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Neuburg Siliceous Earth

in UV-curing wood coatings:

Transparent primer

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Contents

1 Introduction

Annual growth has been running at around 10 to 20 % with these systems since the beginning of the 90's due to the increased demand for environmental tolerability (solvent-free) and good mechanical characteristics of UV varnishes.

The objective of the present study was to demonstrate the advantages of Neuburg Siliceous Earth over competitive fillers in relation to optical properties and abrasion resistance in a transparent UV-curing parquet primer.

2 Experimental

The tests were carried out at BASF, Ludwigshafen. Thanks a lot for the kind support and assistance.

2.1 Basic structure of UV-curing parquet coatings

Surfacer
Amount used: 50 g/m²
Filler content: 30-40 %

The surfacer is necessary to remove any unevenness after sanding and to avoid sharp outlines (black streaking and indentation) in the individual wood elements. The surfacer also ensures that the primer cannot penetrate too deeply into the wood and this prevents discoloration. High-quality silicate fillers are essential in order to improve sanding and the mechanical properties of the surfacer.

Primer
Amount used: 15-20 g/m²
Filler content: 10-15 %

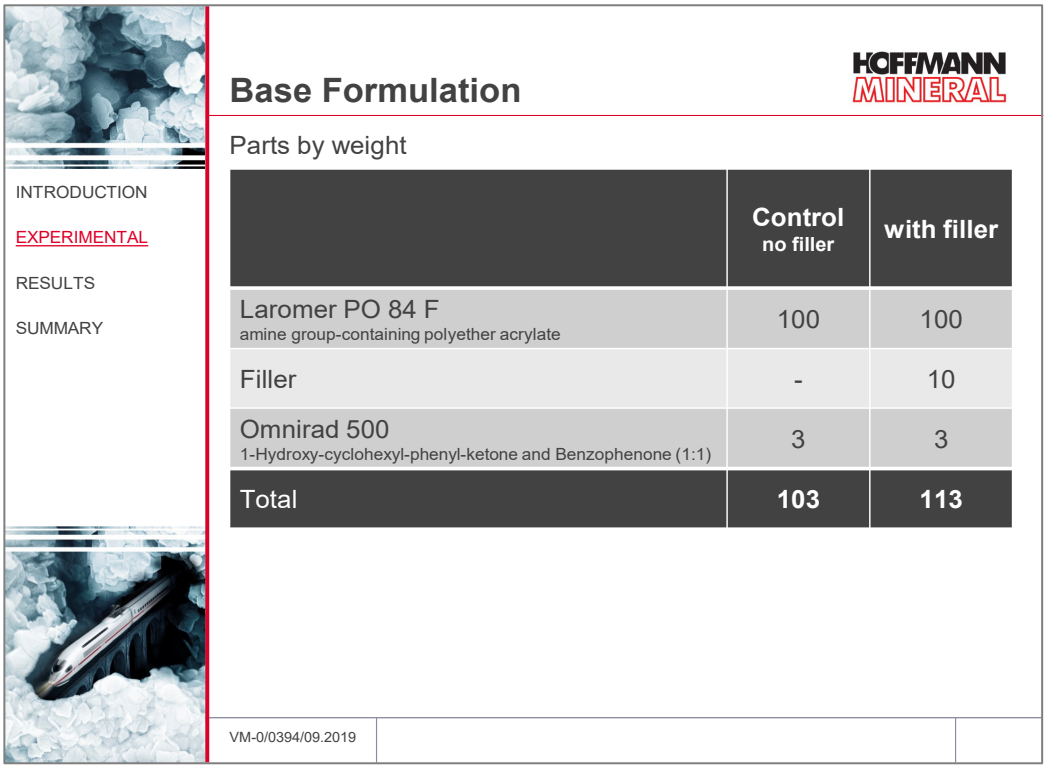
To compensate unevenness of the wood surface and to improve adhesion, an intermediate sanding takes place after filling. Then the primer is rolled up by machine. Surfacer and primer mainly influence the mechanical properties (abrasion, scratch resistance, adhesion).
To improve sandability, it is recommended to add small quantities of talc to primers.

