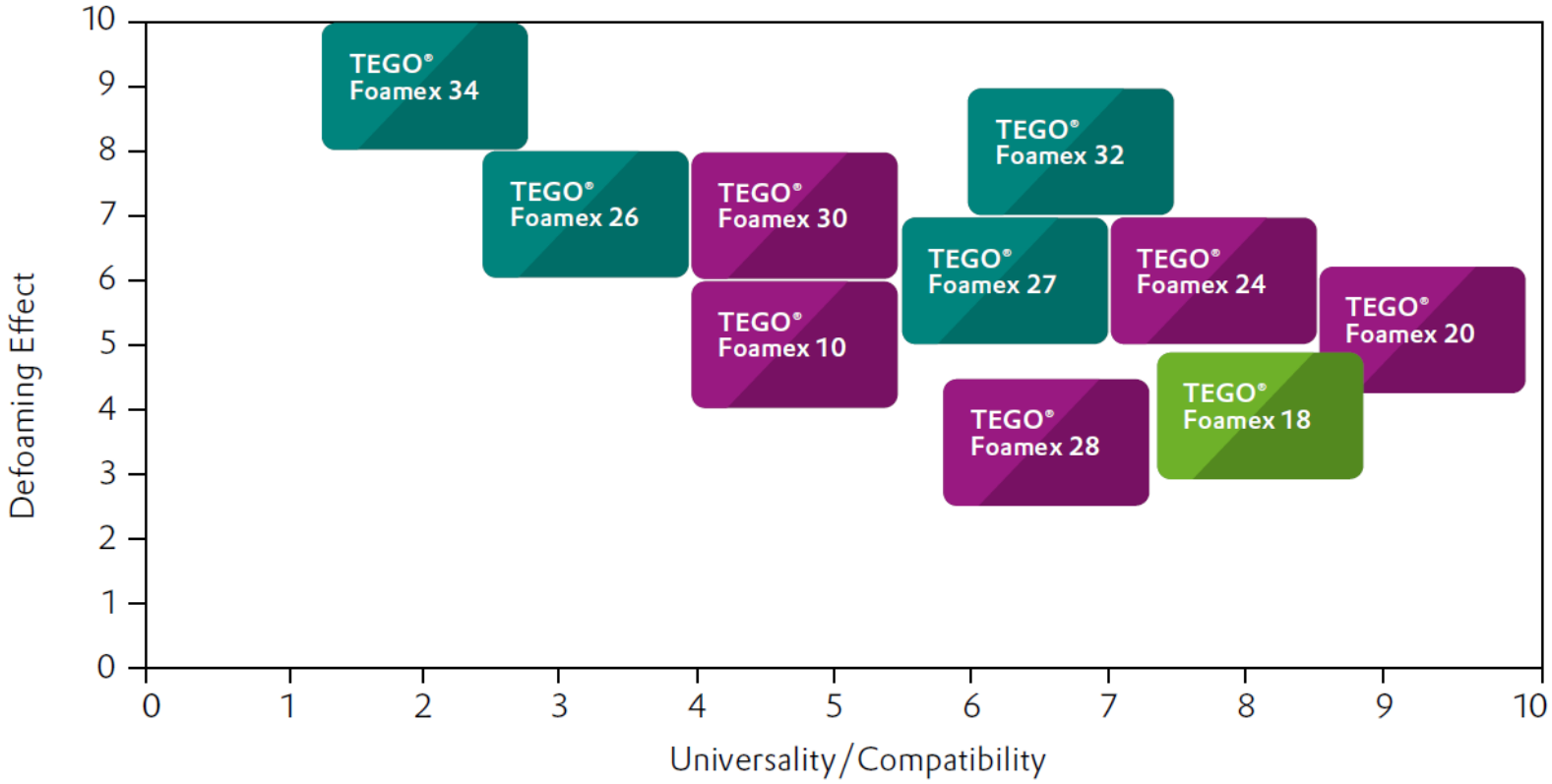
- Add the more **incompatible defoamer (concentrates)** to the **grind**
- Add the more **compatible one (emulsions)** to the **let down**

- Incorporate incompatible defoamer with **high shear forces**
- Incorporation / compatibility can be improved by **prediluting**

- **Wetting agents** can improve the compatibility of defoamer



Dedicated Portfolio to cover major needs in Architectural paints



Selection of

- strong defoamers for more efficient processing
- more universal/compatible for sensitive systems

100% Product/Concentrate

100% Product/Renewable Concentrate

Emulsion

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What are Snail Trails and what are they caused by?

What are snail trails?

- Vertical streaks after rain showers
- Discoloration of the facade coating
  - Could be darker or lighter than the original color
  - More visible on darker colors

What causes snail trails?

