

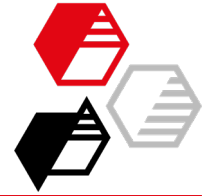
## Natural fillers for long-lasting corrosion protection

Author: Susanne Reiter, Hoffmann Mineral GmbH

European Coatings Show, 28.03.2023

# Content

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- Who is Hoffmann Mineral?
- What kind of filler is Neuburg Siliceous Earth?
- Outlook product portfolio
- Approvals in water-based anti-corrosion coatings
- Summary

# Hoffmann Group of Companies

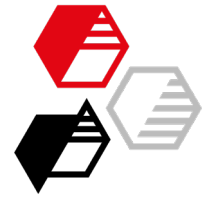


**HOFFMANN  
MINERAL**

**SONAX**

**DD**  
DuroDruck





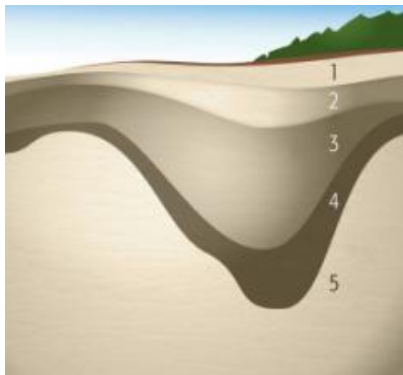
## Neuburg Siliceous Earth (NSE) – Formation of a unique raw material



- covered by the sea
- 95 million years ago
- NSE-layers on limestone sediment from the early Jurassic period



- professional mining



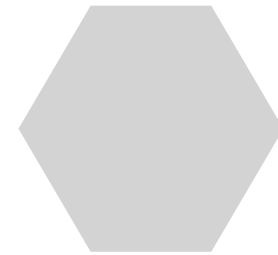
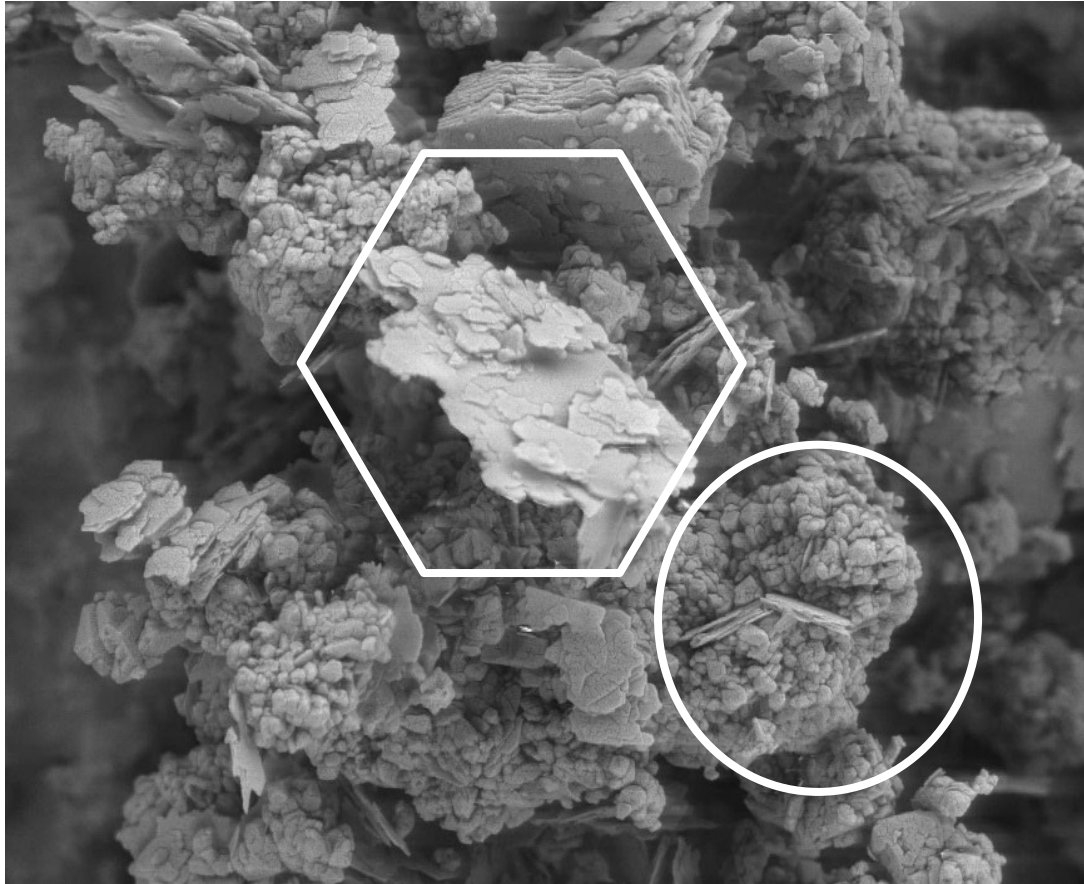
- collapsed limestone layer
  - forming karst funnels
- 1 overburden
  - 2 fine sand
  - 3 siliceous Earth
  - 4 clay
  - 5 limestone