Top coat (clear coat)
Film thickness: some µm
No filler

A filler-free varnish is applied by roller to provide a high gloss and a smooth surface.

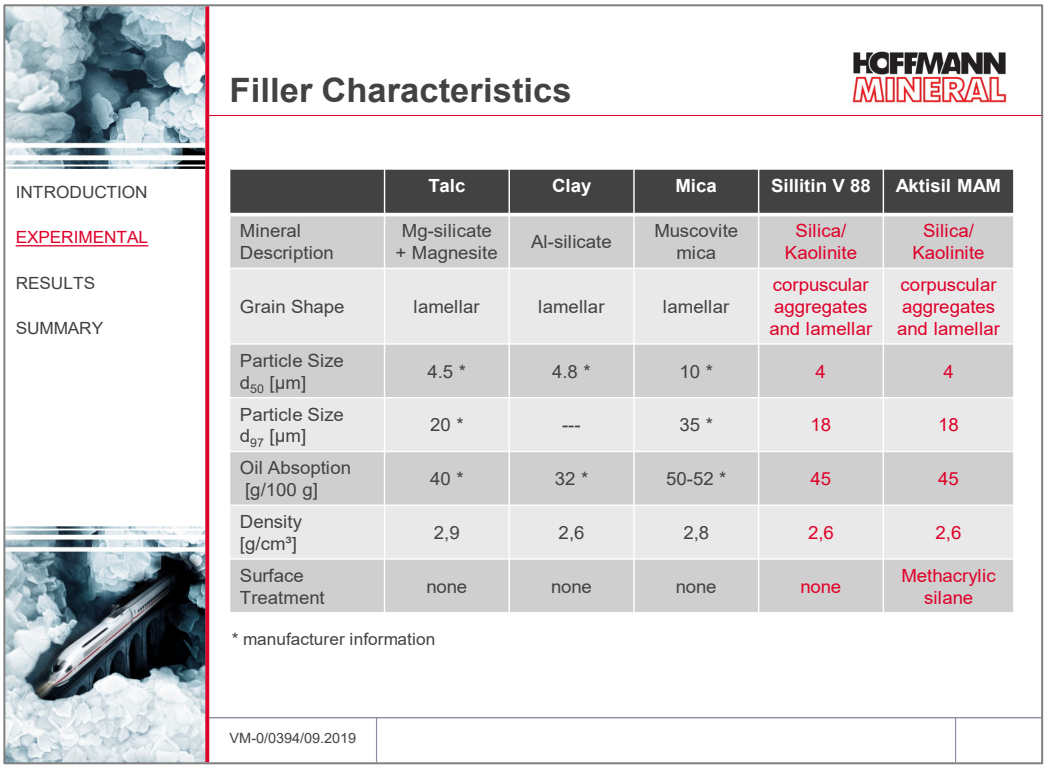
2.2 Base formulation

The base formulation for this study was a guide formulation from BASF for a UV-curing primer.
In the filler-free base formulation additively 10 parts by weight of fillers were incorporated.



2.3 Filler characteristics

Competitive fillers were talc, clay and mica. From the Neuburg Siliceous Earth range, Sillitin V 88 and Aktisil MAM were selected.



2.4 Neuburg Siliceous Earth

Structure

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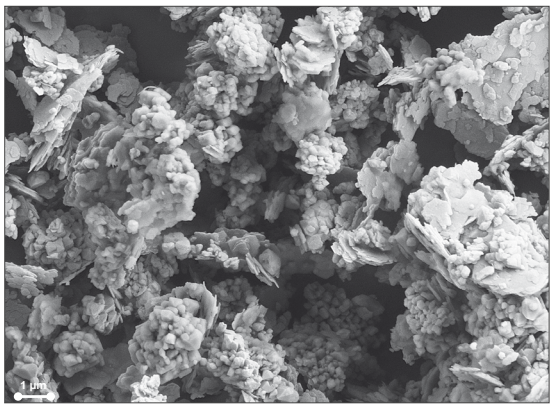

A natural combination of corpuscular Neuburg silica and lamellar kaolinite: a loose mixture impossible to separate by physical methods.