- Water soluble ingredients of a paint like glycols, additives, thickeners or emulsifiers are essential for the production and handling of paints
- After application/painting however, most of these raw materials are redundant
- The required water solubility of these substances turns into a potential risk of leaching out by water contact
- Depending on the quantity of water, they rinse off or dry at the surface

Comparison of Snail Trail Test Methods

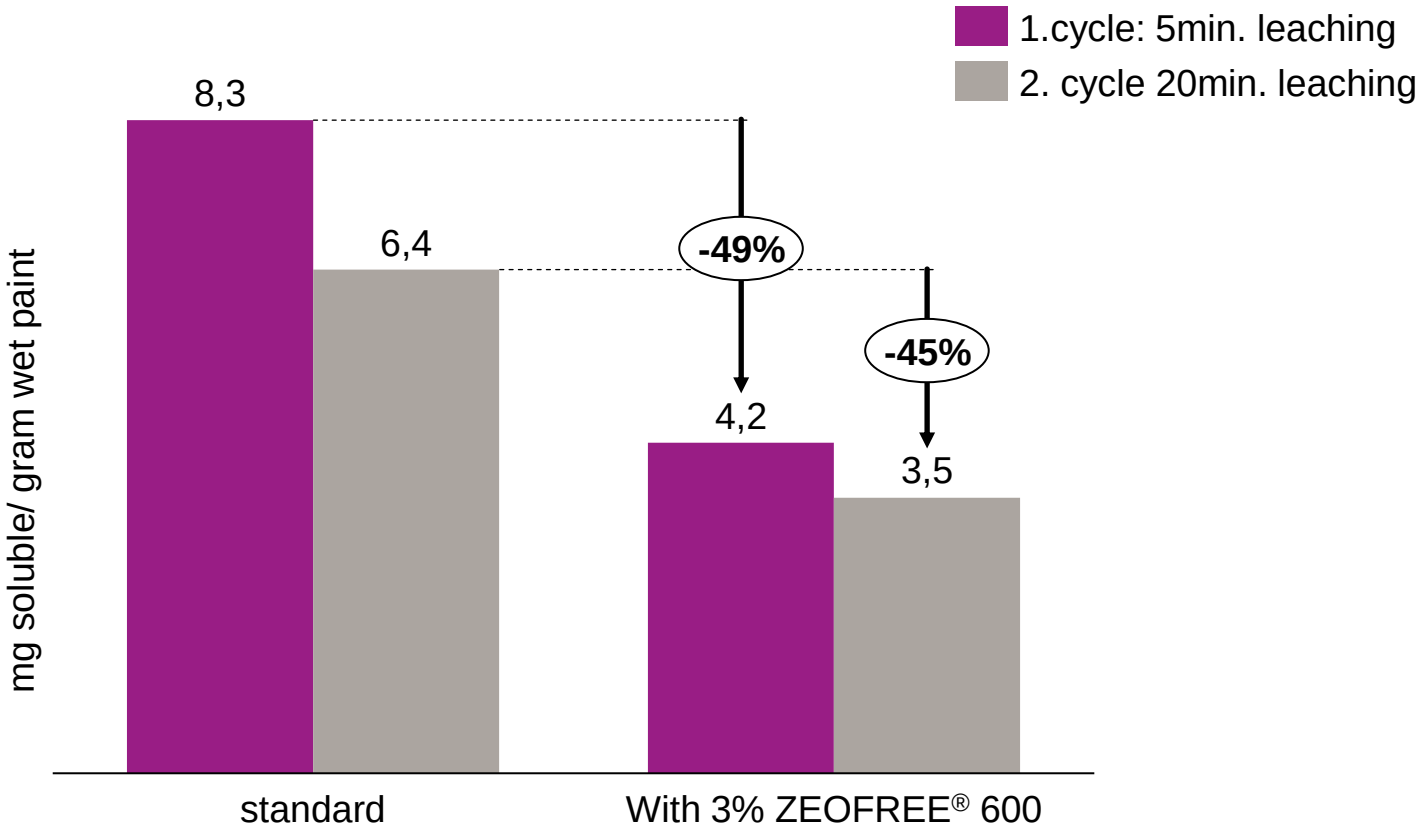
3% novel calcium silicate and 5% water post added to a commercial high PVC paint

Wet film thickness 200 micron, drying time 1h at 50 degree Celsius

ASTM D 7190–10

Evonik Coating Additives rain simulation

Quantitative Evaluation of Exudation



Inside of a bottle coated with paint, after drying filled with water

1. cycle: 5min leaching

2. cycle, same bottles, 20min leaching

Quantitative evaluation of soluble by evaporation of water

Novel silicate particles reduce the quantitative exudation significantly

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Snail trails – how to overcome streaky surfaces

ZEOFREE®
600

Property	Typical Values
Chemistry	Calcium silicate
Moisture (%)	< 10
5% pH	10
Sodium sulfate (%)	< 1.0
Specific gravity (g/cc)	2.1
Oil absorption (cc/100g)	450
Median particle size (µm)	5

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Blistering Defect of Exterior Facade Coatings

What is blistering?

