

# NANOTECHNOLOGY

## *as a High Card in the Competition Struggle*

Unique water treatment plants fitted with special nanofibre filters, which can clean water without the use of chemicals, or efficient lithium nano-accumulators, photocatalytic paints, thanks to which moulds disintegrate on walls in daylight, hydrophobic sprays, which know how to remove dirt from furniture, tiles, mirrors and window panes, antibacterial underwear with an admixture of silver nano particles: these are just a few examples of nano products developed by Czech firms.

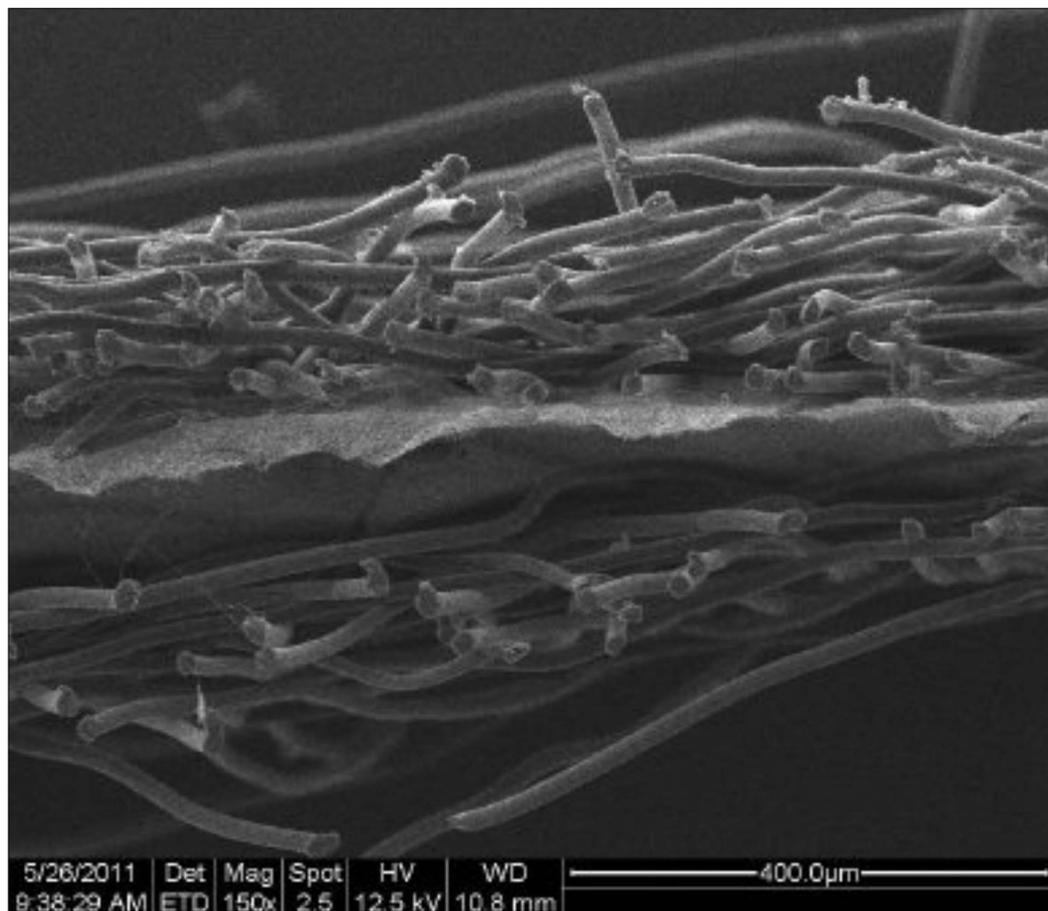
**N**ANOTECHNOLOGY has long ceased to be just a matter of research, and has found practical use in a number of areas, including environmental protection, communication technologies, medicine and genetics, the manufacture of paints and the chemical industry in general. More than 250 entities in the public and private sectors are already engaged in the area of nanotechnology. They see in it the chance to leave their rivals behind, and are beginning to use industrial applications of nanotechnology especially in the manufacture of nanomaterials. The number of firms in the Czech Republic concerned with nanotechnology research and development and the manufacture of specific nano applications has trebled over the past seven years and their number already exceeds one hundred, according to a survey conducted by the Czech Society for New Materials and Technologies.