The silica portion exhibits a round grain shape and consists of aggregated primary particles of about 200 nm diameter.

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Morphology of Neuburg Siliceous Earth

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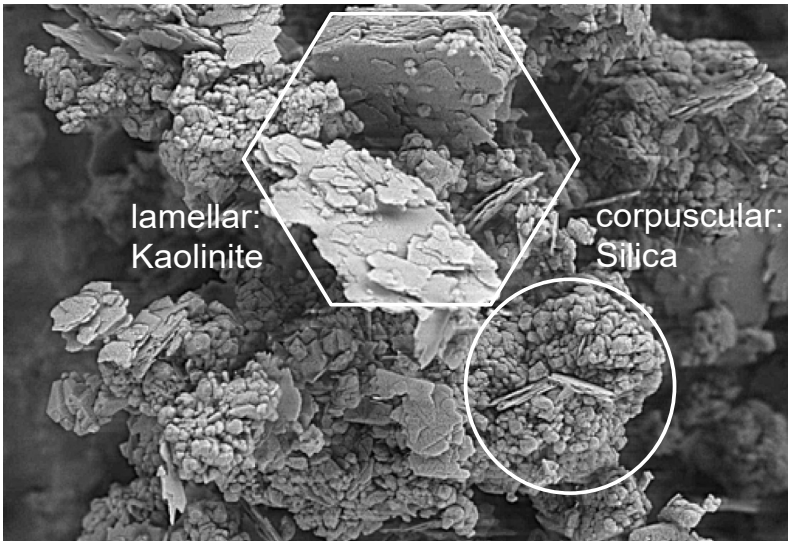
Magnification 10.000x