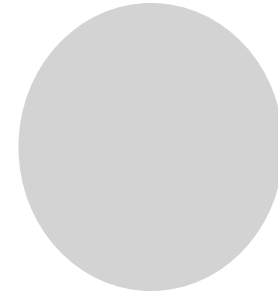
- creation of new biotopes



## Neuburg Siliceous Earth



lamellar: kaolinite



corpuscular: Neuburg silica



## Products – Neuburg Siliceous Earth



**Sillitin®**  
**Sillikolloid®**

**puriss**

**aktiSil®**

**Silfit®**

**aktifit®**

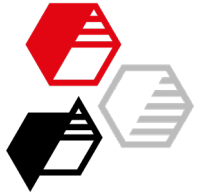
Standard product  
natural,  
untreated fillers

Improved dispersion  
properties created by  
a downstream  
process

Surface-treated  
products  
Neuburg Siliceous  
Earth treated with  
additives

Calcined products  
based on Sillitin

Activated Silfit  
produced through  
surface treatment  
with special additives



## Products – Tailored Filler Solutions

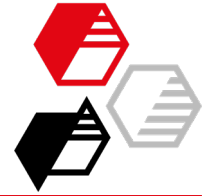
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The Tailored Filler Solutions are now expanding the portfolio. We will use our know-how of Neuburg Siliceous Earth and transfer it to new base materials, combined with innovative modifications for further improvement.

**GLOXiL**<sup>®</sup>

**struktoSiL**<sup>®</sup>

# Primer red, Acrylate, with **AKTIFIT PF 115**



## Formulation

Pigment preparation	Water demineralized		7.0	15.0
	Edaplan 490	dispersing agent	0.8	
	Byk 024	defoamer	0.1	
	Butyl glycol	co-solvent	3.0	
	Bayferrox 130 M	pigment	8.9	
	Filler	Calcium carbonate	10.5	
		Talc	3.0	
		<b>Aktifit PF 115</b>		<b>13.5</b>
Heucophos ZPO	anti-corrosion pigment	7.0		
Heucorin RZ	org. corrosion inhibitor	1.0		
Let down	Alberdingk SC 48	acrylic dispersion	39.7	
	Water demineralized		10.9	2.9
	Optifilm Enhancer 300	co-solvent	1.0	
	Byk 024	defoamer	0.4	
	Byk 349	wetting agent	0.1	
	Ascotran H10	flash rust inhibitor	0.5	
	Ammonia (25 %)	neutralizing agent	0.8	
	Resydrol AX 237w/70BG	epoxy-alkyd resin	4.0	
	Borchi OXY-Coat 1101	drier	0.1	
	Tafigel PUR 41	rheology modifier	1.2	
<b>Total [%]</b>			<b>100.0</b>	

Solids content w/w [%]	56
PVC [%]	31
Basis: Guide formulation FP 48-02 by Alberdingk Boley	
Preparation: dissolver with toothed disc	



# Primer red, Acrylate, with **AKTIFIT PF 115**



## Adhesion / Humidity Test / Salt Spray Test

		Cold rolled steel Q-Panel R 48		Total dry film thickness 150 µm as dual-layer		Drying 28 d 23°C / 50% RH	
		Calcium Carbonate + Talc		Aktifit PF 115			
Adhesion		GT 0		GT 0			
Cross-cut before test							
Humidity test		 480 h blistering already after 240 h GT 3 (1 h)	 stripped	 480 h blister-free GT 0 (1 h)	 stripped		
		 800 h blistering already after 480 h GT 4 - 5 (1 h)	 stripped	 800 h blister-free GT 0 (1 h)	 stripped		
Salt spray test		 no delamination at scribe 240 h 480 h	 stripped	 no delamination at scribe 240 h 480 h	 stripped		
		 no delamination at scribe 240 h 480 h	 stripped	 no delamination at scribe 240 h 480 h	 stripped		

# Primer grey, 2C Epoxy, with **SILLITIN V 85** and **AKTISIL AM**



## Formulation

	Low VOC PVC 32 %	Active pigment / Inhibitor free Fast drying / Mechanically flexible	Control	Filler blend by equal volume with <b>Neuburg Siliceous Earth</b>	
<b>Component A</b>					
Pigment Preparation	Water demineralized		11.94		
	Dispersing additive		3.52		
	Defoamer		0.16		
	Texanol		0.64		
	Titanium dioxide		21.85		
	Pigments yellow / black		1.60		
	<b>Talc</b>		<b>9.06</b>		
	Barite		24.62		
	<b>Neuburg Siliceous Earth</b>				<b>15.37</b>
Let Down	Rheology modifier		0.64		
	Methoxypropanol		1.07		
	Beckocure™ EH 2261w/41WA (Amine hardener)* <sup>1</sup>		24.90		
	<b>Total</b>		<b>100.00</b>	<b>94.69</b>	
<b>Component B</b>					
			<b>49.80</b>	<b>49.80</b>	
			64.1	62.8	
			Stoichiometric crosslinking ratio amine / epoxy 0.53		

