Neuburg Siliceous Earth in water-based corrosion protection acrylate primer red

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Status Quo

Solvent-based coatings have always been first choice in corrosion protection of metals by organic coatings.

On the other hand, legislative pressure for VOC reduction and increasing consumer demand require development of solvent-reduced and environmentally friendly formulations.

Water-based coating systems are therefore becoming increasingly important, but at the same time they are intended to fulfill the high performance level associated with classical systems:

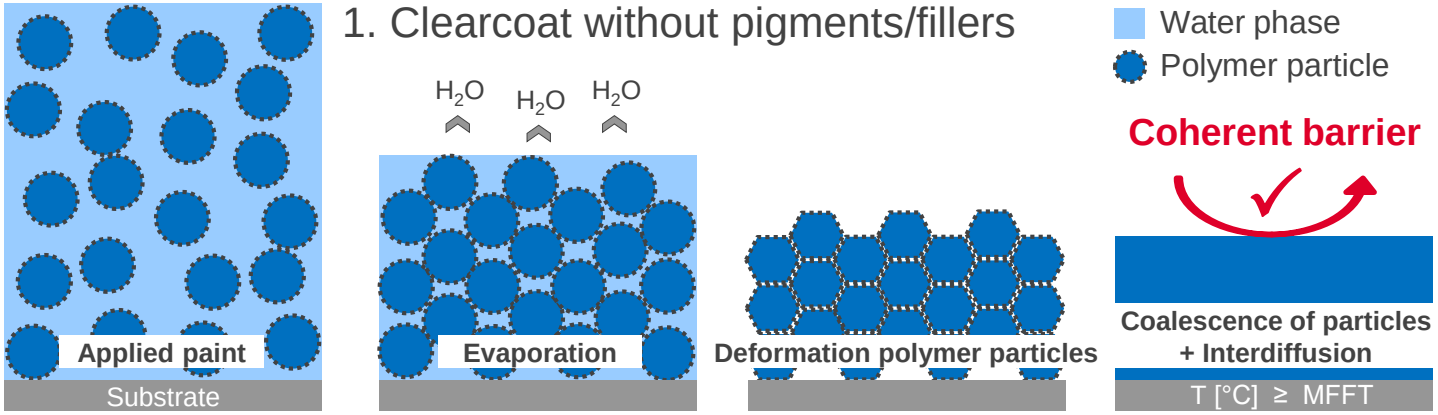
- Technical producibility / storage stability / processing properties
- Good adhesion, particularly for primer application
- Excellent corrosion protection

In addition, the deviating film forming process compared to solvent-based coatings places high claims on the use of modern fillers.

