

***HOMBITEC –
the inorganic UV-
Absorber for long-
term protection***

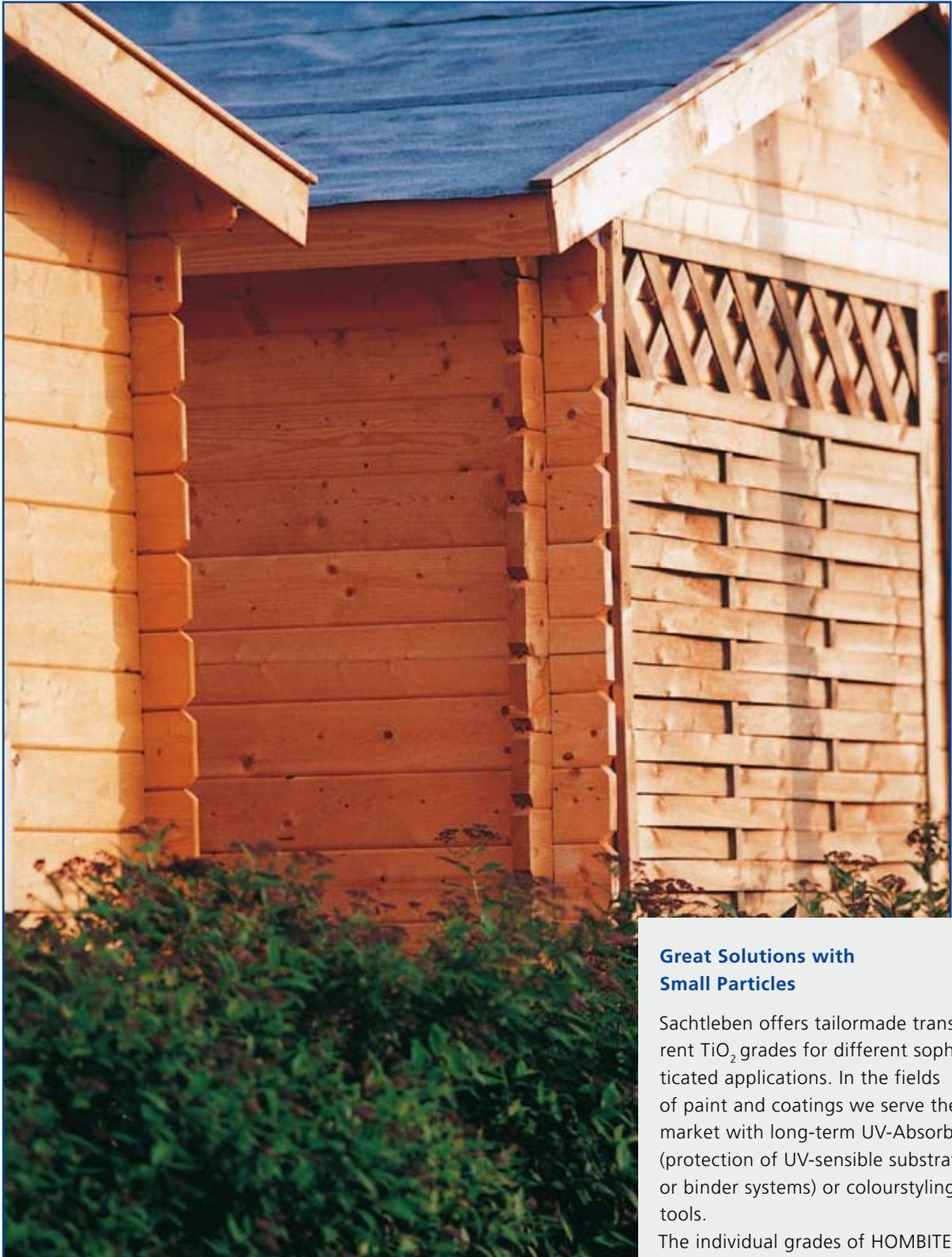


Great Solutions with Small Particles



SACHTLEBEN

Solutions for long-term protection



Great Solutions with Small Particles

Sachtleben offers tailor-made transparent TiO_2 grades for different sophisticated applications. In the fields of paint and coatings we serve the market with long-term UV-Absorbers (protection of UV-sensitive substrates or binder systems) or colourstyling tools.