Water-based 2C epoxy  
anti-corrosion coating

Allnex Company

Low VOC  
Active pigment / Inhibitor free

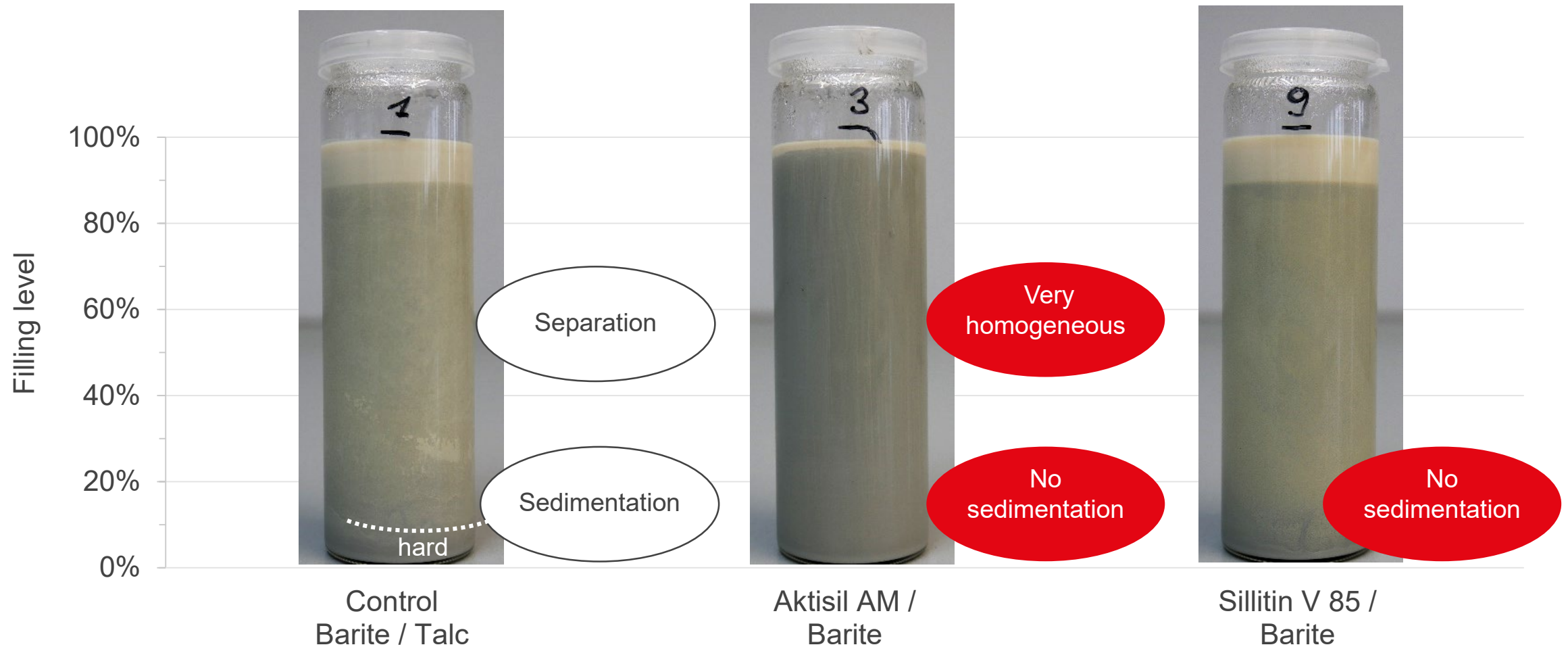
Fast drying  
Mechanically flexible

# Primer grey, 2C Epoxy, with **SILLITIN V 85** and **AKTISIL AM**



## Sedimentation

A-Component 28 days, 40°C







Cyclic Corrosion Test / Humidity Test – Blasted Aluminum

### Cyclic corrosion test

Drying  
14 days 23°C

Adhesion  
1 h / 24 h

Blistering  
Rusting

4 Cycles = 672 h

GT ≤ 1 ✓

0(S0) ✓

Ri 0 ✓

All DB  
compliant

Scribe  
Blistering  
Delamination /  
Corrosion  
≤ 2 mm

no

no ! ✓

... to 1680 h

GT ≤ 1

1(S2)

Ri 0

no

no !

### Humidity test

Drying  
14 days 23°C

Adhesion  
1 h / 24 h

Blistering  
Rusting

480 h ... to 1000 h

GT ≤ 1 ✓

0(S0) ✓

Ri 0

All DB  
compliant

Scribe  
Blistering  
Delamination /  
Corrosion

no

no



## Cyclic Corrosion Test / Humidity Test – Blasted Steel

### Cyclic corrosion test

Drying  
14 days 23°C

Adhesion  
1 h / 24 h

Blistering  
Rusting

4 Cycles = 672 h

GT ≤ 1 ✓

0(S0) ✓

Ri 0 ✓

All DB  
compliant

Scribe  
Blistering  
Delamination /  
Corrosion  
≤ 2 mm

≤ 2 mm

~ 1.7 mm ✓

... to 1680 h

GT ≤ 1

≤ 2(S2)