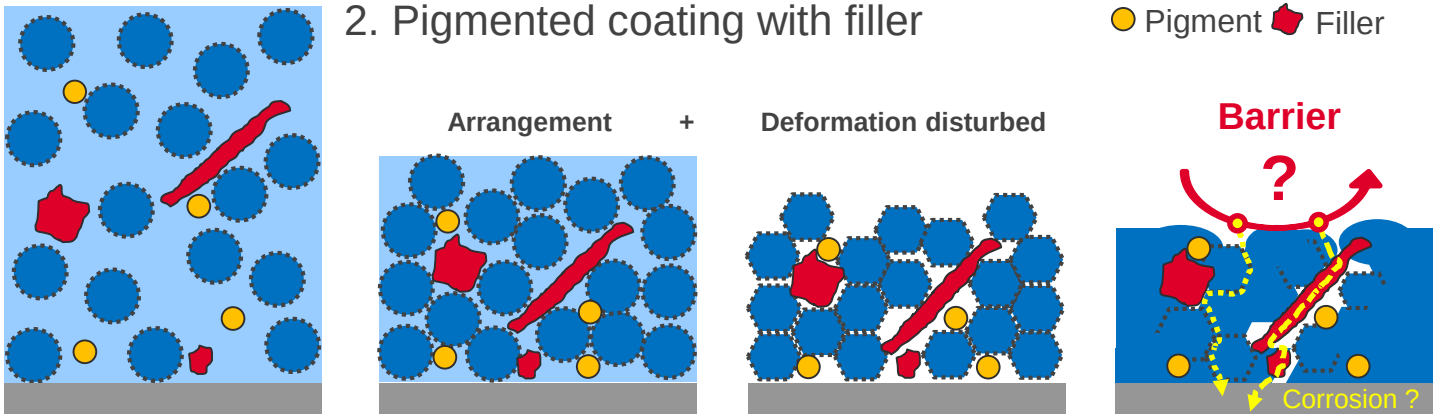
Corrosion Protection Requirements

Film formation process water-based paint

1. Clearcoat without pigments/fillers



2. Pigmented coating with filler



Objective

Use of Neuburg Siliceous Earth as a functional filler for optimizing the performance of water-based anti-corrosion coatings.

For this purpose the calcined and amino functionalized hydrophobic grade Aktifit PF 115 is used as a suitable variant.

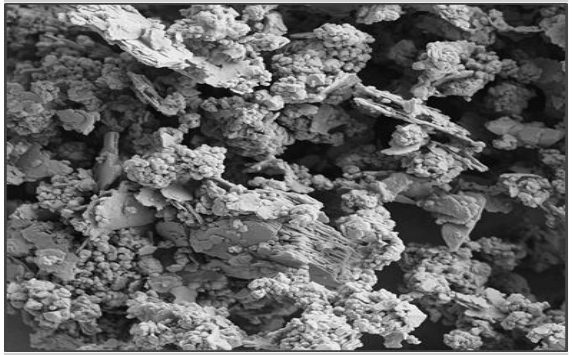
A common filler combination consisting of natural calcium carbonate and talc serves for comparison

Base formulation:	Acrylic primer red, physically drying PVC 31 %, Solids content 56 % (w/w)
Binder:	ALBERDINGK® SC 48, MFFT 14°C

Formulation Variants

				Control	NSE
Pigment preparation	1	Water demineralized		7.0	15.0
	2	Edaplan 490	dispersing additive	0.8	
	3	Byk 024	defoamer	0.1	
	4	Butyl glycol	co-solvent	3.0	
	5	Bayferrox 130 M	pigment, red	8.9	
	6	Filler	Ground calcium carbonate	10.5	
			Talc	3.0	
			Aktifit PF 115		13.5
	7	Heucophos ZPO	anti-corrosion pigment	7.0	
	8	Heucorin RZ	org. corrosion inhibitor	1.0	
Let Down	9	Alberdingk SC 48	acrylic dispersion	39.7	
	10	Water demineralized		10.9	2.9
	11	Optifilm Enhancer 300	co-solvent	1.0	
	12	Byk 024	defoamer	0.4	
	13	Byk 349	wetting agent	0.1	
	14	Ascotran H10	flash rust inhibitor	0.5	
	15	Ammonia (25 %)	neutralizing agent	0.8	
	16	Resydrol AX 237w/70BG	epoxy-alkyd resin	4.0	
	17	Borchi OXY-Coat 1101	drier	0.1	
	18	Tafigel PUR 41	rheology modifier	1.2	
Total [%]				100.0	
Solids content w/w [%]				56	
Pigment volume concentration [%]				31	

Filler Characteristics

	Calcium carbonate	Talc	Aktifit PF 115
Particle size d_{50} [µm]	1.1	8.0	2.3
Particle size d_{97} [µm]	3.5	24.1	8.5
Oil absorption [g/100g]	39	47	60
	Ø 41 Filler package		
Surface treatment	-	-	amino functionalized, hydrophobic

Preparative Methods

Mixing  Source: VMA Getzmann	Pigment preparation: • Dissolver with toothed disc (Cowles Blade) • 10 min at 10.0 m/s under ice water cooling Let Down: • Submission of binder thinned with water • Addition of remaining ingredients at 5.0 m/s • After dosing thickener finally 5 min at 5.0 m/s avoiding air entry
Application	After 28 d maturing time Substrate: cold rolled steel, Q-Panel Type R 48 Dual-Layer: undiluted with doctor blade 12 mm/s Automated film applicator / 4 h intermediate drying Total dry film thickness (DFT): ~ 150 µm Single-Layer: dilution to spray viscosity 3 mm compressed air nozzle at 2 bar, DFT ~ 80 µm
Conditioning 	Drying conditions 23°C / 50% RH Gloss: 7 d Adhesion / Corrosion Tests: 28 d 

