

3. Summary

The results can be summarised as follows:

- The combination of HT coating and UV light showed a significant reduction in the NO concentration.
- The reduction in NO(x) concentration was significantly less pronounced than the reduction in the NO concentration. The reason for this can be assumed to be the fact that part of the nitric oxide (NO) is oxidised to form nitrogen dioxide NO₂ and that this is also recorded in the NO(x) measurement.
- The effect of UVA light on the test gas without the presence of ceramic tiles already resulted in a reduction in the NO concentration.
- Within the measuring accuracy, the effect of UV light and HT coating remained almost constant over the test period.

DSCB

Certificate: Long Term Guarantee

Explanation:

Deutsche Steinzeug Cremer & Breuer AG's long term guarantee states that the HT coating is just as resistant to wear as the surface of the respective. Provided that wear remains within the limits of the respective tile wear rating group, the photocatalytic properties will remain available for an unlimited time.



easy to clean
antibacterial
decomposing odours
and air pollutants

Guarantee Certificate

for the HT coating

The HT coating is burned-in at high temperatures. It is as wear-resistant as the surface of the particular tile itself. This means: as long as the wear remains within the limits of the respective stress group, the photocatalytic properties are maintained **permanently** already at normal lighting by artificial light or sunlight. This guarantee covers all first-choice tiles produced by Deutsche Steinzeug Cremer & Breuer AG and treated with the HT coating.

Dieter Schäfer
Chairman of the Board of Management

Deutsche Steinzeug Cremer & Breuer AG

Jasba

DEUTSCHE STEINZEUG AGROB BUCHTAL

Please keep your receipt of purchase together with the certificate. If individual tiles do not meet the specified criteria, we undertake to replace them free of charge with tiles of equivalent value. Apart from that, the liability is governed by our General Terms and Conditions of Sale and Delivery.

Prof. Dr. Horst Kisch
Certificate: Contaminant reduction

Explanation:

Prof. Dr. Horst Kisch, Universität Erlangen-Nürnberg, confirms that offensive or harmful odours and air pollutants such as formaldehyd resulting from traffic and industrial sources are significantly reduced by the HT coating. Thus HT produces a long term improvement in a building's surrounding atmosphere.

Titanium dioxide is the catalyst for this process. It is harmless and is used daily in foods and personal hygiene products.

Prof. Dr. Horst Kisch

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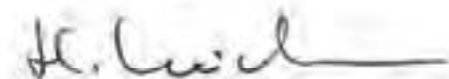
Erlangen, 03.06.2012

Your contract dated September 2011

Dear Ms. Reger,

Please find the concluding report and documentation concerning the photocatalytic reduction of acetaldehyde in two samples of tile material. In accordance with your samples sent on 22.09.2011, the reduction was measured both with and without a cut-off filter (455 nm).

Yours sincerely,



Prof. Dr. Horst Kisch

Documentation of the photocatalytic reduction in acetaldehyde on tiles with HT coating

Task set

Two different tiles of production dates 05.07.2011 (Sample 5810) and 15.07.2011 (Sample 5811) were to be tested in a sealed system for their characteristics of photocatalytic reduction of acetaldehyde.

The experiment and its implementation

Tiles 5810 and 5811 in their dimensions, 12 x 3 cm were each exposed to a gaseous atmosphere consisting of air and acetaldehyde and irradiated for 3 hours with UV light both without a cut-off filter and with a 455 nm cut-off filter respectively. The reduction in the acetaldehyde concentration was determined at hourly intervals by gas chromatography (GC FID). Acetaldehyde concentrations in the regions of approx. 5 ppm (vol.) and 4,000 mg/m³ respectively were selected as the initial concentrations.

Gas samples were taken by means of a septum seal (see Fig. 1)



