

# RESEARCH CENTRE FOR NANOSURFACE ENGINEERING



## "NANOPIN"

[www.nanopin.cz](http://www.nanopin.cz)



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The Research Centre for Nanosurface Engineering "NANOPIN" has been established in 2005 under the Research and Development Program of the Ministry of Education, Youth and Sports of the Czech Republic as a Centre of Applied and Oriented Research (Project No. 1M0577). The Research Centre is formed by five partners from academia and industry: the Advanced Technology Group (ATG), the Institute of Inorganic Chemistry of the Academy of Sciences of the Czech Republic (IIC AS CR), the J. Heyrovsky Institute of Physical Chemistry of the Academy of Sciences of the Czech Republic (JH IPC AS CR), the Institute of Chemical Technology Prague (ICT) and the Technical University Liberec (TUL), and it is chaired by Dr. Frantisek Peterka.

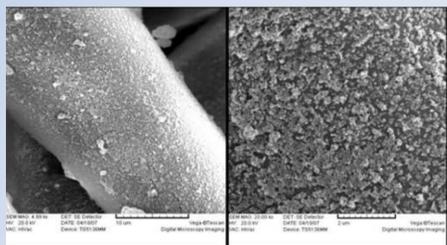
The Centre is focused on the complex study of nanocrystalline photoactive materials; the **research of their practical utilization** in the field of self-cleaning, anti-bacterial coatings, photocatalytic purification of water, air, contaminated soils, and solar energy conversion; and **development of standard procedures** for the evaluation of the photocatalytic and hydrophilic properties of these materials. NANOPIN is open and offering all kind of collaborations with both academia and industry partners being interested in the field of photocatalytic applications.

### Photocatalytic applications of NANOPIN

The Czech activities in the field of photocatalytic applications begun in mid-1990s, which resulted in the production of so-called **HYDROTECT antibacterial tiles** that were manufactured under TOTO license by Czech company RAKO (DSCB group) in 2000. This was one of the first commercial photocatalytic products in Europe ever. Soon after that the Czech translation of the book *TiO<sub>2</sub> Photocatalysis - Fundamentals and Applications* from Fujishima *et al* was published by Peterka *et al*. Next activities led later on into establishing of centre NANOPIN.



**Plasma deposition of nanophotocatalytic films** at low temperate without necessity of additional calcinations. These films show highly anti-bacterial and anti-virus properties and would be suitable for antiseptic plasters and water disinfections in the field conditions. NANOPIN has its own plasma know-how thanks to TUL. In addition, it is closely collaborating with the team of prof. M. Černák from Masaryk University, Brno, who developed and patented award-winning atmospheric-pressure plasma technique for surface activation of textile materials. Figure below shows immobilization of TiO<sub>2</sub> nanopowder onto polypropylene nonwoven fabric (left) by Diffuse Coplanar Surface Barrier Discharge (right) developed by team of prof. M. Černák.



NANOPIN is cooperating with Belgium company Eoxolit on testing and development of **novel composite material EOXO<sub>2</sub>LIT with photocatalytic function** designed for air purification and self-cleaning effect. According to ISO standards and the first field tests for NO<sub>x</sub> removal, material performance is excellent in UV as well as in visible light region.



### International activities of NANOPIN

NANOPIN initiated in 2006 establishing of European **COST Action 540 »Photocatalytic technologies and novel nanosurfaces materials - critical issues (PHONASUM)«**, which served as network of researchers and practitioners working in the field of photocatalysis from all around Europe. The Action joined 21 European countries and Japan and was running 4 years till January 2010. The COST Action 540 significantly contributed to establishing of European CEN standard TC 386 for photocatalysis in December 2008. Centre NANOPIN organized in the frame of this Action several international conferences presenting the state of art of applications and testing methods in the field of photocatalysis in Europe and Japan. During the meeting in Liblice, Czech Republic in 2009 the first European exhibition of existing ISO and CEN methods and devices was organized by NANOPIN.

COST Action 540 "PHONASUM"



### Testing and standardization activities of NANOPIN

Centre NANOPIN is one of European groups pioneering application field in Europe. According to the proposals of ISO test standard methods for evaluation of self cleaning performance of photocatalytic materials, NANOPIN in cooperation with Advex Instruments, Brno ([www.advex-instruments.cz](http://www.advex-instruments.cz)) developed two simple portable devices for measurement of self-cleaning performance of non-porous (**Advex SEE System** - based on **measurement of contact angle** of liquid drops on solid surfaces - figure on the left) and porous (**Advex PhotoCat System** - based on **measurement of methylene blue degradation** - figure on the right) photocatalytic surfaces, respectively. Both instruments are equipped with special-purpose software, which can handle all necessary operations.



Another testing device developed by NANOPIN is the **chamber for testing self-cleaning and antimicrobial properties of active films and coatings**. The box has transparent front wall with two glow ports for sampling, inside of the chamber are jets for producing fine liquid sprays, electricity cut-outs and the vent of the ventilation fan are at the rear wall of the chamber. At the chamber cover the illumination system of 4 UV black-light lamps is mounted (Osram UVA 350 to 400 nm, L 18 W/73).



The centre NANOPIN is also able to provide for their partners **standard tests of photocatalytic activity according to ISO-TC206-1**, which is based on evaluation of air purification performance of NO<sub>x</sub> removal (figure on the left). Using **QUV Accelerated Weathering Tester** (figure on the right) we are able to simulate and determine the effect of atmospheric condition - sun, humidity, rain - on variety of the surface properties of photocatalytic coatings optical (glaze, colour) mechanical (hardness) - photoinduced (photoactivity, wettability). In just a few days or weeks, the QUV can reproduce damage that may occur over months or even years outdoors.