max. punctual

≤ 4 mm

~ 3.2 mm

### Humidity test

Drying  
14 days 23°C

Adhesion  
1 h / 24 h

Blistering  
Rusting

480 h ... to 1000 h

GT ≤ 1 ✓

0(S0) ✓

Ri 0

All DB  
compliant

Scribe  
Blistering  
Delamination /  
Corrosion

≤ 1 mm

< 1 mm

# Primer-surfacer yellow, 2C Epoxy with **AKTISIL AM** and **AKTIFIT AM**



## Formulation

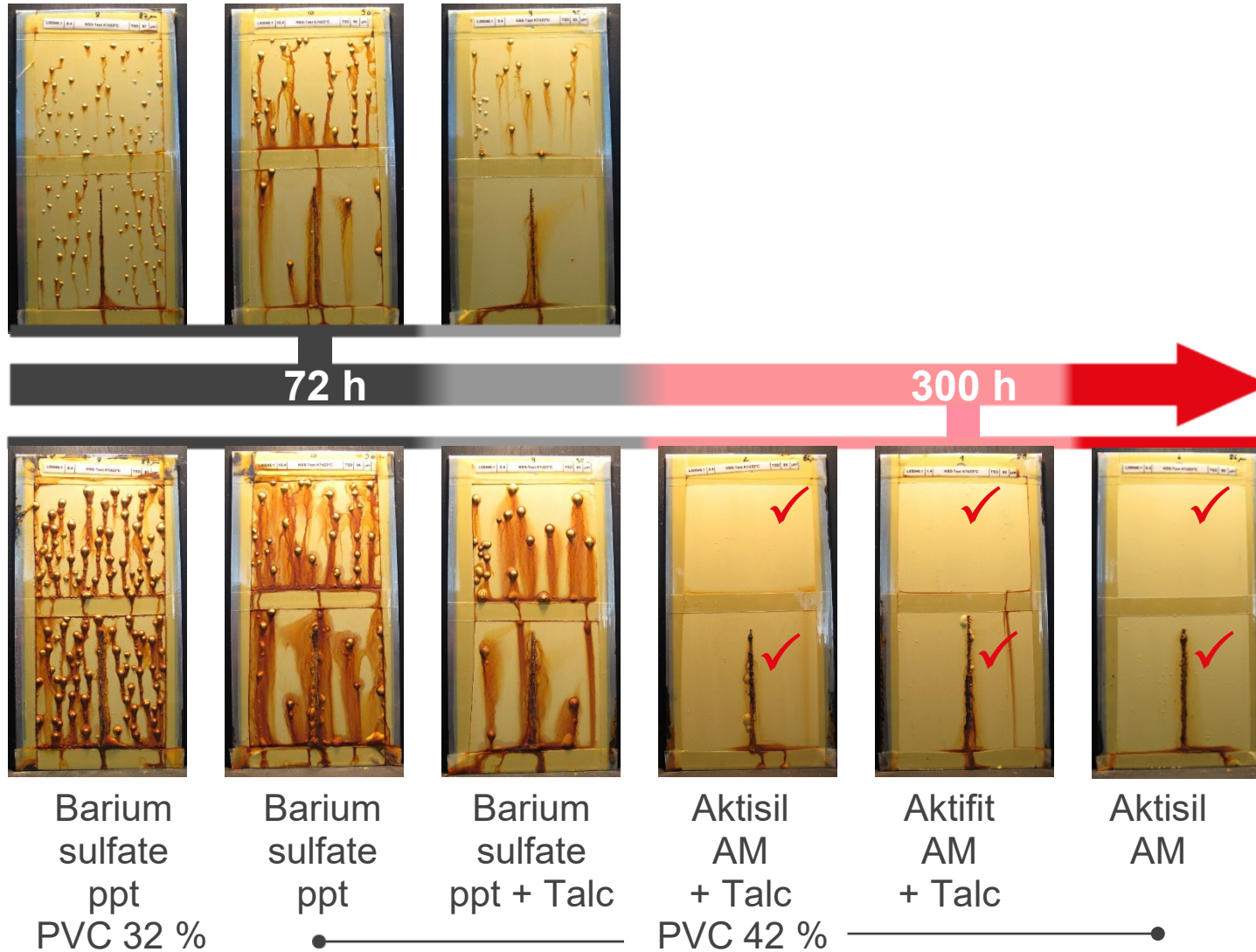
		Control with barium sulfate ppt		Replacement of filler			
		PVC	Filler dosage increased	Substitution by equal volume			
				+ Talc	Aktisil AM + Talc	Aktifit AM + Talc	Aktisil AM
		32 %	42 %	constantly			
Component A	Water demineralized	15.1	17.5	19.1	30.5	30.5	32.0
	Dispersing additive	3.3	3.3	3.3	3.3	3.3	3.3
	Defoaming additive	0.1	0.1	0.1	0.1	0.1	0.1
	Titanium dioxide	8.0	8.0	8.0	8.0	8.0	8.0
	Pigments yellow / red	2.53	2.53	2.53	2.53	2.53	2.53
	<b>Barium sulfate ppt</b>	<b>45</b>	<b>75</b>	<b>50</b>			
	<b>Talc</b>			<b>15</b>	<b>15</b>	<b>15</b>	
	<b>Neuburg Siliceous Earth</b>				<b>30</b>	<b>30</b>	<b>44</b>
	Defoaming additive	0.05	0.05	0.05	0.05	0.05	0.05
	Texanol	0.6	0.6	0.6	0.6	0.6	0.6
	Rheology Modifier	0.6	0.6	0.6	0.6	0.6	0.6
	Methoxypropanol	1.0	1.0	1.0	1.0	1.0	1.0
	Beckocure™ EH 2261w/41WA (Amine hardener)* <sup>1</sup>	24.2	24.2	24.2	24.2	24.2	24.2
	Corrosion inhibitors	2.4	2.4	2.4	2.4	2.4	2.4
	Water demineralized	1.4					
Component B	Beckopox™ EP 387w/52WA (Epoxy resin)* <sup>1</sup>	41.3	41.3	41.3	41.3	41.3	41.3
	Water demineralised	4.6	4.6	4.6	4.6	4.6	4.6
<b>Total</b>		<b>150.2</b>	<b>181.2</b>	<b>172.8</b>	<b>164.2</b>	<b>164.2</b>	<b>164.7</b>