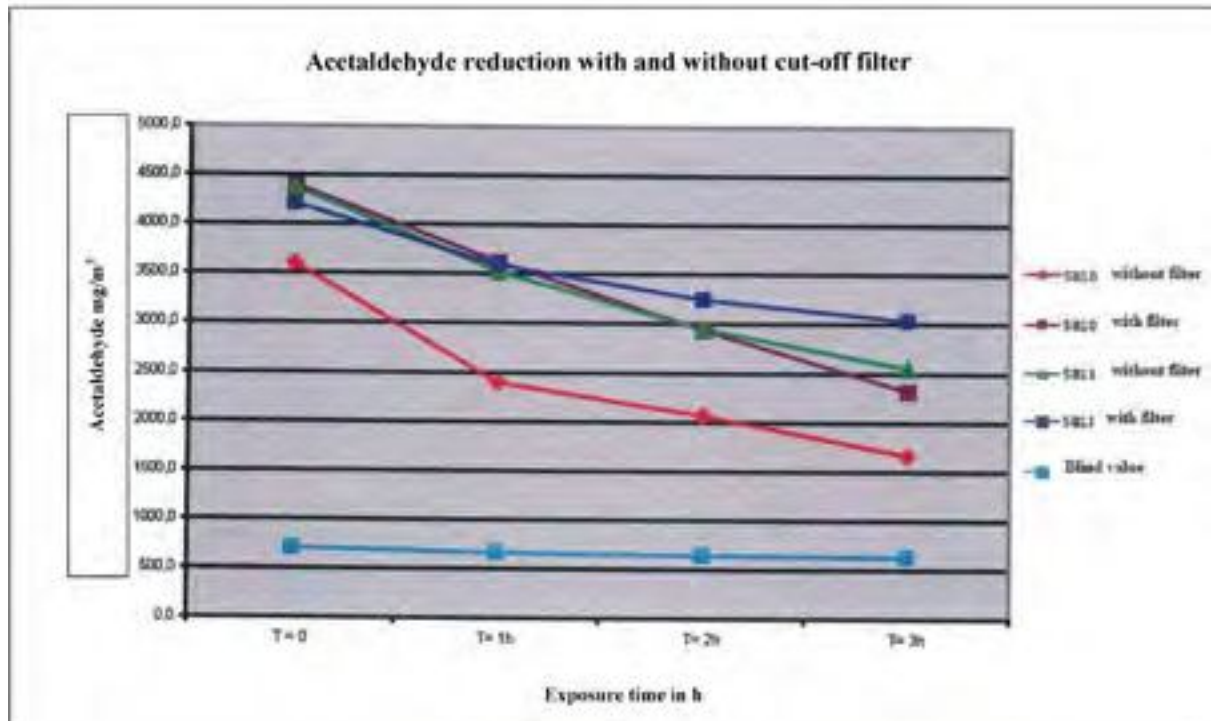
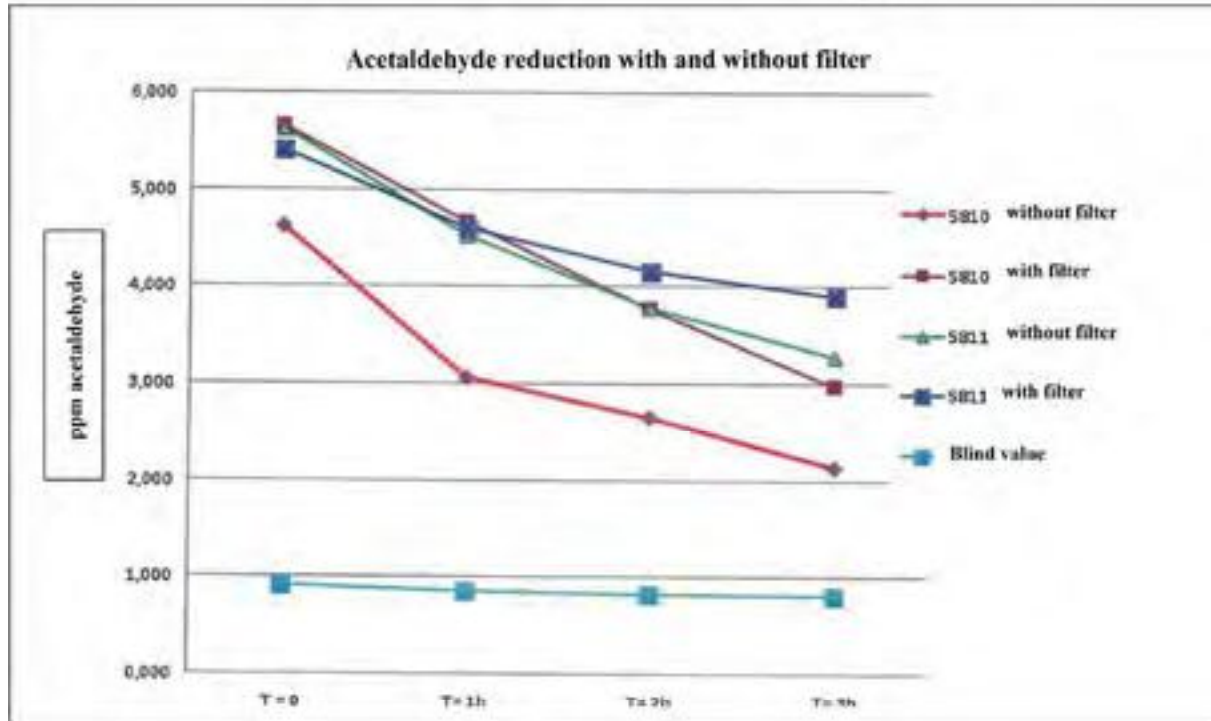
Fig. 1: Photoreactor with water filter for the removal of infrared rays (centre).
The lamp - not illustrated - is located to its left.