Deformation or lifting of the paint film from the substrate. Leads in the final stage to cracking and peeling of the paint.

What causes blistering?

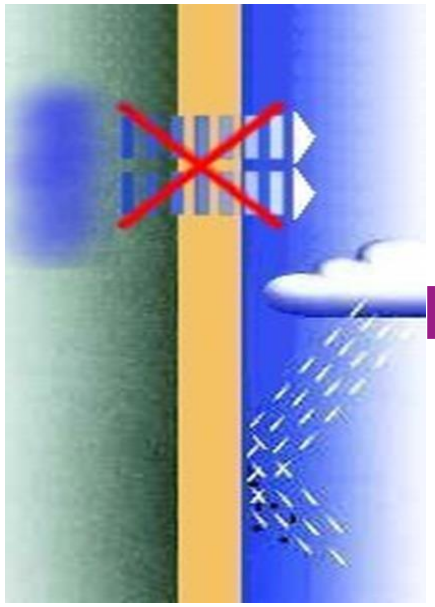
- Leaky connections, opening cracks and insufficiently water-repellent plasters or paints allow water to enter to the masonry.

- Incorrectly executed plinth connections to the ground are an important reason for rising damp.

➢ If blistering occurs, the protection against water absorption of the subsequent coating gets lost which may causes more damages.

Relevance of Paint PVC for Blistering

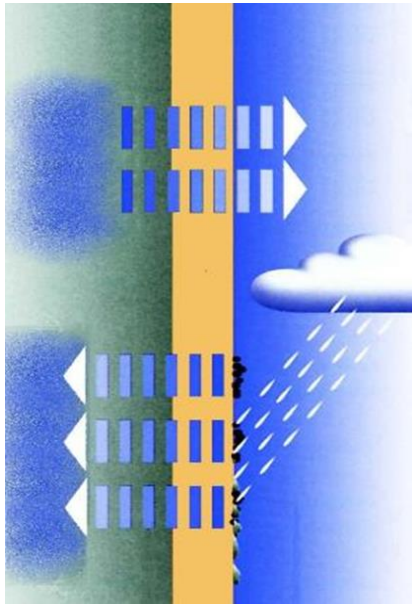
No water vapor diffusion



Low PVC paint

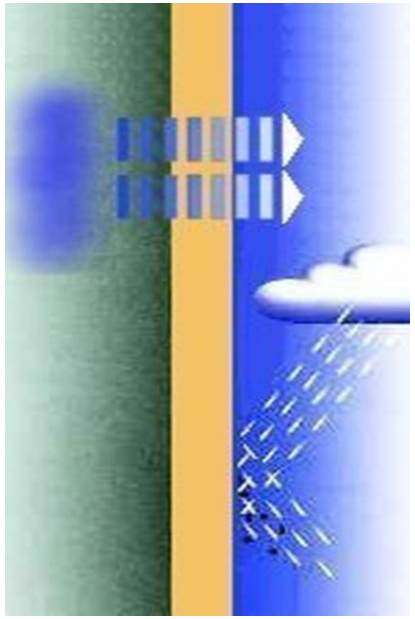
Blistering

High water absorbtion



High PVC paint

High water vapor transmission and low water absorbtion



Hydrophobized high PVC paint

Blistering – how to overcome cracks in the facade coating

A facade paint with high water diffusion in combination with **TEGO® Phobe silicone resins** helps to avoid blistering.

TEGO® Phobe 1650

Silicone resin with very good reduction of capillary water uptake

TEGO® Phobe 1659

Silicone resin for lowest capillary water uptake and minimized dirt pick up

Emulsion | Water resistance | Water uptake | Water beading

Efflorescence

What is efflorescence?

Efflorescence describes the migration of salt to the surface of a porous material, where it crystallizes after evaporation of moisture.
The defect appears particularly on buildings with bricks and natural stones, but also on concrete, stucco or other building materials

How to avoid efflorescence?

To prevent the efflorescence one of the three key conditions must be prevented:

- Presence of water-soluble salts
- Presence of moisture to transform solid salts into a liquid solution
- Mobility of the liquid salt solution

Efflorescence – how to overcome salt migration

An impregnation or a primer based on **TEGO® Phobe** helps to avoid efflorescence.