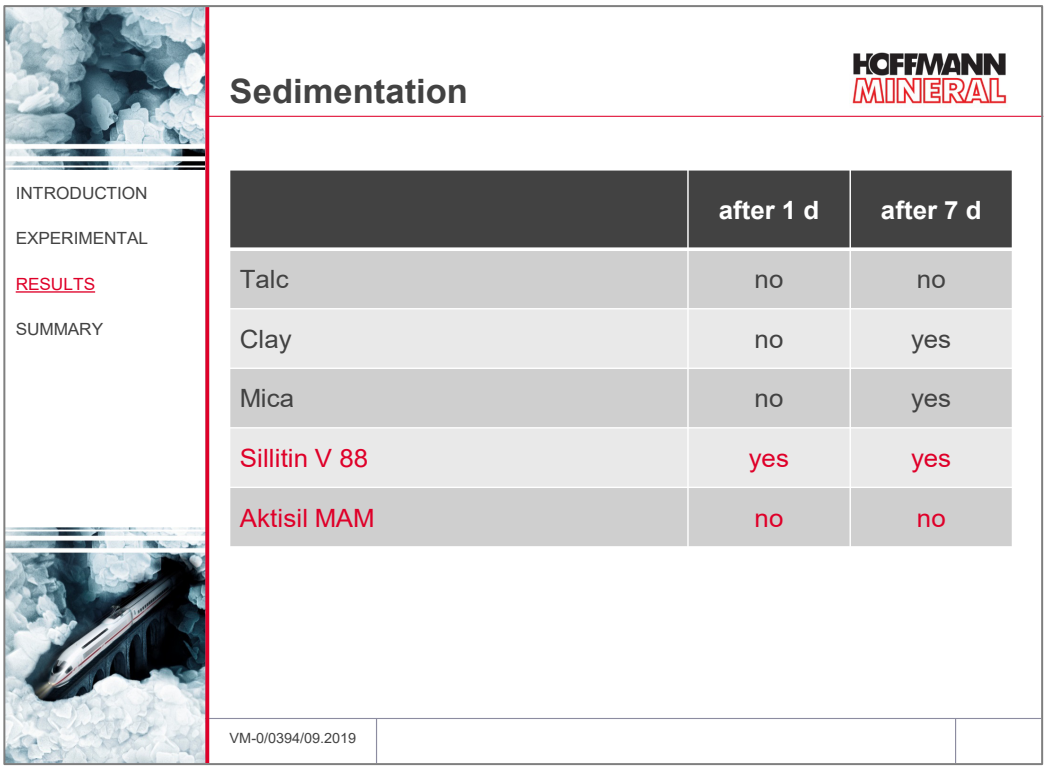
VM-0/0394/09.2019

Aktisil products are made by modyfing the surface of Neuburg Siliceous Earth with chemical agents, mostly silanes. The by-products (for example alcohols) split off during the treatment reaction of the Aktisil grades are largely removed during the production process, which firmly attaches the silane to the filler surface. This helps minimize undesirable side effects, as they are potentially encountered with in-situ mixing (direct addition of silane to the compound).

The Aktisil MAM used in the study is surface-treated with methacrylic silane and therefore fits very well into radical-crosslinking systems. During crosslinking (curing) of the coating system, the methacrylic groups of the Aktisil MAM, especially in the presence of radicals, react with the functional groups of the binder.

3 Results

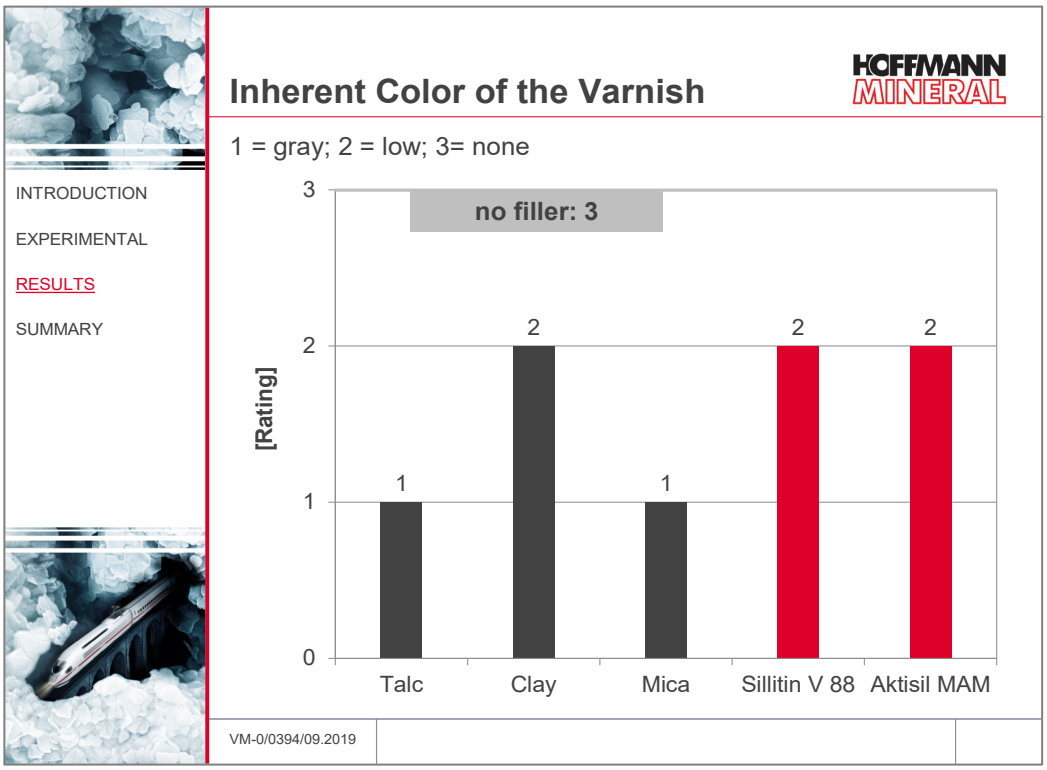
3.1 Sedimentation



	after 1 d	after 7 d
Talc	no	no
Clay	no	yes
Mica	no	yes
Sillitin V 88	yes	yes
Aktisil MAM	no	no

