

Test report (copy)

Determination of the photocatalytic  
activity of tiles by the degradation of  
methylene blue based on  
ISO 10678:2010

On behalf of:

**Deutsche Steinzeug Cremer & Breuer AG**

Servaisstr.

53347 Alfter-Witterschlick

Performed by:

**Fraunhofer Institute for Surface Engineering and Thin  
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## 1. Subject matter of the work

The subject matter of this test report is the determination of the effectiveness of photocatalytic activity of tiles by the degradation of methylene blue. For the test, the dye molecule methylene blue was put into contact with the photocatalytic-active surface of a test specimen, as well as an inactive reference specimen, in an aqueous solution and was illuminated by UV light. This causes the solution to lose its color and the dye content of both samples can be continually recorded using an UV/VIS spectrometer. The reduction in the dye concentration is deemed to be an indication of activity and is represented by the specific degradation rate  $P_{MB}$  or photon efficiency  $\zeta_{MB}$ .

A correlation between the photocatalytic activity regarding the purification of direct contamination, the degradation of gaseous molecules in the surrounding air or the anti-microbial effectiveness can exist.

## 2. Overview of the tested samples

To perform the tests, IST was provided with 2 equal, homogenously coated tile samples with the dimensions 50 x 25 mm<sup>2</sup> as well as 2 uncoated tiles of the same type and dimensions as reference samples. The samples submitted by the client for this work had been pre-cleaned with nitrogen and pre-activated for 24 hours by UV illumination at an intensity of 2.3 mW/cm<sup>2</sup>.

The tests were performed in the period from 19-21/08/2013.

No.	Sample name
1	Tiles (with coating)

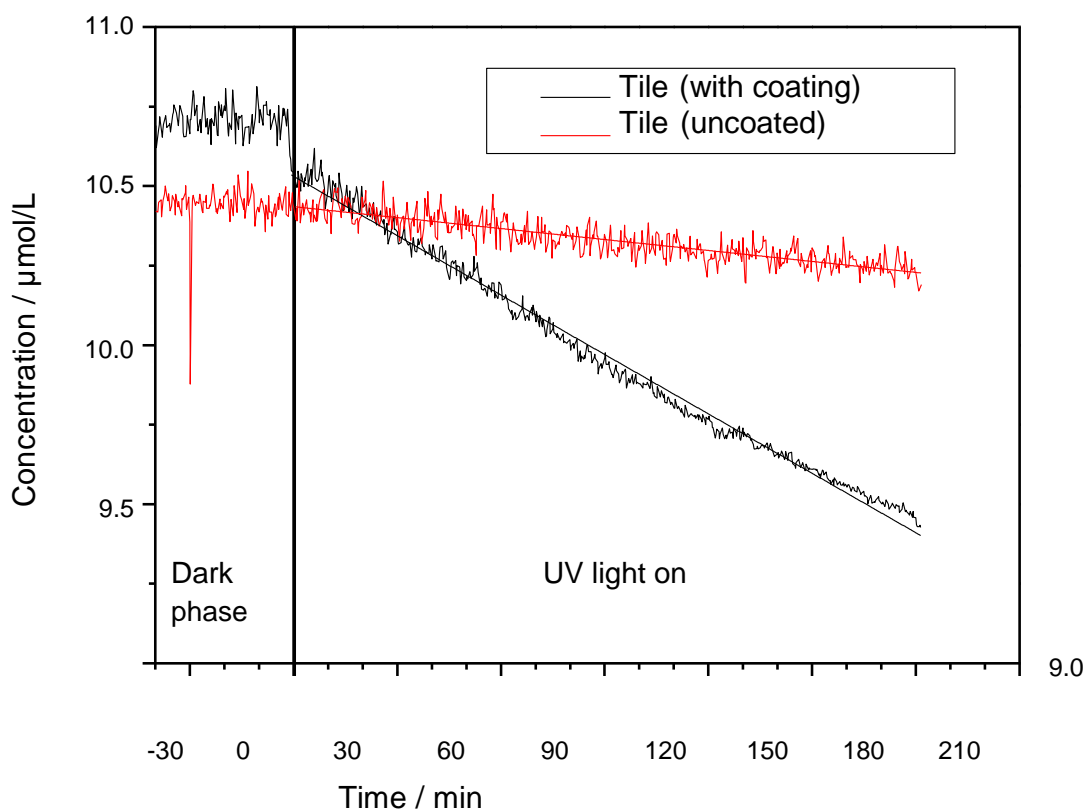
Inactive reference sample: tiles (uncoated)

### 3. Overview of the test conditions

Test procedure	ISO 10678:2010 - Determination of the photocatalytic activity of surfaces in aqueous medium by the degradation of methylene blue
Test laboratory	Fraunhofer Institute for Surface Engineering and Thin Films IST
Tester	Dagmar Kampmeier (CTA)
Sample pre-treatment	Blown with nitrogen
Temperature in the lab	21±2°C
Cuvette type (test length)	Rectangular quartz cuvette (60 mm); Test set-up in accordance with ISO 10678 Fig. B.2
Conditioning solution	120 ml; 20 µmol/l, 16 h stored in a dark place
Test solution (temperature)	120 ml; 10,0 µmol/l, 23,5 °C, stirred continually
UV lamp (pre-conditioning)	Philips Actinic fluorescence lamp TL-K 40W; 2,3 mW/cm <sup>2</sup> ; 24 h continually
UV lamp (test)	Sankyo Denki fluorescence lamp F15T8BLB 15W; 365 nm, 0.98 mW/cm <sup>2</sup> ; 180 min continually
UV test device	PeakTech type 5085, calibrated Si-photodiodes 290-390 nm
Spectrometer type	OceanOptics QE65000
Duration of test	270 min
Known deviations from the standard	None

### 4. Specific test results

Graphic presentation of the test results:



Tabular presentation of the test results:

Sample no.:	Increase detected [ $\mu\text{mol/l}\cdot\text{h}$ ]	Spec. photocat. activity $P_{\text{MB}}$	Photon efficiency $\zeta_{\text{MB}}$ [%]
1	-0.3048	29.24	0.02716

## 5. Summary of the test results

The specific degradation rates  $R$  of the active samples ( $R_{\text{active}}$ ) and the inactive reference ( $R_{\text{Reference}}$ ) were calculated by the linear regression of data and for the tested sample

### tile (with coating)

showed a specific photocatalytic activity  $P_{\text{MB}}$  of 29.24  $\mu\text{mol}/\text{m}^2\cdot\text{h}$ . This corresponds to a photon efficiency  $\zeta_{\text{MB}}$  of 0.02716% at an irradiation strength of 0.98  $\text{mW}/\text{cm}^2$  UVA (365 nm). Braunschweig, August 2013