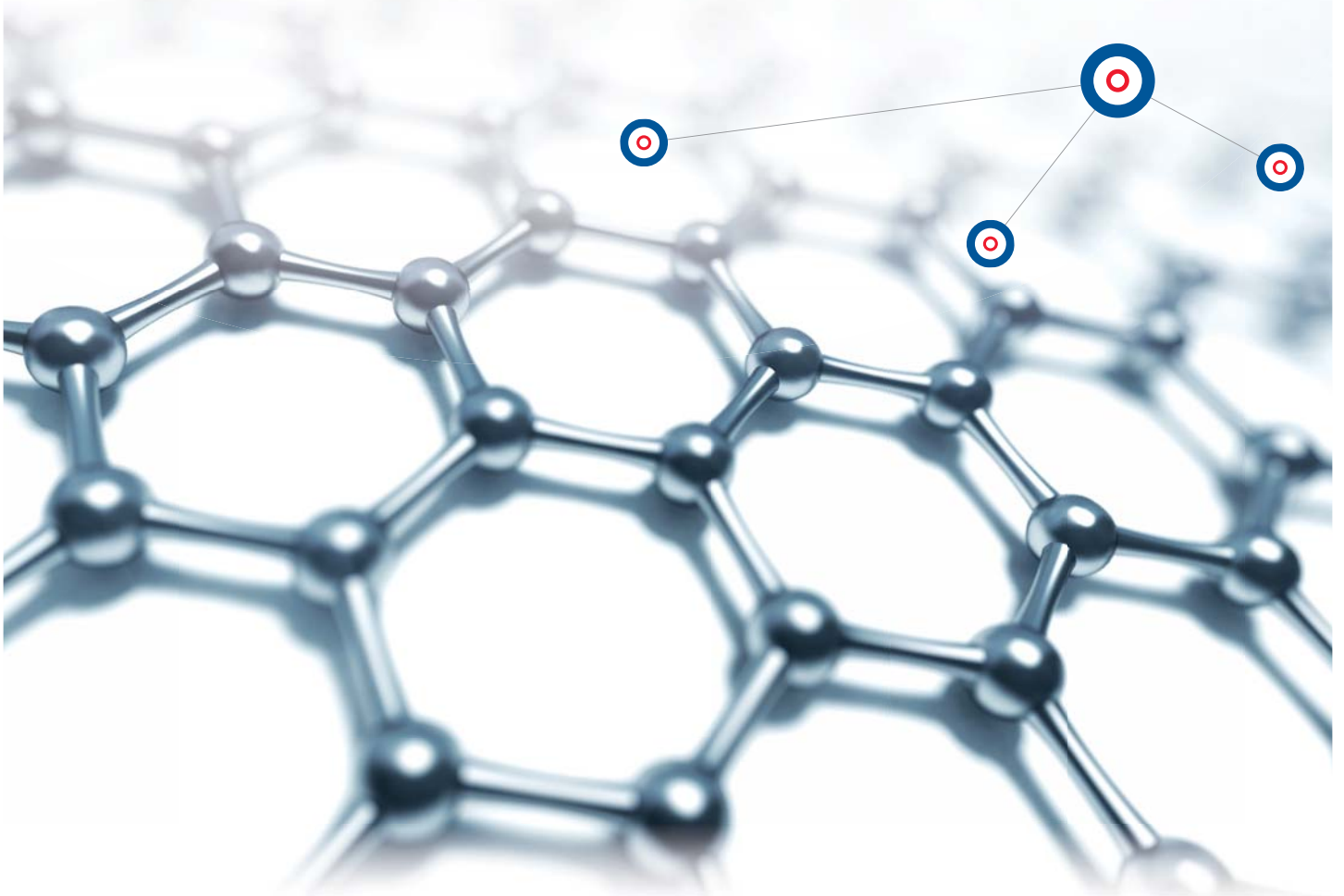


CzechRepublic

NANOTECHNOLOGY





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Czech Trade Promotion Agency is proud to present Czech nanotechnology in the new sector guide.