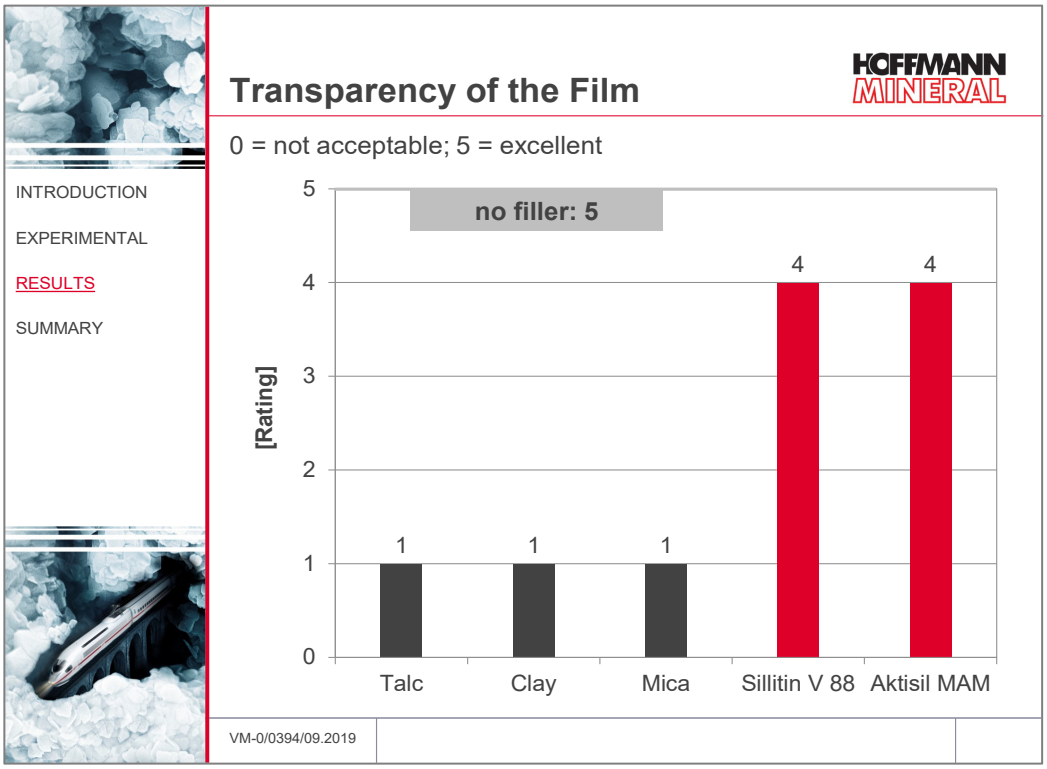
Aktisil MAM showed no sedimentation after 7 days of storage.