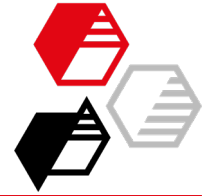
# Primer-surfacer yellow, 2C Epoxy with **AKTISIL AM** and **AKTIFIT AM**



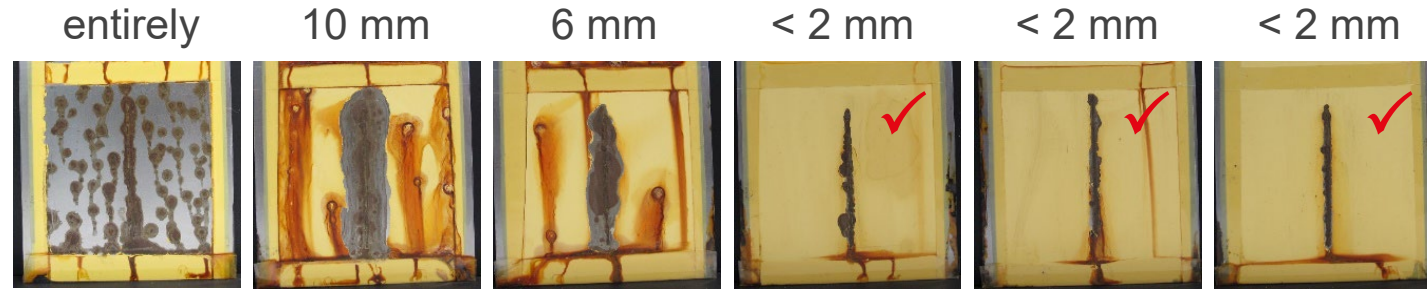
## Salt Spray Test



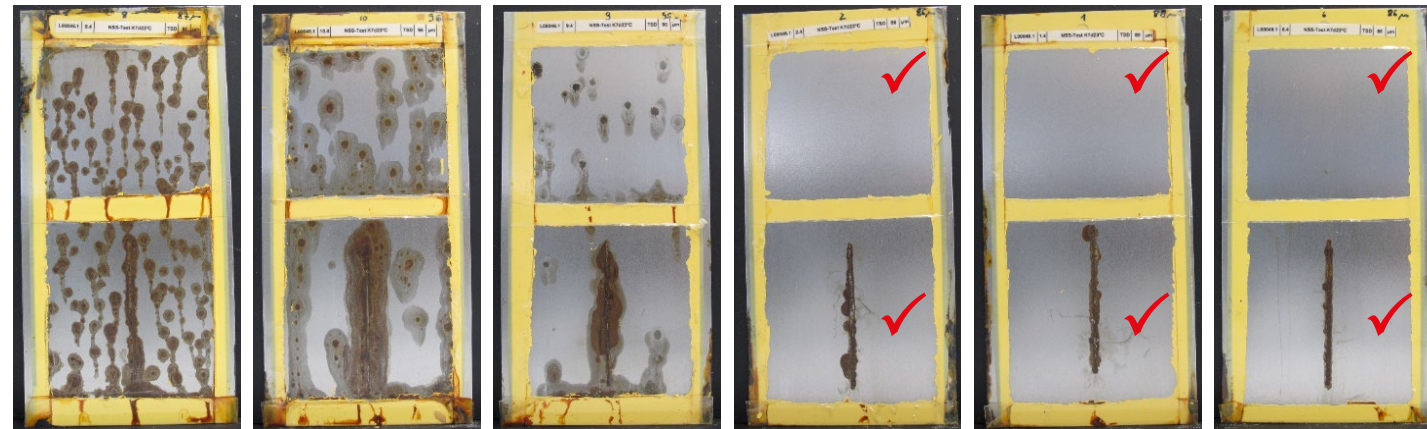
# Primer-surfacer yellow, 2C Epoxy with **AKTISIL AM** and **AKTIFIT AM**



Salt Spray Test 300 h – delamination at scribe/stripped coating after 24 h regeneration time



+ coating stripped



Barium sulfate ppt

Barium sulfate ppt

Barium sulfate ppt + Talc

Aktisil AM + Talc

Aktifit AM + Talc

Aktisil AM

PVC 32 %

PVC 42 %

# DTM (white), Acrylate, with **SILLITIN Z 89** and **AKTIFIT Q**

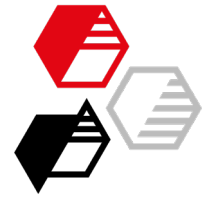


## Formulation

Pigment preparation	Water demineralised		5.90	
	Edaplan 490	dispersing agent	1.20	
	AMP 90	neutralizing agent	0.02	
	Byk 024	defoamer	0.10	
	Byk 349	wetting agent	0.18	
	Kronos 2190	pigment	17.70	
	<b>Filler</b>		<b>7.50</b>	
	Water demineralized		2.90	
Let down	Alberdingk AC 2403		57.90	
	Byk 024		0.15	
	premix	Asconium 142DA	corrosion inhibitor	1.90
		AMP 90	neutralizing agent	0.15
		Water demineralized		1.90
	Optifilm Enhancer 300		1.50	
	Ascotran H10		0.50	
	Tafigel PUR 60 solution (10 % PUR 60; 20 % Dowanol DPM; 70 % Water)		0.50	
<b>Total [%]</b>		<b>100.00</b>		