If you are looking for a supplier in the Czech Republic, Czech Trade Promotion Agency will be delighted to assist you in order to find new manufacturing / service partners, professional organisations and interest groups.



CzechTrade network contains more than 50 offices.

CzechTrade is a government trade promotion agency of the Czech Republic focusing on developing international trade and cooperation between Czech and foreign businesses. CzechTrade works with Czech companies to facilitate their success on international markets.

The goal of this brochure is to inform interested foreigners about the field of nanotechnology in the Czech Republic. Take the companies listed in this brochure as a sample listing, which will help you to formulate a better picture of the specific field. If you are interested in more information on Czech companies, please contact: **supplier@czechtrade.cz**

CzechTrade

YOUR BUSINESS PARTNER IN THE CZECH REPUBLIC

Foreign companies contact CzechTrade when looking for new reliable partners in the Czech Republic. CzechTrade foreign office network together with its sourcing team will identify potential suppliers based on your requirements:

- ⊙ initial consultation by phone/email/in person
- ⊙ provision of a basic overview of a special sector
- ⊙ enquiry exposure to an entire supplier database through the National Business Opportunities website and a parallel dedicated supplier search
- ⊙ compilation of a contact list of companies interested in cooperation
- ⊙ eventual facilitation of meetings with Czech companies

Other services:

- ⊙ doing business in the Czech Republic guide
- ⊙ access to verified Czech suppliers
- ⊙ assistance with language support
- ⊙ presentation of Czech companies at foreign trade shows
- ⊙ preparation of business missions to the Czech Republic



**Information and contacts
for individual foreign offices
can be found at
www.czechtradeoffices.com**

Head Office:

CzechTrade Promotion Agency
Dittrichova 21
128 01 Prague 2
Czech Republic
Phone: +420 224 907 820
E-mail: Info@czechtrade.cz

DID YOU KNOW?

CzechTrade has an extensive network of more than 50 foreign offices on five continents. With their scope of activities, the foreign network offices cover Europe from Scandinavia to the Balkans, Eastern Europe and the CIS, Africa from Sub-Saharan Africa to South Africa, major Asian regions, the American continents from Canada to Latin America, and Australia.

ABOUT THE CZECH NANOTECHNOLOGY INDUSTRY ASSOCIATION

The Czech Nanotechnology Industry Association was founded on 27th November, 2014. At present, it has 19 members, and its chairman is Jiří Kůs. It brings together Czech companies from various industries, from textile through to biotechnology, environmental applications, optics to the energy sector, of which nanotechnology is the core business. Some companies are using nanotechnology procedures in production; others are developing and manufacturing final products from nanomaterials or their applications. The aim of the association is to represent the interests of Czech nanotechnology companies and research in this field at both the national and world level, in business as well as research and educational sphere. It takes pride in the good name the Czech Republic has in this field. In the world it is trying to spread the positive awareness about nanotechnologies in society. It also focuses on active search for support and opportunities for cooperation between the commercial and research spheres.

The association is a partner of The Office of the Government of the Czech Republic, ministries and other state institutions involved in the creation of the economic strategy of the Czech Republic. It also actively participates in economic diplomacy projects with the aim presenting Czech nanotechnology companies abroad. It is about creating an image of the Czech Republic as one of the world's incubators of nanotechnologies, as a country that is one of the world leaders, especially in the nanotechnology applications in industry as well as in consumer products. Successful events, e.g. in the USA, Israel, Germany, Great Britain, the Russian Federation or Austria have already taken place.

In the popularisation and education project "Czech is nano", which was launched in 2015, the Czech Nanotechnology Industry Association wants to show the public in an attractive way the success the Czech nanotechnology companies have achieved. Part of the project "Czech is nano" are Nanodays, which are gradually taking place in all regional cities of the Czech Republic including Prague. Visitors can explore nanotechnology products there, have their functioning explained, test them, watch the production of nanofibre with their own eyes and discuss with leading Czech nanotechnologists and inventors. So far Nanodays have been held in Liberec, Brno, České Budějovice, Prague and Pardubice.

