Report on the First Meeting of WG 2 (Standardization) of the COST 540 Project

The first meeting of WG 2 (Standardization) was held in Hannover, Germany, on Monday, 13.11.2006, and Tuesday, 14.11.2006. It was organized by Detlef Bahnemann, Institut fuer Technische Chemie, Gottfried Wilhelm Leibniz Universitaet Hannover, who opened the meeting at 9:00 on 13.11.2006. In his lecture titled "Why harmonizing of existing testing methods on photocatalytic field is important -history of COST 540 Action" Dr. Frantisek Peterka gave an overview over the various activities and contacts that led to the proposal to COST finally resulting in the granting of the present project.

Subsequently, Mr. Tatsuya Imura gave an overview of the standardization situation in Japan. Several standards have already been proposed both to JIS and to ISO while others are being prepared currently. Strong international links in this subject area are highly desired and have already been initiated by JIS. In his overview of the standardization situation in Taiwan, Dr. Chien-Kuo (Jacq) Huang, described the work on very practical self-cleaning standards combining illumination and washing cycles.

The second session of this workshop started with an overview of the standardization situation in Finland presented by Prof. Markku Leskela. In particular, an apparatus has been proposed by Kemira company to assess the photocatalytic activity in the gas phase by continuous FTIR measurements. In his overview of the standardization situation in Germany Prof. Detlef Bahnemann described the foundation of the DIN working group NMP 293 which is focussed on new standards in Photocatalysis and has so far suggested a standard method for the photocatalytic degradation of the dye methylene blue in aqueous solution. The latter method has been developed in close collaboration with the JIS standard committee group led by Prof. Kazuhito Hashimoto.

The third session of this workshop started with a presentation by Rita Tóth titled "Nanoparticulate Langmuir-Blodgett films for photocatalytic applications: antireflection and self-cleaning properties" presenting a new approach to prepare photocatalytic coatings on various substrates and suitable ways to assess their activity. Subsequently, Prof. Urska Lavrencic Stangar described how tailor-made photoreactors with immobilized catalyst for degradation of pollutants in water should be designed and can be tested. Thereafter, Dr. Mark A.S. McGrady introduced the use of inks to standardise photocatalysts. It was shown that this method allows an extremely rapid assessment of the photocatalytic activity of coated surfaces.

Dr. Bernhard Goer from Pilkington glass company acted as the chairperson of the last session of the first day of this workshop. Herein, Prof. Günther Rupprechter explained how the surface analysis of UHV-grown thin oxide films can be performed yielding very interesting results such as the observation of all details of the dissociative adsorption of water molecules onto the bare titanium dioxide surface. Finally, Dr. Andreas Brüger showed how the photocatalytic wastewater treatment on TiO_2 thin films can be studied and what kinds of test methods can be utilized to determine the activity of the employed apparatus. An extensive discussion of all participants ended the first day of this workshop.

The second day started with an overview of testing methods to evaluate photocatalyst material used by the National centre for nanosurfaces engineering in the Czech Republic given by Dr. Jaromir Jirkovsky, the vice-chair of this COST 540 working group. He showed how absolute quantum yields of photocatalytic processes can be calculated provided that the optical properties

of the employed photocatalyst powders are determined accurately. Subsequently, Dr. Suresh Pillai presented proposed photocatalysis test methods for measuring antibacterial activity, before Prof. Claudio Minero showed what kinetic tests could do to determine the photocatalytic efficiency of powders and films.

The second session of day 2 of this workshop started with the presentation titled "Some approaches to standard photocatalytic tests in solid, liquid and gaseous phase" given by Prof. Josef Krysa who described the respective approaches in the Czech Republic. Thereafter, Prof. Lars Österlund explained what makes a good TiO_2 photocatalyst for air cleaning, before Dr. Ronan Garrec from Saint-Gobain glass company presented the output of a European project focussed on a new European standard for Self-cleaning glass. He described the development of suitable standard dirt as well as details of the testing protocol which will be proposed to CEN by the project consortium.

The final lecture session of this workshop was led by Dr. Claire Bygott from Millennium Performance Chemicals company, one of the world's largest titanium dioxide producers. Herein, Dr. Catherine Jacquiod from Saint-Gobain Quartz company explained the need in standardization for air purification for photocatalytic media and purification systems. Afterwards, Dr. Benoit Kartheuser presented a photocatalysis device for air purification and explained the necessary standardization needs in this area. The final lecture of this workshop was given by Dr. Michael Vergöhl who talked about new measuring techniques for the standardization in photocatalysis. In particular, he showed that fluorescing molecules can be utilized as very sensitive probe molecules and that very homogeneous layers of solid test compounds can be formed through vacuum evaporation.

A general discussion led by Dr. Alexandra Seeber from the BASF AG concluded the workshop. While the need of reliable standards for photocatalysis was apparent to all participants, they agreed that there is a definite lack of knowledge concerning the bureaucratic steps required to be involved in such a process both, as a country as well as an individual expert. Those delegates who are interested to actively participate in this standardization process will now communicate this to their respective national standardization boards to initiate the required procedures. It was unanimously agreed that more than one standard will be required to cover the broad range of applications in photocatalysis reaching from water and air treatment to self-cleaning and/or anti-bacterial surfaces which can also be superhydrophilic. The next meeting of this working group will be organized by the delegates from the Czech Republic and has been scheduled for May 2007 to be held in Prague. Prof. Bahnemann concluded the present workshop thanking all delegates for their active participation and the COST 540 project for the financial support. The meeting ended at 16:00 on 14.11.2006.

Hannover, 20.11.2006

Prof. Dr. Detlef Bahnemann