Solids content w/w [%]	56
PVC [%]	21
Basis: Guide formulation FP 2403-44 by Alberdingk Boley	
Preparation: dissolver with toothed disc	

# DTM (white), Acrylate, with **SILLITIN Z 89** and **AKTIFIT Q**



## Salt Spray Test / Humidity Test 1000 h

Cold rolled steel Q-Panel R 48, spray application, total dry film thickness 70 µm as single-layer, drying 28 d 23 °C / 50 % RH

	Calcium Carbonate		Sillitin Z 89		Aktifit Q	
Humidity test 1000 h						
	cross-cut: GT 1-2 (24 h)	stripped  incipient under-film corrosion	cross-cut: GT 0-1 (24 h)	stripped	cross-cut: GT 0-1 (24 h)	stripped
Salt spray test 1000 h						
	delamination: rust creep:	26.3 mm 1.4 mm	delamination: rust creep:	17.9 mm 0.7 mm	delamination: rust creep:	4.8 mm 0.6 mm



# DTM (black), Acrylate, with **AKTISIL AM**



## Formulation

			BaSO <sub>4</sub>	Aktisil AM
Formulation completion	Setaqua DTM 6851	Acrylic dispersion	714.0	714.0
	Ammonia 25%		2.0	2.0
	Filler Paste		192.0	159.5
	Black Paste		84.5	84.5
	Water demineralized		10.0	
	flashproTAC C4E	Flash rust inhibitor	2.0	1.0
	Byk 024	Defoamer	2.0	1.0
	Asconium 142 DA	Org. corrosion inhibitor		20.0
	AMP 90	Neutralizing agent		1.5
	Tego Wet KL 245	Wetting agent		2.0
	Tego Glide 494	Slip and flow additive		1.5
	Tafigel PUR 45 (1:1 in Water)	Thickener		10.0
	Additol VXW 6387	Anti-settling	2.0	
	Additol XW 6580	Wetting agent	2.5	
	Additol VXW 6388 (1:10 in Water)	Thickener	28.5	
<b>Total</b>		<b>1039.5</b>	<b>997.0</b>	
Pigment volume concentration [%]			12.3	
Solids content w/w [%]			46.2	43.5

# DTM (black), Acrylate, with **AKTISIL AM**



## Formulation of the filler paste

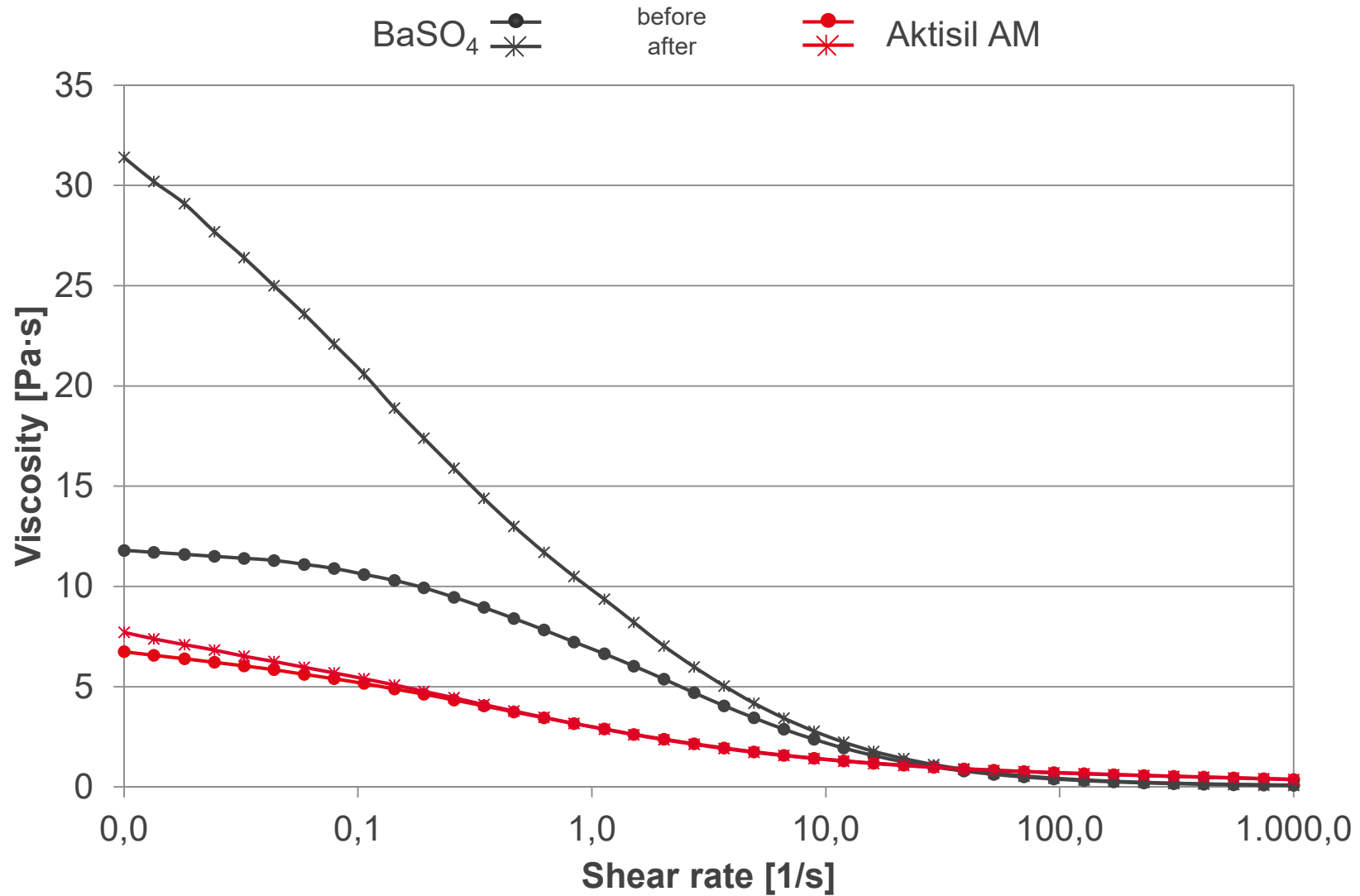
			BaSO <sub>4</sub>	Aktisil AM
Filler paste	Water demineralized		33.89	53.89
	Additol XW 6588	Dispersing additive	5.76	5.76
	Byk 024	Defoamer	3.07	3.07
	Dowanol DPM		5.76	5.76
	Aerosil R 972	Thickener	0.38	
	Barium sulfate natural	Filler	105.79	
	<b>Aktisil AM</b>	<b>Functional Filler</b>		<b>91.02</b>
	Nubirox 102	Anti-corrosion pigment	33.99	
	Additol VXW 6388	Thickener	0.48	
	Rheobyk 7420 ES	Thickener	2.88	
<i>Subtotal</i>			<i>192.0</i>	<i>159.5</i>
Black paste	Water demineralized		63.29	
	Surfynol 104 E	Surfactant	0.34	
	Colour Black OE 430 W	Pigment black	20.87	
	<i>Subtotal</i>			<i>84.5</i>