Viscosity

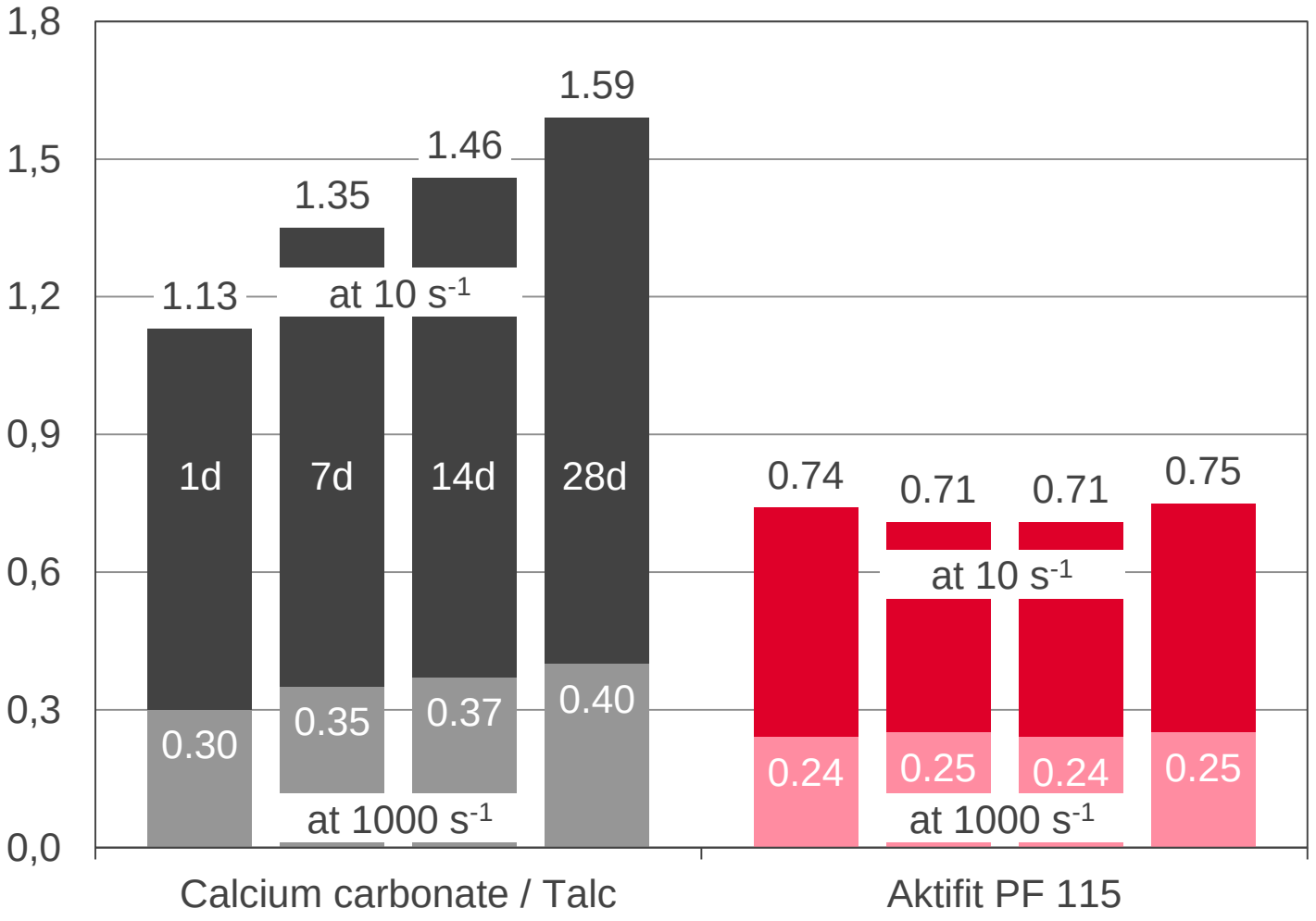
INTRODUCTION

EXPERIMENTAL

RESULTS

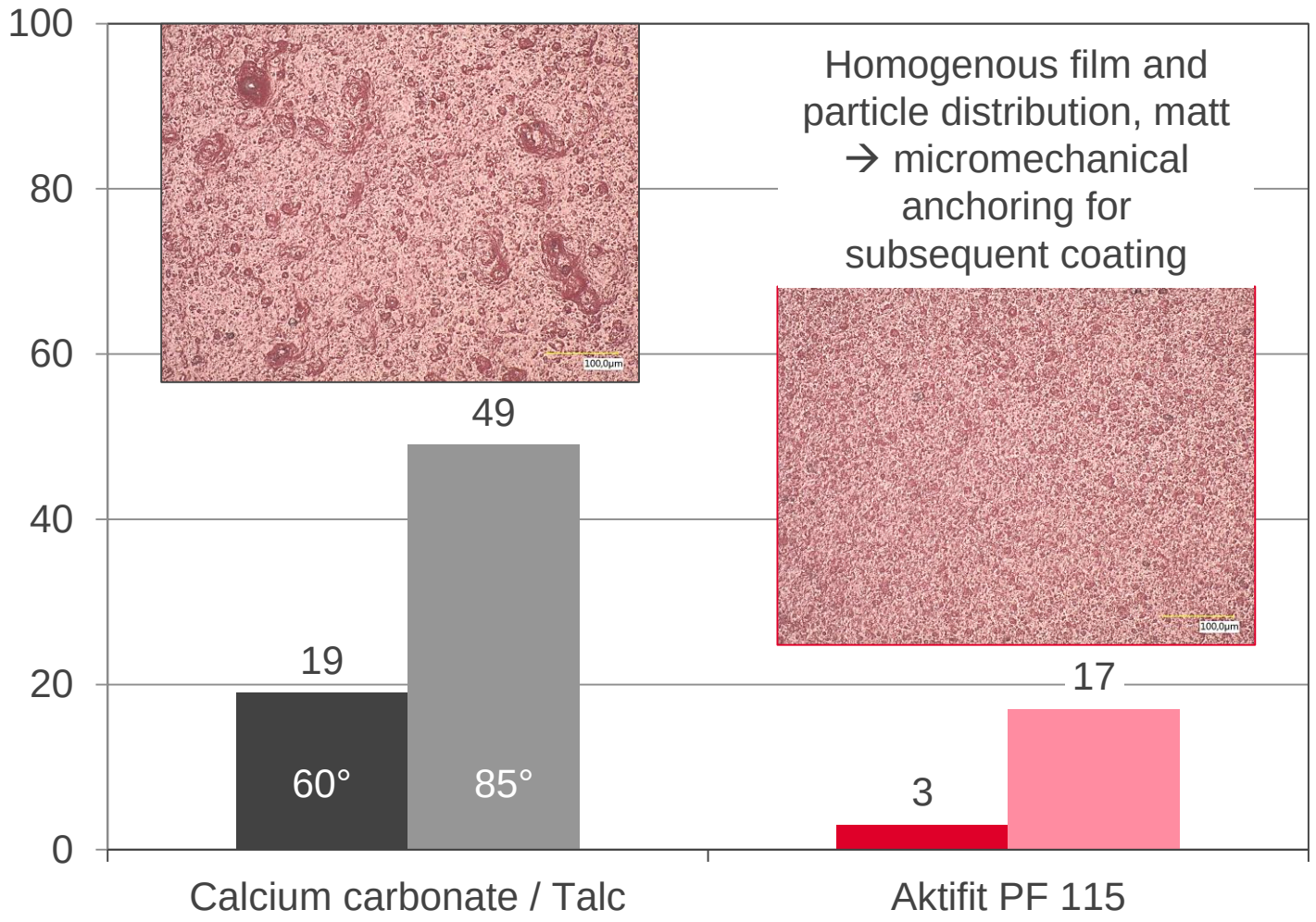
SUMMARY