3.2 Inherent color of the varnish



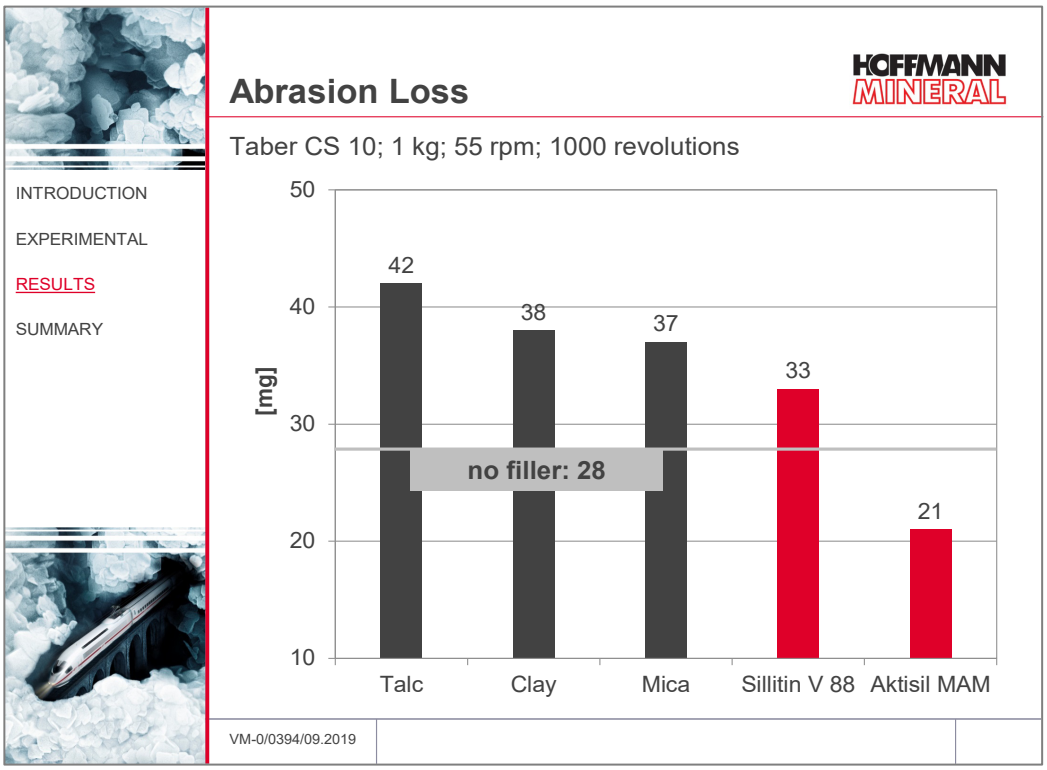
In the case of talc and mica, a distinct gray inherent color of the varnish occurred. With Neuburg Siliceous Earth and clay, the inherent color of the paint was significantly lower.

3.3 Transparency of the film



The transparency of the coating films was significantly better with the Neuburg Siliceous Earth Products Sillitin V 88 and Aktisil MAM than with the competitive fillers.

3.4 Abrasion loss



In the Taber abrasion test, the untreated Sillitin V 88 already showed a slight improvement over the competitive fillers.
The surface-treated Aktisil MAM achieved by far the lowest abrasion loss even below the level of the reference formulation without filler.

4 Summary

The competitive fillers talc, clay and mica have significant disadvantages, both in terms of transparency as well as abrasion.

Advantages of Neuburg Siliceous Earthin UV-cured varnish systems:

- very high transparency (no graying)
- good price/performance ratio due to high filling capacity
- good sandability
- good adhesion
- high resistance to scratching
- improved abrasion resistance with Aktisil MAM

The untreated Neuburg Siliceous Earth grade Sillitin V 88 offers good properties as a cost-effective filler for UV-curing parquet varnishes.

Aktisil MAM shows consistently good results in all tests. Systems filled with Aktisil MAM have little inherent color of the varnish and excellent transparency. The sedimentation tendency of Aktisil MAM is also very low. The abrasion resistance of the coating is significantly improved by Aktisil MAM.
The sandability by machine is maintained. Nevertheless, if there is a need for a higher sanding removal, this can be achieved by adding a small amount of talc.

Aktisil MAM is an optimal filler in transparent UV-curing parquet primers for dark and light woods.

Not tested in this study, but additionally recommended:

Silfit Z 91	similar to Sillitin V 88, but with highest color neutrality, best dispersion properties, higher gloss
Aktifit Q	same as Silfit Z 91, but with lower viscosity and improved abrasion resistance
Aktifit VM	same as Aktifit Q, but improved hiding power in white pigmented coatings without UV-curing problems
Sillitin Z 89	same as Sillitin V 88, but with lower color neutrality, higher viscosity, reduced sedimentation, higher gloss
Sillitin Z 89 puriss	same as Sillitin Z 89, but with improved dispersion
Aktisil VM 56/89	same as Sillitin Z 89, but with improved abrasion resistance

5 Appendix: Guide formulations

You can also find the recommended formulations on our homepage.

UV-curing transparent surfacer for wood, without reactive diluent (I45404.0 [1])

UV-curing transparent primer for wood, highly reactive, without reactive diluent (I45401.0 [1])

UV-curing transparent primer for wood, highly reactive, TSCA-approved, without reactive diluent (I45402.0 [1])