Czech Nanotechnology Industry Association

Lannova 2061/8, 110 00 Prague 1

Jiří Kůs

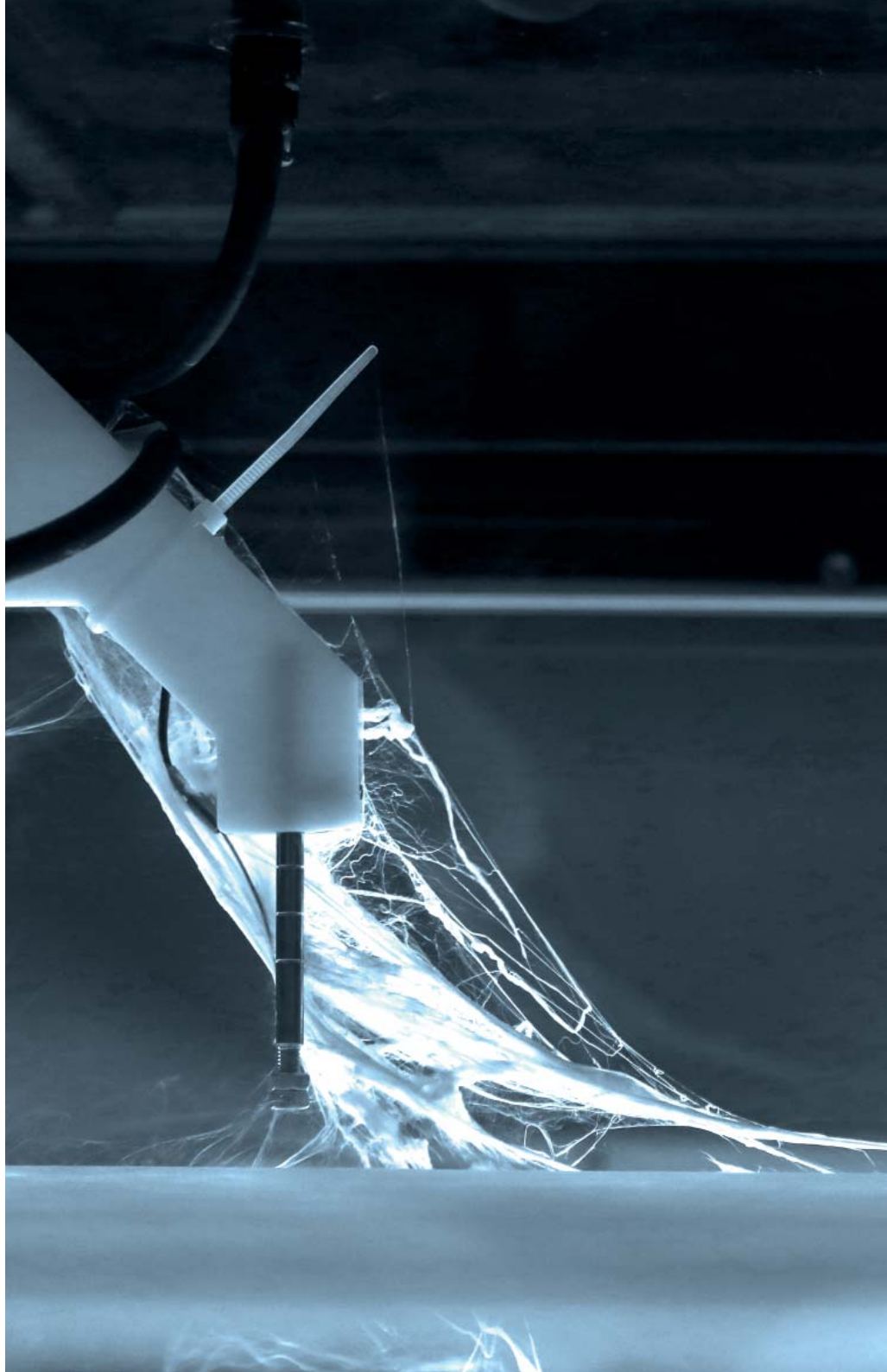
Chairman of the Executive Board

Phone: +420 603 417 229

E-mail: jiri.kus@nanoasociace.cz

The events in the Czech nanotechnology industry are published by the association at their website www.nanoasociace.cz/en/ in both Czech and English. The association is also very active on social media, on the Facebook the community: *Czech is nano* www.facebook.com/CeskoJeNano/ is very popular, on Twitter the association reports daily about nanotechnology news from around the world on @NanospaceNews and on @ceskojenano accounts about the news from the Czech nanotechnology environment and about upcoming as well as ongoing events of the association.

The title of the project "*Czech is nano*", which is also the logo of the association, became a slogan and a message to both the Czech and global public. It represents two levels of communication within itself. The first is that the Czech Republic is a small country, literally nano among the world powers. However, the second level of the statement says that we are also a nanosuperpower, a country that is one of the world's leading nanotechnology developers.



1 CZECH IS NANO

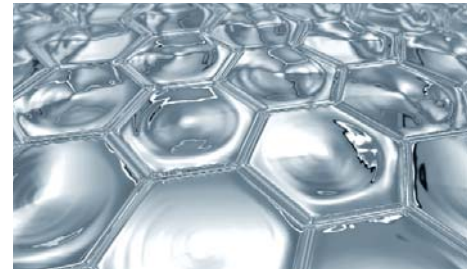
The Czech Republic is a world leader in the research, development and industrial production of nanofibres. The country is one of the cradles of modern nanotechnology. Dynamic growth of the industry, coupled with excellent research and business results, is linked to the revolutionary nanofibre production machine patentfibre.

Since this time in the field of nanotechnology, the Czech Republic has been constantly innovating and creating new generations of nanofibrous structures. The result is the development and production of two-component nanofibres containing nucleus and envelope. This dramatically expanded the horizons and application possibilities. They allow, for example, the distribution of rare substances in precisely defined quantities.