Control

0.4 % TEGO® Phobe

TEGO® Phobe 6510

Reactive siloxane for waterborne impregnations on alkaline substrates

TEGO® Phobe 6600

Universal reactive siloxane for waterborne primers and impregnations

TEGO® Phobe 6010

Reactive silane/siloxane for solventborne impregnations and primers

Emulsion

100% Product

Water resistance

Water uptake

Water beading

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Craters

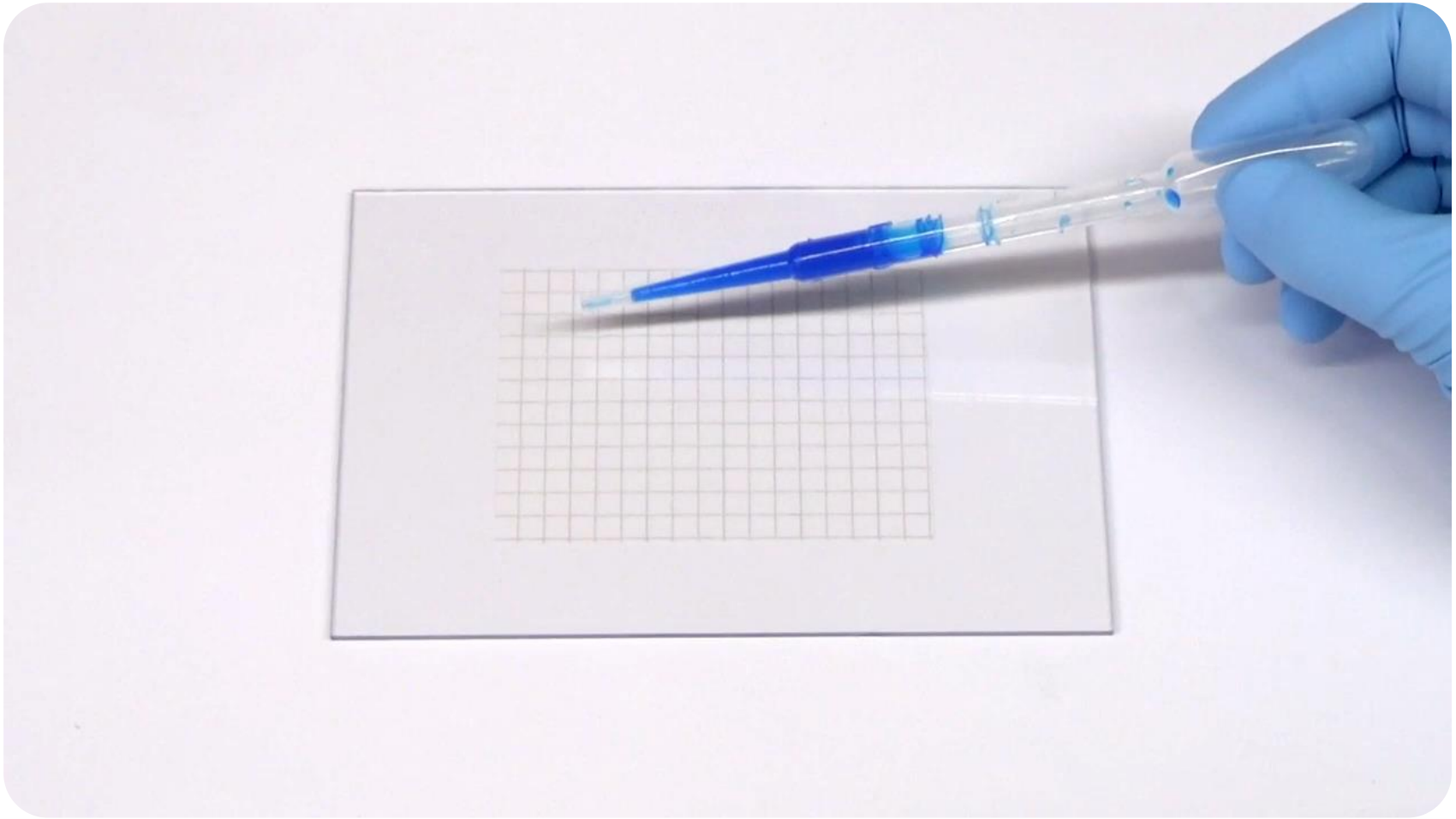
What are craters?