The individual grades of HOMBITEC, our ultrafine TiO_2 , differ from each other in their crystallite size, surface treatment and crystal-lattice doping.

HOMBITEC

The product

HOMBITEC RM 110 is a white powder and consists of a doped TiO₂ base producing improved weather resistance. It is coated with Al₂O₃.

HOMBITEC RM 300 is a brown powder and consists of a doped TiO₂ base producing improved weather resistance. It is coated with Al₂O₃ and also includes an additional surface treatment to enhance dispersibility.

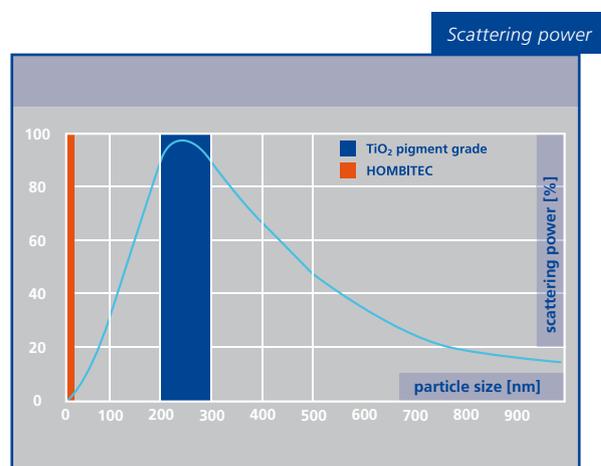
HOMBITEC RM 400 is a grade specially developed for wood protection. It consists of a doped TiO₂ base with an organic and inorganic surface treatment. A further modification with a metal oxide matches the natural colour of wood.

Technical data

	HOMBITEC RM 110	HOMBITEC RM 300	HOMBITEC RM 400
▶ Crystal form	rutile	rutile	rutile
▶ Crystal size [nm]	approx. 10	15	10
▶ Powder appearance	white	brownish	yellowish
▶ Specific surface area [m ² /g]	approx. 100	70	110
▶ TiO ₂ [%]	approx. 79	87	78
▶ Transparency	very good	good	very good
▶ UV-Absorption	good	very good	very good
▶ Application	wood / general	general	wood

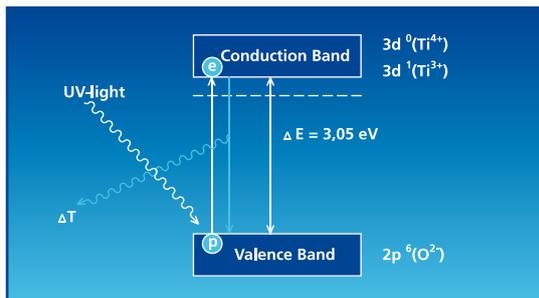
Scattering power

The scattering power of a pigment depends not only on its refractive index and the wavelength of the light, but also on the pigment's particle size. Thanks to their fineness, ultrafine titanium dioxides such as HOMBITEC do not scatter visible light and are therefore suitable for the use in clear paint and coating systems.



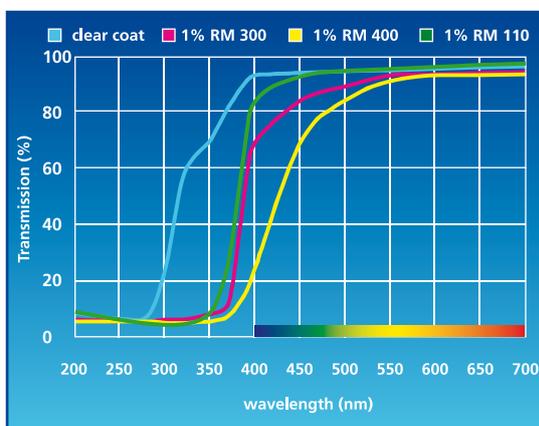
Light transmission

Usually TiO_2 is used as the best efficient white pigment in the market. But by using non pigmentary TiO_2 hidden properties change to the essential ones. The light perceptible to the human eye is only an extremely small portion of the total spectrum of electromagnetic waves. The so-called visible range of the spectra is located between 400 and 800 nm. Electromagnetic rays with a longer wavelength are referred to as infrared radiation, while shorter wavelengths characterize the high-energy ultraviolet (UV) radiation.