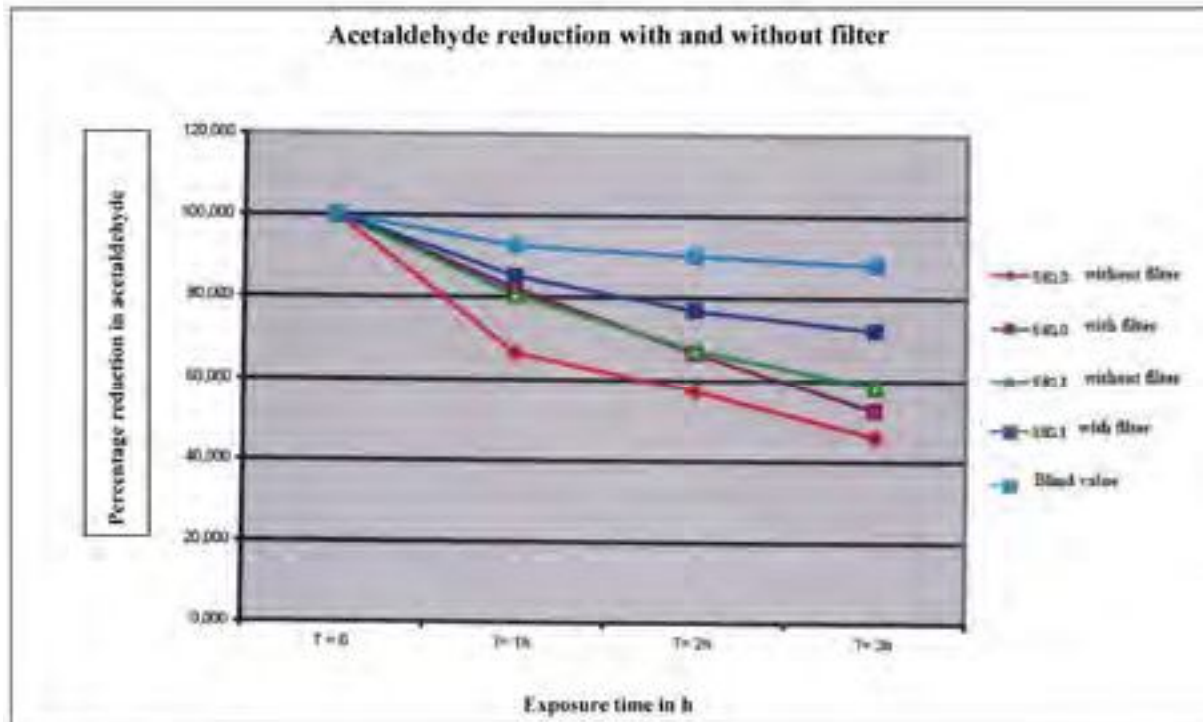
Exposure to acetaldehyde gas was effected by injecting the appropriate volume.
After an equilibration time of 15 minutes in darkened conditions, the samples were exposed for 3 hours to a 150w Xe lamp without and with an upstream 455 nm cut-off filter. A gas-tight septum was used to take samples for analysis at the beginning, after 1 hour, after 2 hours and after 3 hours.

1. Measurement results

Exposure for 3 h without and with 455 nm cut-off filter

No.	5810	5810	5811	5811	
Description	HT tiles	HT tiles	HT tiles	HT tiles	Blind test without tile
PN date	22.09.2011	22.09.211	22.09.2011	22.09.2011	
Dimensions	10 x3 cm	10 x 3 cm	10 x 3 cm	10 x 3cm	
Colour	white	white	white	white	
Gassing	Acetaldehyde	Acetaldehyde	Acetaldehyde	Acetaldehyde	Acetaldehyde
Cut-off-filter	without	455 nm	without	455 nm	without
Lamp	Xe 166 w	Xe 166 w	Xe 166 w	Xe 166 w	Xe 166 w
Equilib.time	15 min.	15 min.	15 min.	15 min.	15 min.
Gas collection tube vol. in ml	211	211	211	211	211
Acetaldehyde in mg/cm ³					
t = 0	3597.9	4406.7	4377.4	4213.3	714.1
t = 1h	2390.8	3628.8	3530.9	3588.5	661.6
t = 2h	2061.2	2936.7	2951.3	3243.2	643.7
t = 3h	1659.0	2313.9	2551.2	3036.8	628.4
Acetaldehyde in ppm (vol.)					
t = 0	4.61	5.65	5.61	5.40	0.92
t = 1h	3.07	4.65	4.53	4.60	0.85
t = 2h	2.64	3.76	3.78	4.16	0.83
t = 3h	2.13	2.97	3.27	3.89	0.81
Relative acetaldehyde reduction in %					
t = 0	100.0	100.0	100.0	100.0	100.0
t = 1h	66.4	82.3	80.7	85.2	92.6
t = 2h	57.3	66.6	67.4	77.0	90.1
t = 3h	46.1	52.5	58.3	72.1	88.0





Test conclusions

The two tile types (5310 and 5311) significantly catalyse the reduction of acetaldehyde under the influence of light. In both tile samples, the reduction progresses rather "more quickly" with UV + vis. light as is illustrated in the example of 5810 with filter (———) (vis. only, i.e. visible light) and 5810 without filter (———) (UV + vis. light).

In contrast, acetaldehyde alone shows no reduction or only a very weak reduction under the influence of light - which is however, caused by the oxidation of the acetaldehyde due to the oxygen content of the air in the gas collection tube.

Erlangen, 28.11.2011

H. Kisch
Prof. Dr. Horst Kisch