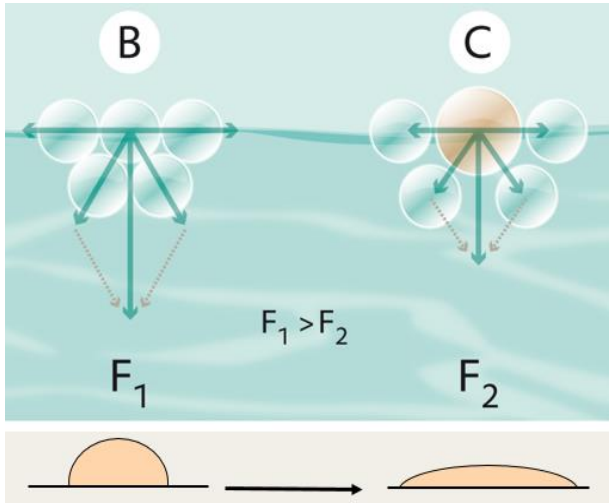
Craters are circular holes or dents in a coating that extend to the underlying substrate. They are either caused by wetting disturbances due to impurities or the substrate or by incompatibilities within the coating.

How to prevent craters?

- Carefully clean the substrates before application
  - ➢Use alcohol to remove fatty impurities
- Use a more compatible **defoamer** in the coating formulation
- Even the usage of a **wetting additive** can lead to less craters
- The higher the viscosity or the PVC of a paint, the lower is the crater tendency

Surface active additives balancing out the attractive forces





The surface active molecule shows lower attraction to the molecules of the liquid resulting in a lower force F_2 towards the interior. The effort to create a spherical surface is reduced.
=> Better spreading

Craters – how to overcome uncovered substrates

Siloxane-based superwetter to improve leveling

Organic-based surfactant with very good compatibility

Universal leveling agent

100% Product/Concentrate

anti cratering | defoaming | leveling/gloss | static surface tension | substrate wetting | recoatable | dynamic surface tension | flow

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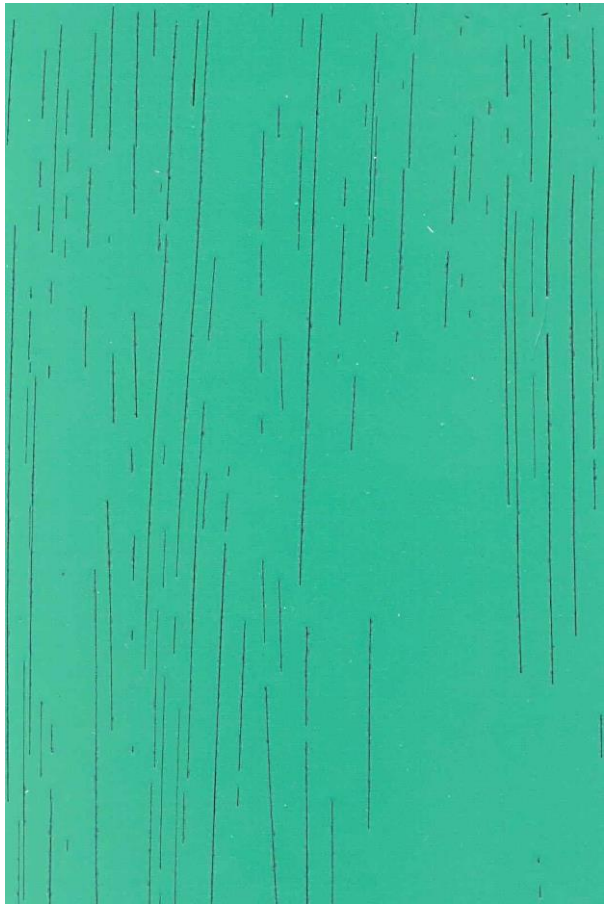
Cissing

What is cissing?

Cissing is characterized as a tearing of the wet paint film, resulting in the exposure of the substrate or the underlying paint layer. It occurs during or directly after the paint application.