Stability up to 28 days [Pa·s] MCR 300 / CC17 / 23°C



Appearance Dry Film

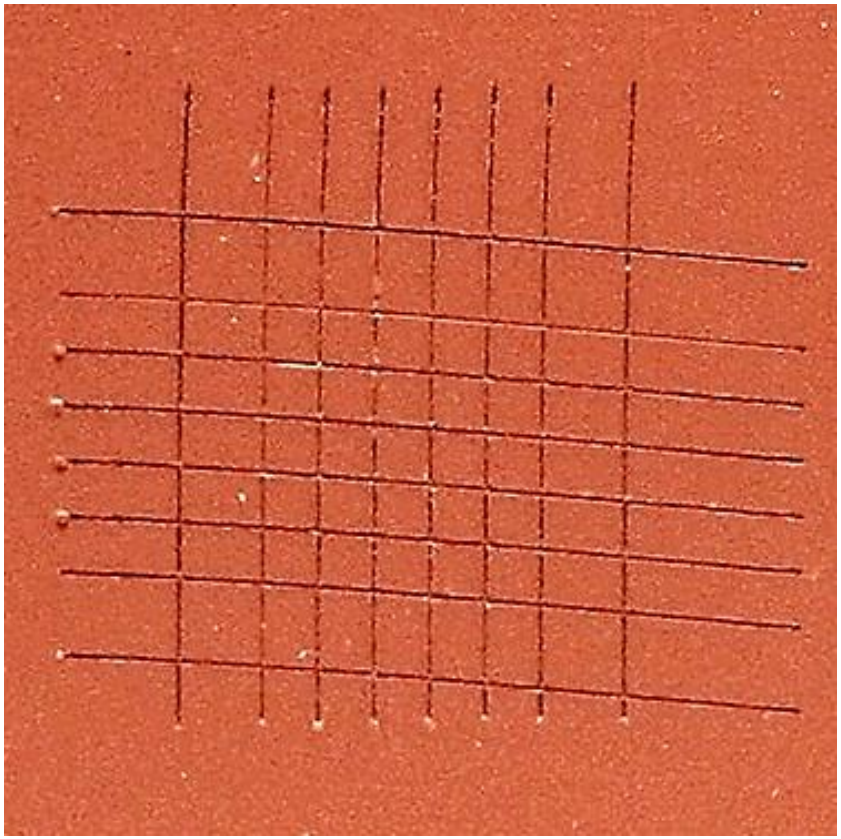
Gloss, [GU] / Microscopy of surface



Adhesion