Transformation of UV-radiation into caloric energy

Ultrafine TiO_2 is like pigmentary TiO_2 a photo semiconductor and can absorb UV radiation. During this process an electron from the valence band is promoted to the conduction band. Radicals are formed and in the presence of water and oxygen the well known chalking process starts. By crystal lattice doping (changing the band structure) and inorganic coating(s) (barrier between Radicals and organic binder matrix) the chalking process is suppressed and excited electrons relax without detrimental effects on the binder. As a result the photo energy of the UV-light is transferred into caloric energy.



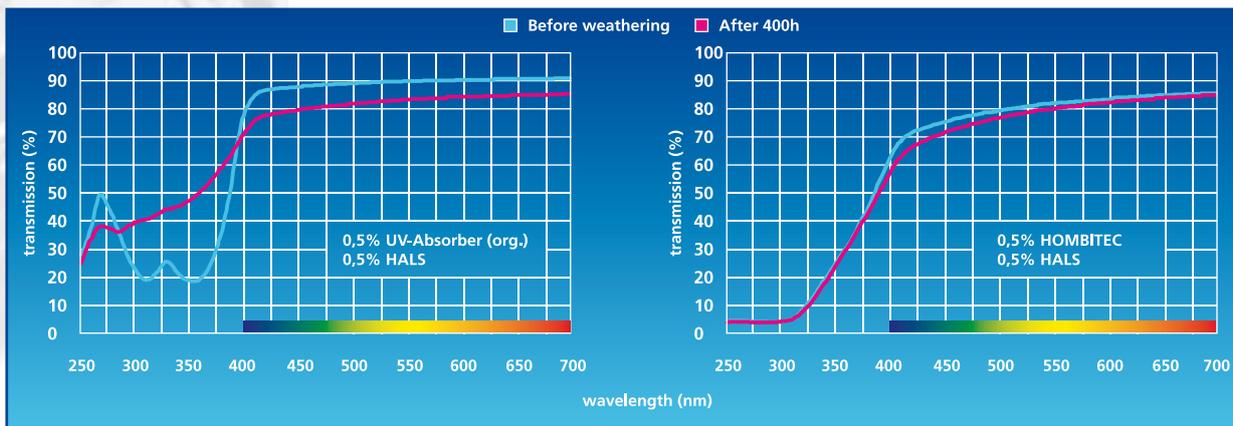
UV-Transmission of a clear coat

Incorporating HOMBITEC into an organic clear coat leads to an absorption of UV radiation while remaining transparent in the visible range of the spectra.

It is possible to protect the binder matrix as well as the substrate underneath from the detrimental effects of UV-A and UV-B shortwave radiation. With HOMBITEC RM 400 even some part of the high energy blue light of the visible spectra is absorbed, leading to an excellent protection of wooden substrates, which can be attacked by wavelengths up to 440 nm.

Long-term UV protection

As inorganic material HOMBITEC, once incorporated into a coating, is not subject to migration. Therefore the UV-Absorption characteristics of HOMBITEC remain the same during the whole lifetime of the coating. This is in contrast to common organic UV-absorbers who can lose their performance during weathering by migration or destruction.