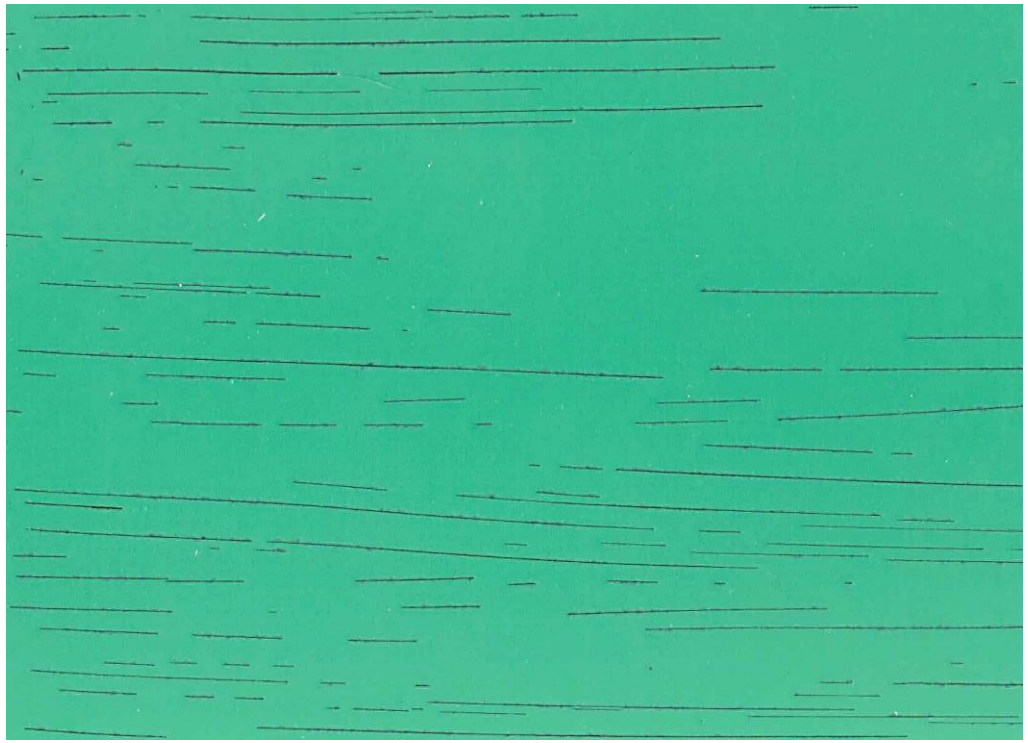


What is cissing caused by?

Cissing is often caused by

- contaminated surfaces by, f.e. oil or particulate substances
- Incompatible paint raw materials, f.e. defoamer
- Lower surface tension of the substrate, f.e. wb paint on glossy oil-based paints

Cissing is not equal to Brush Marks



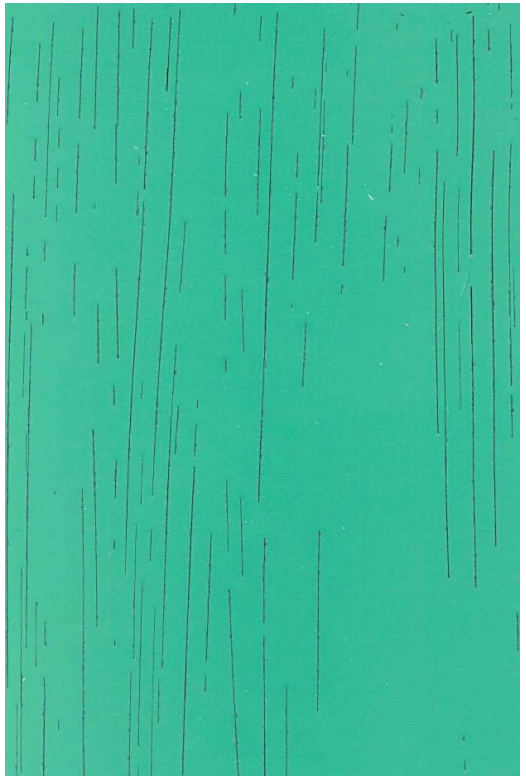
Wetting problem on difficult substrates along the brush application – Cissing or splitting

Bad leveling, brush marks due to high viscosity

Essential addition of a highly suitable substrate wetting additive

How to avoid cissing?

- Make sure the coated surface is clean of contaminations e.g. grease, oil, wax or silicones
- Glossy or semi-glossy oil-based coatings should be sanded before applying water-thinned materials.
- If cissing occurs paint must be allowed to dry and harden before it is rubbed down and recoated.
- Reduce the surface tension of the coating by using **wetting additives**



wb alkyd, blank
Strong cissing

0,5% DYNOL™ 800
Less cissing

Cissing – how to overcome unleveled surfaces

Low foam superwetter

Organic-based superwetter with anti-crater properties and excellent recoatability

Outstanding anti-crater effect

100% Product/Concentrate

anti cratering | defoaming | leveling/gloss | static surface tension | substrate wetting | recoatable | dynamic surface tension | flow

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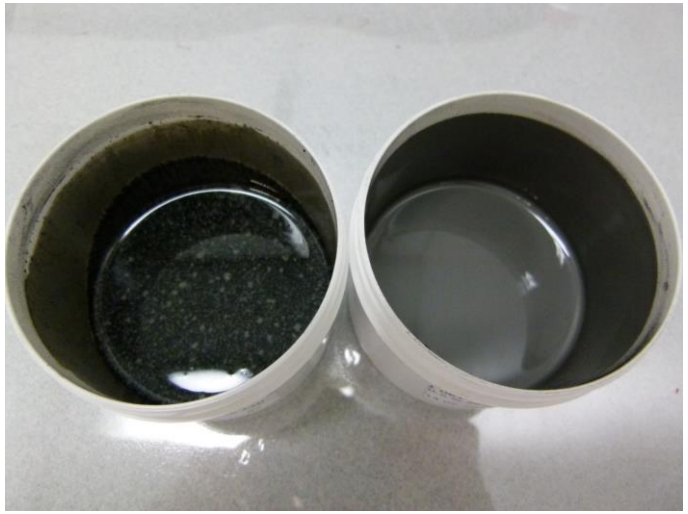
Floating and Flocculation – A Pigment Stabilization Problem

What is floating and floccuation?