### Chance for Smaller Firms

The most dynamic development is to be seen among small and medium-sized firms. In Conti-pro Biotech at Dolní Dobruška in the Ústí nad Orlicí Region, for example, several dozen research workers specialise in the research and development of nanofibres and microfibrils made from biopolymers (polysaccharides and proteins) and their use as preparations for the faster healing of wounds, the development of carriers for the targeted distribution of biologically active substances and preparations for tissue conditioning. Paints with a prolonged antimicrobial effect on the basis of nanomaterials and caoutchouc nanocomposites for rubber products used in the automotive and defence industries are being developed in the laboratories of SYNPO a.s. research organisation in Pardubice. Carbon nanostructures for sensors, in turn, are being developed at TESLA Blatná. Inotex at Dvůr Králové nad Labem concerns itself with the development of multifunction textiles

for use in medicine, while filtering materials based on nanofibres used in protective face masks are developed in the laboratories of the company SPUR in Zlín. Asio, manufacturer of sewage treatment plant based in Brno, develops nanofibre filters for air purification in water supply facilities. IQ Structures at Ječ near Prague, in collaboration with an instrument manufacturing institute and a British partner work on new nanostructures securing documents, duty and postage stamps and goods against forgery.

The number of development projects of a nanotechnology nature leading to the manufacture of new marketable products is increasing. Grid electron microscopes from TESCAN in Brno offering an insight in the micro and nano-world are currently used in 50 countries. Two years ago, after selling its semi-conductor division,



Nano fibre.



Natural Sciences of Masaryk University in Brno, which makes it possible to substitute chemicals used in the treatment of materials by a special electric discharge generating a cold plasma, was an impulse for the establishment of the ROPLASS spin-off firm.

“Starting a business based on the manufacture of nanomaterials or nanoproducts, however, is no easy thing to do,” says Marcela Munzarová from Nanovia, Litvínov, the first firm in the Czech Republic to start industrial production of materials from nanofibres. The firm sells most of its textiles, used for example to make respirators, face masks, membranes for textiles and water and air filters, to foreign countries. “Unless the manufactured volume is at least close to industrial proportions, production is not efficient,” she points out. In addition, nanofirms in the Czech Republic are feeling the lack of clear rules regulating the safety of labour and protection of the environment. This fact was another impulse at the beginning of the year to set up the Czech Nanotechnology Industries Association as a platform to promote the interests of its members at home and abroad.

#### NANOCON 2016 Conference in Brno

New nano applications have come into being and are being developed on Czech ground. They will be presented by their makers and inventors at the NANOCON conference ([www.nanocon.eu](http://www.nanocon.eu)) to be held in Brno from 14 to 16 October 2016 and to devote to the research and development of nanomaterials. The opening lecture will be given by Prof. Dr. A. Paul Alivisatos from University of California in Berkeley, U.S.A., who has been hailed as a pioneer in nanomaterials development and is an internationally recognized authority on the fabrication of nanocrystals and their use in biomedical and renewable energy applications. Another plenary speaker will be the German scientist Professor Dr. Thomas Michely from the University of Cologne, a specialist in thin film growth and epitaxy and graphene. The papers to be presented there by Czech and foreign researchers will concern nano materials and their properties and ways of their preparation, nano-structural metallic materials, nanosilver, polymer nanocomposites, carbon nanomaterials, materials for electronics and optics and nanoceramic materials. The lectures will also be focused on bio-materials used in medicine, e.g. magnetic nano-biocomposites and their use. To underline the need for the responsible research and commercialisation of nanotechnologies, one of the conference sections deals with nanotoxicity and labour safety when working with nanomaterials and nanoparticles.

ELMARCO decided to specialise in the further development of the patented Nanospider fibrillation technology and the manufacture of equipment for making nanofibre materials on an industrial scale. The Moravian manufacturer of paints, Rokospol, produces a photocatalytically active paint developed in collaboration with the Institute of Inorganic Chemistry of the Academy of Sciences of the Czech Republic. The firm Timplant in Ostrava has developed and supplies a dental implant substance containing nanostructured titanium. Another Czech firm, nanoSPACE, in Domažlice makes anti allergy beddings from patented anti-allergen nanofibre textile material made by the company Nanovia. Inorganic nanofibre materials from Pardam, Pardubice, are used as separators of 3d lithium batteries, developed by HE3DA in Prague. According to the company director Jan Procházka, these accumulators, thanks to their high capacity and safety, have a good chance to be used in hybrid motorcars and the linking of several cells and modules makes it possible to create big and exceptionally powerful accumulators for the power industry.

#### Linking Research and Production

The NANO IRON firm in Rajhrad near Brno is an example showing that the work of a university research team can result in the establishment of a manufacturing company even in Czech conditions. It manufactures nanoparticles of elementary iron, which are used by clean-up companies for the remediation of groundwater contaminated with chlorinated hydrocarbons. “Nanoparticles produced by this technology have been applied in real remediation at a number of sites in the Czech Republic and several pilot experiments have been carried out in different localities in Europe and the USA,” says Radek Zbořil, one of the founders of NANO IRON and Professor at Palacký University of Olomouc. The technology developed at the Faculty of

#### What is Nanotechnology?

Nanotechnology is research and technological development at atomic, molecular or macromolecular level, on the scales of approximately 1–100 nanometres (nm, i.e.  $10^{-9}$  metre), and the application of this knowledge to create useful materials, structures and devices.



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