# DTM (black), Acrylate, with **AKTISIL AM**



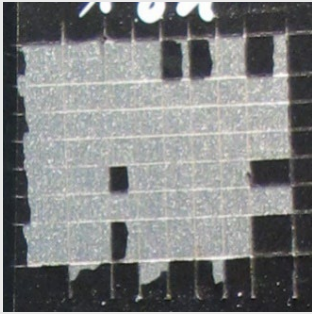
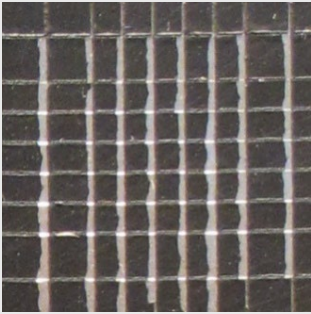
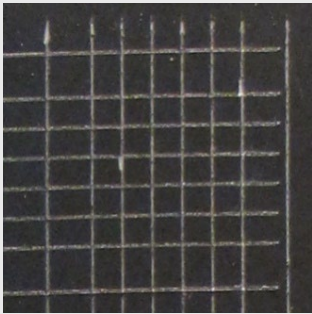
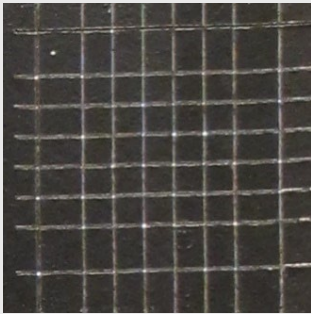
Storage Stability 8 weeks at 40°C