Cross-cut test 2 mm, tape tear-off

Both variants
Rating: 0



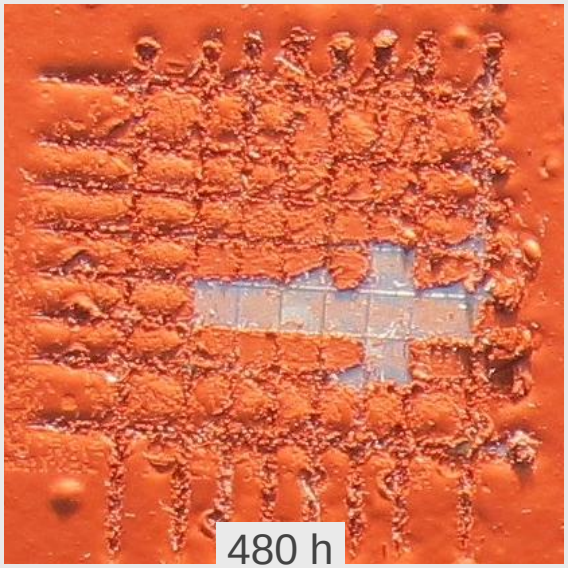
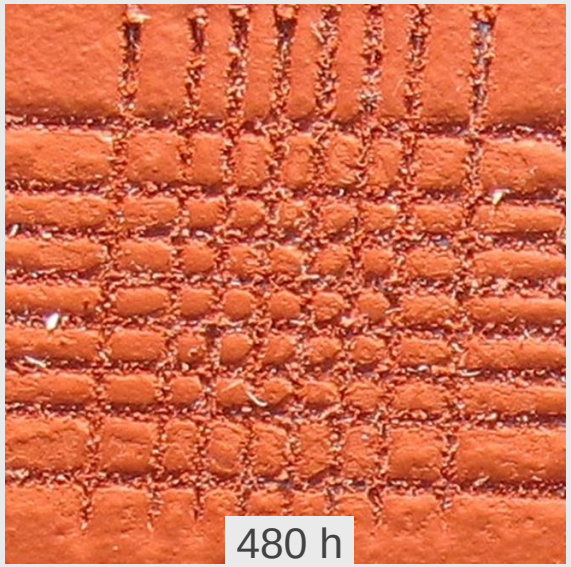
Corrosion Protection