Czech companies achieve excellent results in air purification using photocatalysis. Self-cleaning smart coatings containing titanium dioxide nanocrystals achieve the highest cleaning efficiency in the world. Czech nanotechnology products and services are also worth attention. They ensure the improvement of the surface properties of a wide range of materials, which then exhibit different added value such as dirt protection, improved or reduced conductivity, improved gliding properties and many others. These are applied practically in all areas of human activity in both industrial and consumer practice.

DID YOU KNOW?

Self-cleaning smart coatings containing titanium dioxide nanocrystals achieve the highest cleaning efficiency in the world.



DID YOU KNOW?

The latest machines bring up to eight times the efficiency of industrial production of nanofibres per unit area compared to original industrial plants. Along with this, there also has been expansion of the range of polymers and underlying carrier on which nanofibres can be applied.

The reason for this success is high-level research, its linkage with business and the rapid application of innovations in practice. In the Czech Republic, there are thus a number of top scientific and research centres working in the nanotechnology field with commercial companies. They offer them a complete services from consulting to solving specific research tasks. The number of subjects engaged in research, nanotechnology development and production of specific nanosciences in the Czech Republic has tripled over the last 7 years.

However, the global nanotechnology market is growing at an incredible rate of over 18 % (CAGR), between 2016–2021. Therefore, we expect a rapid rise in nanotechnology applications in everyday life, from nanocosmetics offering miraculous wrinkle removal to industry 4.0, where nanotechnology will play a key role. Czech companies are prepared predominantly for this.

In this catalogue, you will learn about other areas in which Czech nanotechnology companies operate and a wide range of unique products that have no competition in the world.