Floating means a separation of one or more pigments in a paint. This results in separation during storage and also can cause color changes during drying of a paint.

Flocculation describes loose assemblies of pigments which get visual due to a color shift during storage or a strong rub out effect



What causes floating and flocculation?

When a coating dries, streams and vertices are created inside the coating. Due to the different moveabilities the separation of the pigments occurs.

Flocculation occurs due to the attraction of pigments to each other and can be redispersed by mild shear forces.

Pigment Stabilization – Rubout Test

Color compatibility of tinted paints

Rub-out test method

COATINO®

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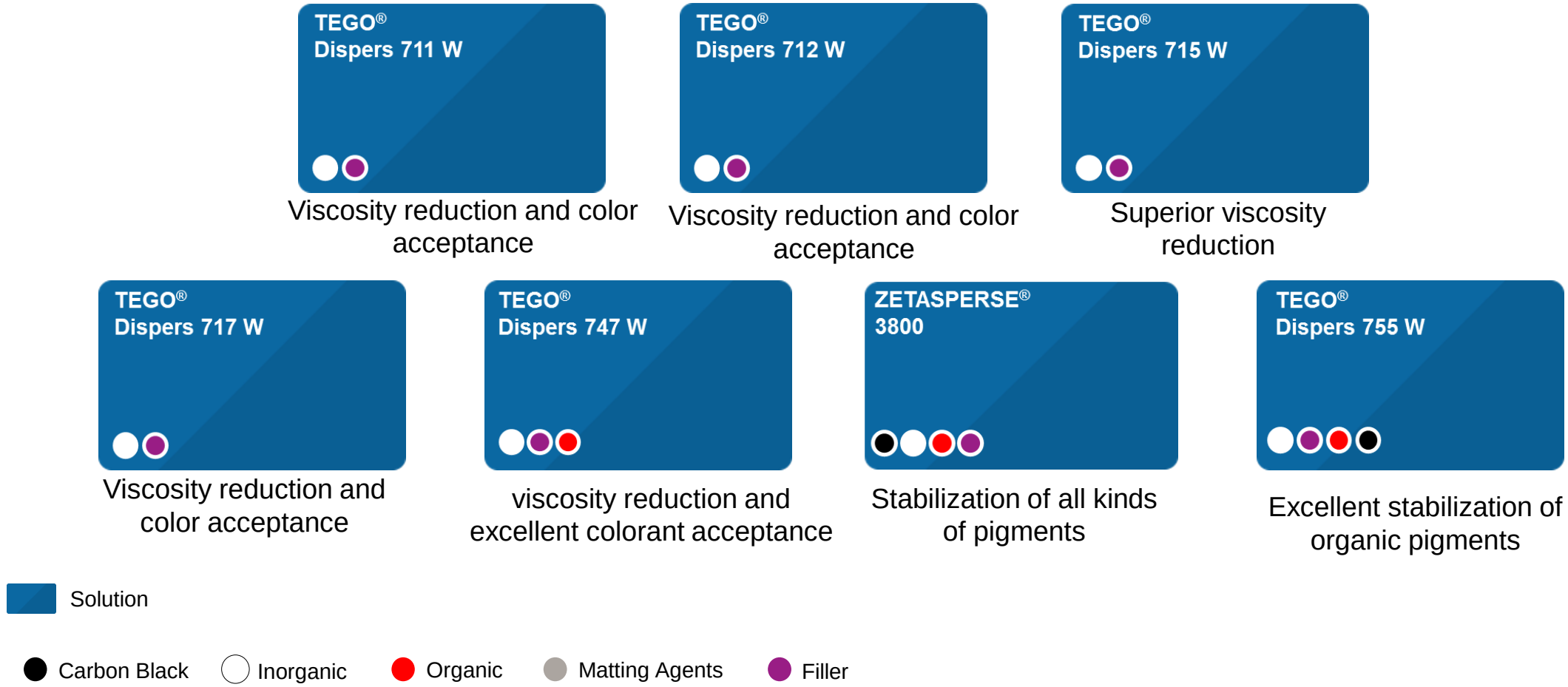
Solutions from Evonik Coating Additives for a better pigment stabilization



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Poor Hiding Power

What is hiding power?