# DTM (black), Acrylate, with **AKTISIL AM**



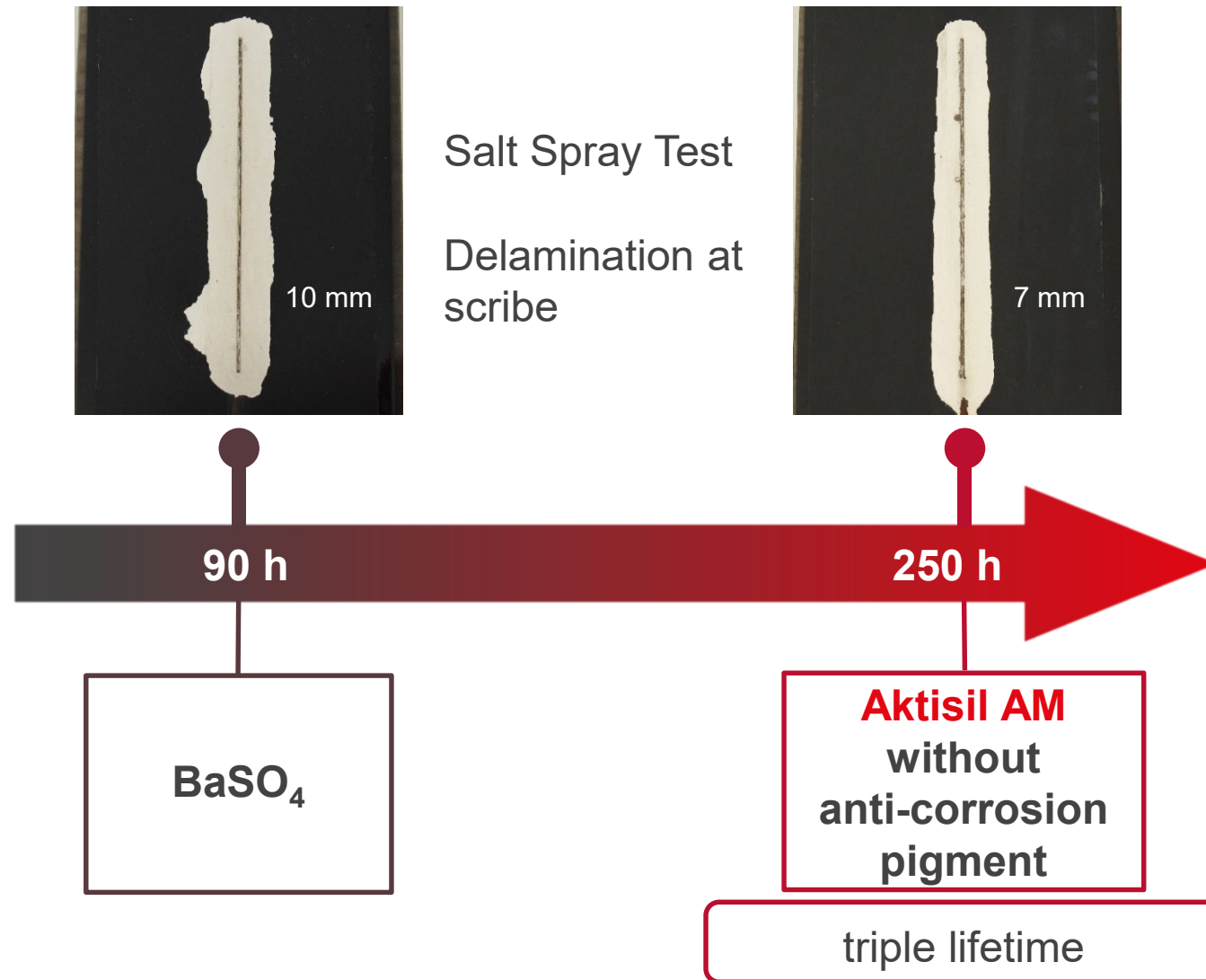
## Humidity Test - adhesion by cross-cut test 2mm with tape

Test duration	18 h	250 h
Regeneration time 23 °C, 50 % rel. H.	1 h	24 h
BaSO <sub>4</sub>		
value	5	1
<b>Aktisil AM</b> without anti- corrosion pigment		
value	0	0

# DTM (black), Acrylate, with **AKTISIL AM**



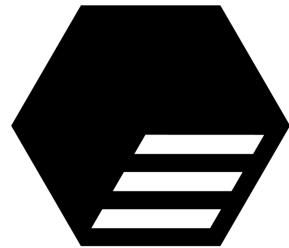
## Salt Spray Test – results at scribe



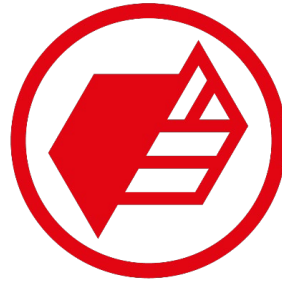
# Summary



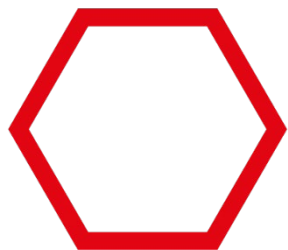
AKTIFIT Q



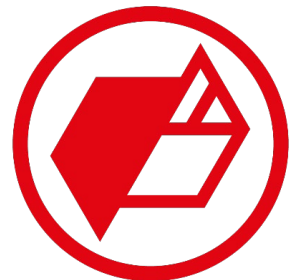
SILLITIN V 85



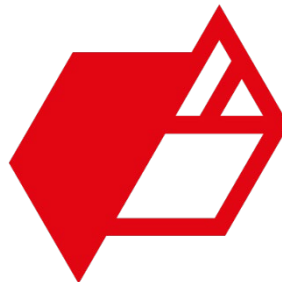
AKTIFIT PF 115



SILLITIN Z 89



AKTIFIT AM



AKTISIL AM

## Neuburg Siliceous Earth:

For a sustainable and efficient path to the future.

Made in Germany.



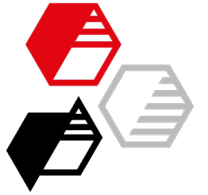
**HOFFMANN**  
**MINERAL**<sup>®</sup>



Life Cycle  
Assessment  
Regular  
Surveillance



www.tuv.com  
ID 000084068



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**Thank you very much for your attention!**

**Please visit us in hall 3A, booth 332**



[susanne.reiter@hoffmann-mineral.com](mailto:susanne.reiter@hoffmann-mineral.com)  
Mobile: +49 (0)171 5879848