NANOTECHNOLOGY IN NUMBERS

1.7	Turnover of companies about 1.7 billion CZK*
60	More than 60 export territories
250	250 companies and research centres engaged in nanotechnologies
65	65 active nanotechnology companies

* Members of nanotechnology cluster Nanoprogress

THANKS TO INNOVATIONS IN PRACTICE THE CZECH COMPANIES ARE LEADERS IN THE FIELD OF MANUFACTURE OF NANOFIBRES

In 2004, at the Technical University of Liberec, the team of Professor O. Jirsák developed the first machine for industrial production of nanofibres in the world. This machine, built on the unique patented technology of Nanospider™, was developed in collaboration with Elmarco, the only manufacturer of them, which constantly develops and refines these machines. In 2017, there were more than 200 machines sold. Nanospider™ from Liberec is the most significant Czech technical invention since 2000,

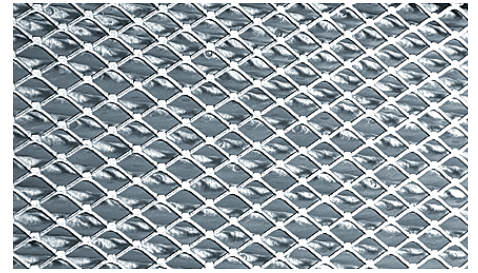
which opened the way to industrial use of nanotechnologies for the world. Nanospider™ is a unique patented technology of nanofibre spinning from the free surface of the polymer solution in a strong electrostatic field without the use of nozzles. This technology is based on an interesting discovery: it is possible to spin not only from a drop of a polymer going through the nozzle, but from the whole thin layer of polymer solution. Thanks to Elmarco and its machines, the Czech Republic has earned its reputation as a global superpower in the field of nanofibres. The first prototype of Nanospider™

machine was designed in 2004 and already in 2006 the first 1.6 meter wide industrial line was installed. Since then, the machines have undergone continuous development and thus maintain the lead in productivity as well as quality of nanofibres. Elmarco has built a research and development centre for its activities in Liberec of the area of 3000 m². In addition to Liberec's headquarters, Elmarco also operates North Carolina branch to support the US market. Elmarco, www.elmarco.com

2 SCIENCE AND RESEARCH AT EXCELLENT LEVEL

Czech university departments which deal with nanotechnologies have the necessary technical equipment and unique know-how. Intensive research takes place at the institutes of the Academy of Sciences and in regional research centres. For example, the Regional Centre for Advanced Technologies and Materials in Olomouc invented a method of modifying solid materials with silver nanoparticles, with the possibility of application on medical instruments. Also, the Centres of Competence supported by the Czech Technology Agency focus on long-term research

cooperation of the academic sphere with industrial companies in nanotechnologies. For example, in the area of advanced microscopic and spectroscopic techniques, nanotechnologies and biotechnologies for water and soil cleaning and development and application of nanocomposites based on graphene. Another science centre, the Central European Institute of Technology, specifically its Smart Nanomachines Group, is concerned with the use of nanotechnologies as modern tools in the treatment of infections caused by multiresistant bacterial strains.



TOP-CLASS NANOCENTRE

There is a top-class nanocentre at the J. Heyrovský Institute of Physical Chemistry in Prague. Eighteen laboratories with unique devices will help students, companies as well as scientists preparing and testing nanomaterials here.

The final substances will find use in sports, electrotechnics, aviation and conservation.

Centre for Innovation of Nanomaterials and Nanotechnologies,
www.jh-inst.cas.cz

DID YOU KNOW?

28 Institutes of the Academy of Sciences of the Czech Republic, 8 Regional Research Centres and 10 Centres of Competence deal with nanotechnologies. Over EUR 800 million was invested in the construction of up to 6 new Centres of Excellence.