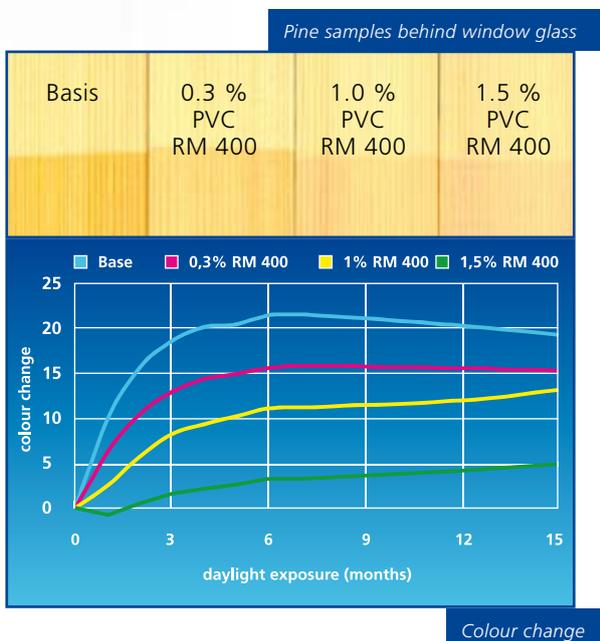


Artificial weathering of organic (left) and inorganic (right) UV-Absorbers

In contrast to other inorganic UV-Absorbers HOMBITEC is insoluble. Furthermore experiments in our application technology's lab indicate that HOMBITEC does not need additional stabilizers like radical scavengers.

HOMBITEC in interior Wood coatings

Since only wavelengths below 315 nm are absorbed by window glass and, in addition, harmful radiation is also emitted by artificial light sources, continuous changes in wooden substrates and the coating material itself can occur. This phenomenon can be observed in the form of yellowing and darkening on a large number of everyday objects, such as solid wood furniture, kitchen paneling, parquet flooring etc.



Colour change

Some pine panels have been coated with a commercially available parquetry coating modified with different amounts of HOMBITEC RM 400. These samples have been exposed to daylight behind a window glass, the upper part was covered. From the picture and from the data one can clearly see the very good stabilization of pine wood by the addition of ultrafine TiO₂ to the coating.

HOMBITEC

Besides HOMBITEC RM 400, which is especially designed for wood coatings, HOMBITEC RM 300 is as well used for interior wood coatings. The incorporation of HOMBITEC RM 300 into a clear wood coating gives the so-called "fresh cut look effect". Depending on the concentration the wood is lightened. HOMBITEC RM 300 is only suitable for very light wood like maple or pine.

In the below example HOMBITEC RM 300 and HOMBITEC RM 400 were added to a transparent styrene acrylate dispersion and compared to a yellow transparent iron oxide and a combination of organic UV-Absorbers/HALS.

The top row is prior to UV exposure and the bottom row is after 1000 hours of exposure in the QUV (313 nm lamp, the circles indicate the measuring points).

From the top row one can see the lightening of HOMBITEC RM 300 to achieve the "fresh cut look" effect combined with an excellent long-term UV-protection. HOMBITEC RM 400 looks much more transparent on a yellow substrate like wood and has an excellent UV-protection as well. The transparent ironoxides show a good UV-protection but have a significant influence on the starting colour tone.



HOMBITEC in exterior Wood coatings

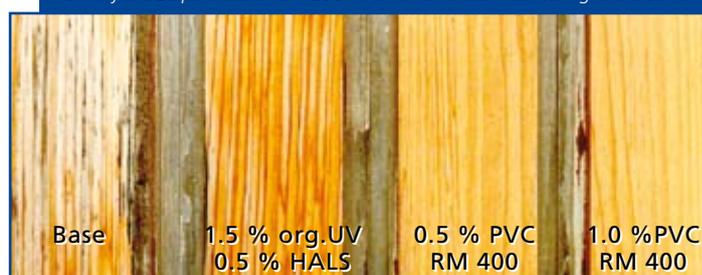
For exterior use the main additional impact on coatings is the exposure to moisture and the attack of micro organisms.