Evaluation criteria on non-scribed surface and at scribe

Humidity test	DIN EN ISO 6270-2 CH
Non-scribed	• Adhesion • Blistering • Corrosion (stripped)

Salt spray test	DIN EN ISO 9227 NSS
Non-scribed	• Adhesion • Blistering • Corrosion (stripped)
Scribed Sikkens 1 mm 6 cm long	• Blistering • Delamination • Corrosion (stripped)

Humidity Test
Adhesion

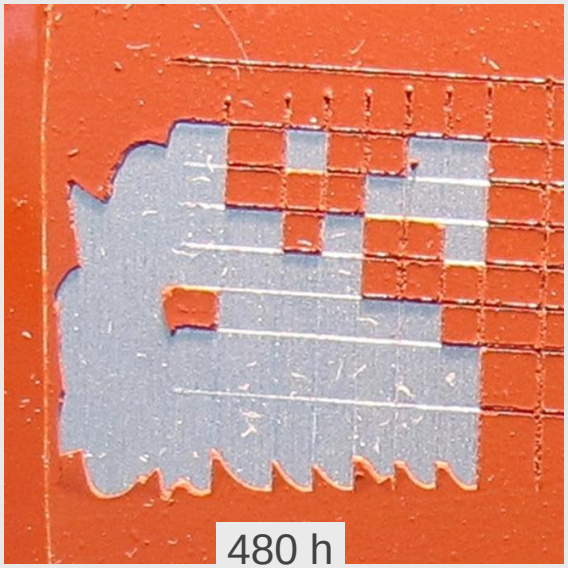
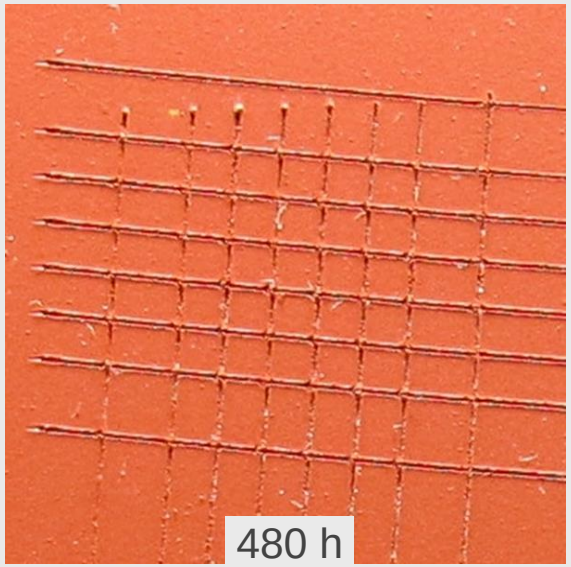
Calcium carbonate / Talc	Aktifit PF 115
	