Hiding Power is the ability of a coating to cover the substrate so that the substrate is not visible through the coating. In architectural paints titanium dioxide is the biggest driver for good hiding power.

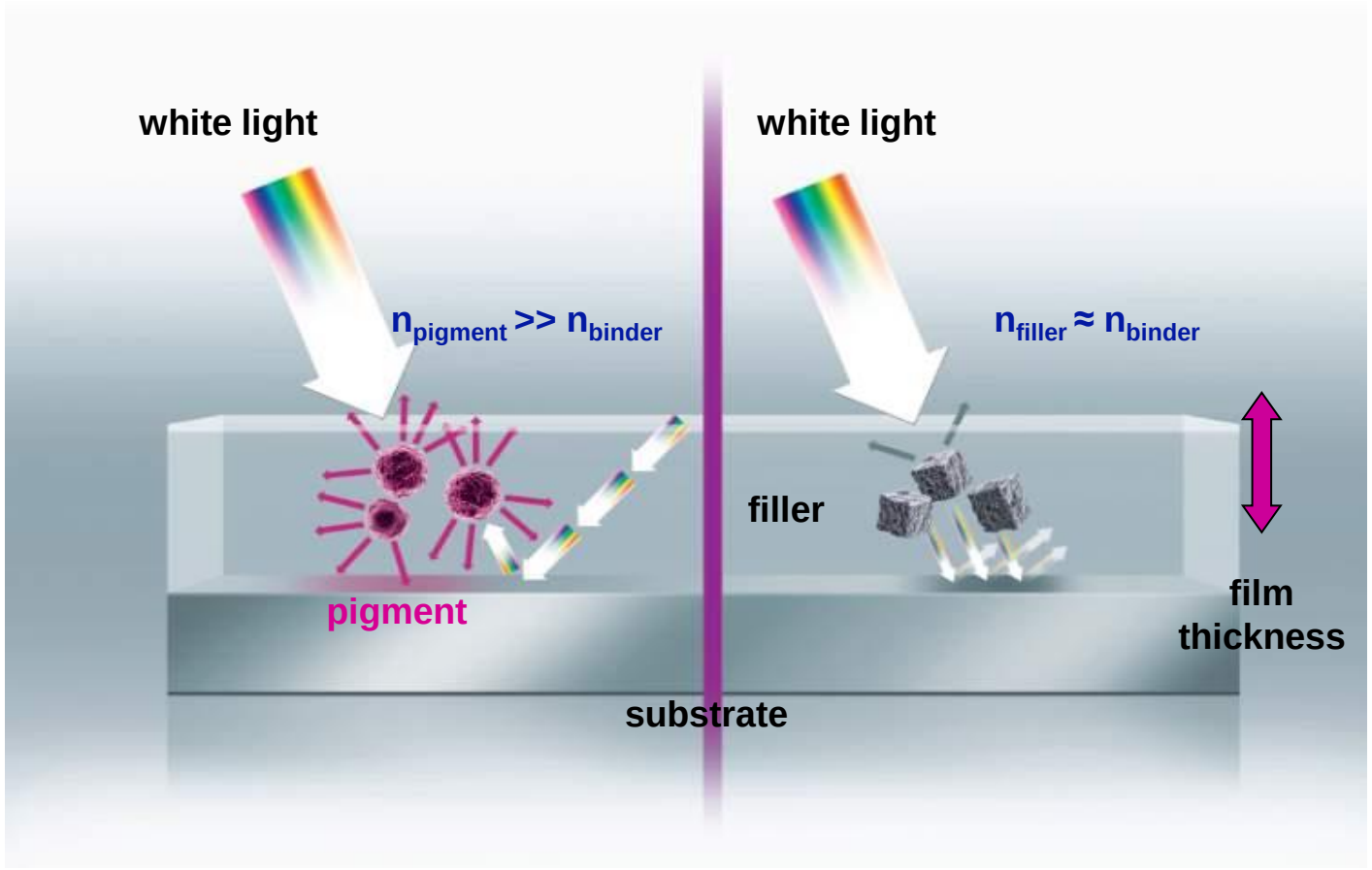
Poor hiding power

Good hiding power

What causes poor hiding power?

- Low pigment content, especially TiO_2
- Lower PVC paints have lower hiding power
- Inefficient use of TiO_2

Absorption, Scattering and Reflection of Light



Extenders

Sodium aluminum-silicate with excellent brightness

Sodium aluminum-silicate with low binder demand and matting effect

Magnesium aluminum-silicate with very good brightness and wet scrub resistance

Sodium aluminum-silicate with good touch-up properties

Sodium aluminum-silicate with good dry hide at over critical PVC

Solid/Powder

Carbon Black | Inorganic | Organic | Matting Agents | Filler | matting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Questions? – Please get in contact with us!

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