To evaluate the exterior properties of ultrafine TiO₂ an outdoor PU-Acrylate dispersion was modified with org. UV/HALS and HOMBITEC RM 400. To accelerate the weathering process all samples were exposed to the QUV instrument for

1500 hours. Afterwards the pre-aged samples were exposed to nature in Alpen, lower rhine area, for another three month.

The advantages of the inorganic UV filter become clearly evident: the discoloration as well as the attack by micro organisms are much stronger with the basis or the organic stabilization.

PU-Acrylate Dispersions after 1500 hours of artificial weathering and additional 3 months outdoor exposure



A two years experiment with only outdoor weathering was performed with an waterborne acrylic clear coat. A base blue stain inhibitor was coated three times with a transparent varnish. In the one case the third layer of the varnish was modified with 4 wt% of HOMBITEC RM 400 WP (predispersed waterborne paste). After two years of outdoor weathering the difference of the coatings is evident. The addition of HOMBITEC only to the outer layer is sufficient to give an excellent UV-protection.



HOMBITEC in industrial coatings

HOMBITEC RM 110 and RM 300 are the ultrafine TiO_2 for the protection of industrial coatings. Both, the binder matrix and the underlying substrate can be protected. As a result it is possible to increase gloss retention and/or intercoat adhesion.

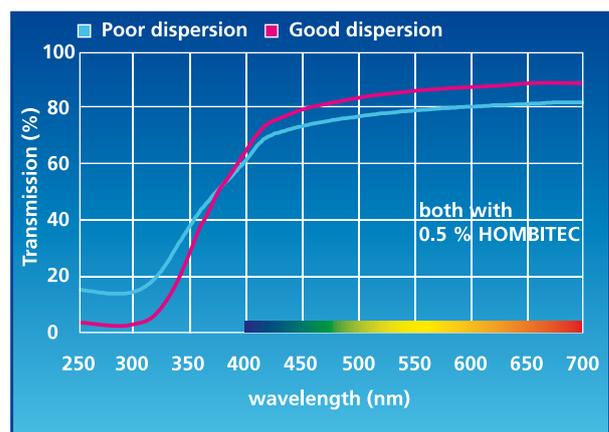
The microscopic images on the left demonstrate the benefits of HOMBITEC RM 300 not only on the yellow pigment's light fastness but also for the protection of the binder matrix and therefore of the underlying substrate. The surface of the coating (alkyd-melamine) modified with HOMBITEC RM 300 remains more or less unaffected, whereas the conventionally stabilized coatings exhibits microcracking and exposes the substrate to the ingress of water, with delamination and mildew as the consequences. Especially adhesion properties after weathering are significantly improved, if the coating is applied on a UV sensible primer.



Dispersion and milling

Irrespective of the application, all HOMBITEC grades must be uniformly dispersed to achieve their maximum efficiency.

Unproper dispersion reduces on the one hand the UV-Absorption properties and on the other hand the transparency. Milling using a pearl mill is mandatory. Typical millbase formulations consist of 30-50 wt% HOMBITEC in 50-70 wt% of a 25-30 wt% binder solution. Both HOMBITEC RM 300 and HOMBITEC RM 400 are also available as predispersed pastes.



Recommended concentrations of HOMBITEC

In transparent wood coatings for substrate protection we recommend 0.25 – 1% PVC of HOMBITEC based on a dry film thickness of 40 - 50 μm . According to the Beer-Lambert-Law higher concentrations at lower dry film thicknesses and vice versa should be used. For the matrix protection we recommend higher dosages (1-3 % PVC) of HOMBITEC to have a higher absorption of UV-radiation in the first pathway of the coating layer.



Sachtleben does not guarantee the accuracy, topicality, correctness, completeness, quality or usefulness of any information provided.
Any liability claims in connection with such information are excluded.

04.043.03.09.e

Great Solutions with Small Particles



Sachtleben Chemie GmbH
A company of **ROCKWOOD** Holdings, Inc.
P.O. Box 17 04 54 • D-47184 Duisburg/Germany
Phone +49 2066 22-2615 • Fax +49 2066 22-3615
E-Mail: coatings@sachtleben.com • www.sachtleben.com