GT 3	GT 0

Cross-cut test 2 mm after 1h 23°C / 50% RH and tape tear-off

Humidity Test
Non-Scribed

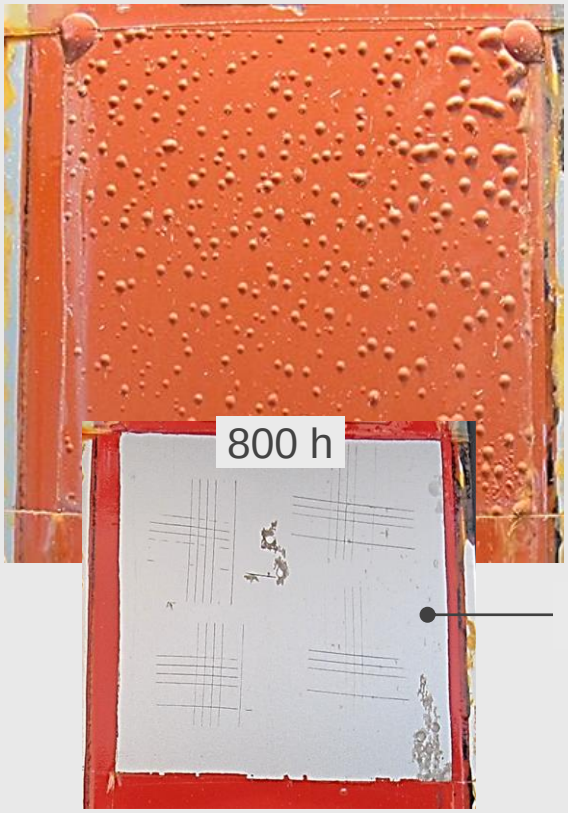
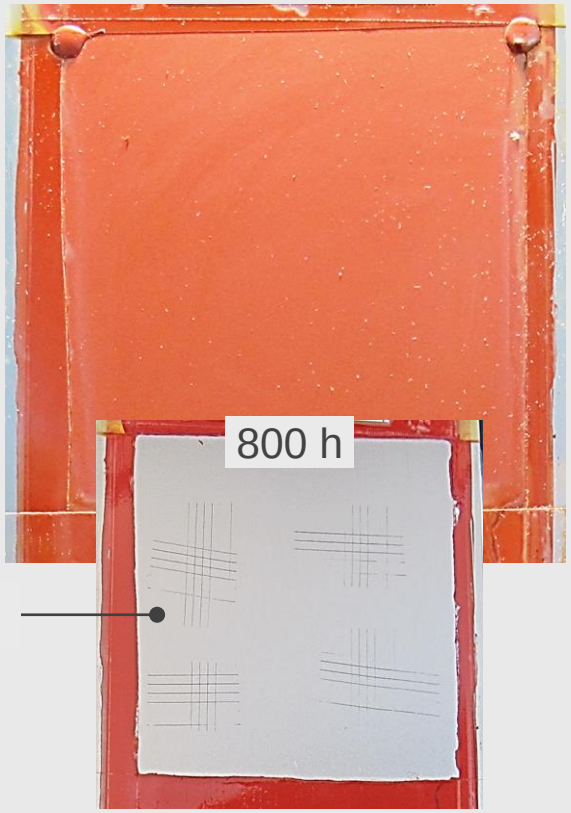
Calcium carbonate / Talc	Aktifit PF 115
	
blistering already after 240 h	blister-free
strong corrosion	virtually corrosion-free

Salt Spray Test
Adhesion

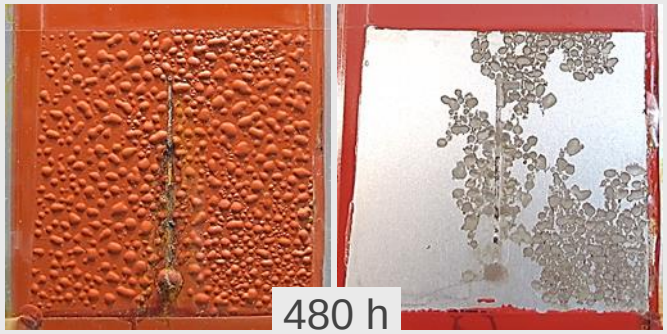
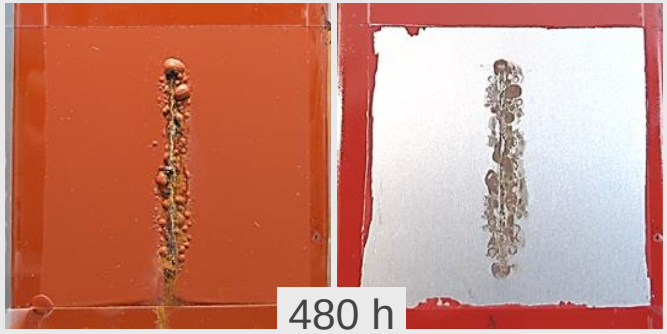
Calcium carbonate / Talc	Aktifit PF 115
 480 h	 480 h
GT 4 - 5	GT 0

Cross-cut test 2 mm after 1h 23°C / 50% RH and tape tear-off

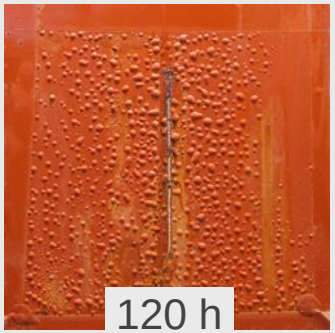
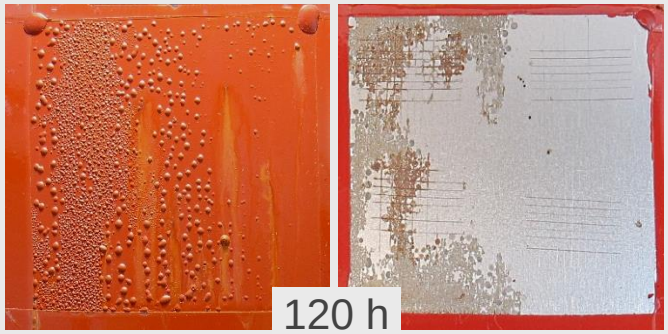
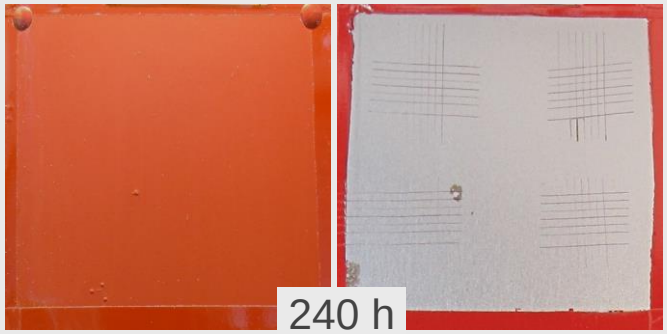
Salt Spray Test
Non-Scribed

Calcium carbonate / Talc	Aktifit PF 115
	
blistering already after 480 h	blister-free
punctual corrosion	corrosion-free

Salt Spray Test
Scribe

Calcium carbonate / Talc	Aktifit PF 115
 240 h	 240 h
No delamination at scribe	
 480 h	 480 h
blistering: early, lateral + strong	reduced and limited to scribe
corrosion: locally strong + extensive	

Salt Spray Test
Single-Layer, 80 µm DFT

Calcium carbonate / Talc	Aktifit PF 115
 120 h	 240 h
No delamination at scribe	
 120 h	 240 h
Barrier failed	intact

Summary

Suitable surface treated Neuburg Siliceous Earth improves the performance of the present anti-corrosion primer formulation.

Compared to the filler combination of ground calcium carbonate and talc, the calcined, hydrophobic grade Aktifit PF 115 is recommended by

- Lower viscosity and better stability during storage
- Higher wet-adhesion in humid and ionic environmental exposure
- Significant improvement in resistance to blistering and corrosion in non-scribed surface area
- Strongly inhibited corrosion progress after coating damage

Optimized barrier properties with Aktifit PF 115 provide

- VOC compliant corrosion protection with only a single filler
- Doubled protection period without loosing performance
- Layer thickness reduction: material / time / energy / cost savings
- Layer saving: Outstanding performance even for economical, much more critical single coat application

We supply material for good ideas!

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