UNIVERSITY SPIN-OFF COMPANIES

Spin-off companies allow quick transfer of know-how into practice. For example, the company Advamat is engaged in the research and development of thin films and materials with special properties, e.g. very low friction. Advamat was founded as a spin-off at the Czech Technical University in Prague. In the academic environment, it deals with the development and testing of predominantly super-hard and tribological layers.

Advamat, www.advamat.cz

NUMBER ONE ON MARKET FOR NANOMATERIALS

P A R D A M is a Czech company that deals with the development of nanofibrous materials and their subsequent production and functionalisation for the needs of specific products and applications. P A R D A M is a holder of five patents and several patent applications. Currently, is successfully commercialising several nanofibre-based products. The main added value of the company is the transfer of laboratory research results into industrial practice and specific final products. The latest success

is a joint patent of University of Pardubice and P A R D A M company for a new technological process for the industrial manufacture of advanced nanostructured quartz fibres. These are a revolution in absorbative materials due to their properties. Fibres made by the new technology have great chemical and heat resistance, a huge surface area and they also have a mesoporous character making them excellent and unmatched sorbents.

P A R D A M,
www.pardam.cz



INTENSIVE RESEARCH PROVIDES COMPETITIVENESS

SPUR has been researching nanostructures in nanotechnology since 2006. In 2011, a trial production of nanofibres' filtering materials was launched in its own electrospinning production facility. Its product portfolio includes the offer of SpurTex[®] nanofibres.

SPUR,
www.spur-nanotechnologies.cz

LONG-TERM INVESTMENTS IN EXPERIMENTAL DEVELOPMENTS

ING MEDICAL has long been investing in other experimental development activities in the business-attractive segment of medical devices with the use of nanotechnologies and seeks to consolidate its market position and to strengthen long-term competitiveness in this promising industry. As part of its research and development activities, the company cooperates with university centres and other major entities in the field of nanotechnology.

Two permanent development centres are currently in operation apart from the Prague headquarters. The main focus of the development of medical devices based on nanofibres and antibacterial surface treatments lies in the joint research and development centre of ING MEDICAL and the Technical University of Liberec (TUL), namely the Institute for Nanomaterials, Advanced Technologies and Innovations of TUL.
ING MEDICAL, www.ingmedical.cz

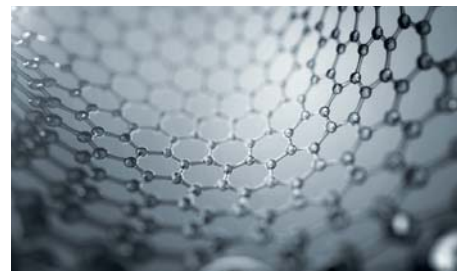
3 PRODUCTS WITH NANOFIBRE STRUCTURES

Nanotechnology is one of the key technologies of the 21st century. There are already a number of products on the market using the outputs of these technologies, but a massive part of the activities is currently underway in the field of applied development. A real nanotechnological boom, which will affect virtually all areas of our lives, is yet to come. The range of products and innovative solutions utilising nanofibres is already constantly expanding. For now, nanofibre materials are most commonly used as very effective and yet breathable barriers.

Nanofibrous structures let the air and water vapor molecules through and at the same time do not let the water droplets through. They are thus suitable, for example, for top-class outdoor clothing that greatly removes sweat away from the body and at the same time is totally waterproof. We already help people allergic to dust mites with anti-allergy beddings, which greatly prevent the spread of dust allergens thanks to the inner nanofibrous membrane. Bandages or adhesive plasters

for wound or burns healing with nanofibrous structures are permeable to desirable air molecules but are also impervious to microorganisms and other contaminants that would cause infection. Conventional filters supplemented with nanofibrous layers achieve 100 times improved filtering efficiency.

Thus, the number of nanofibre filters is constantly increasing. Nanofibres have a thousand-fold larger surface area than, for example, microfibrils. In addition, nanofibrous materials are highly porous. The wool-like nature of new generations of nanofibrous structures offers revolutionary use in medicine and also allows very effective decontamination of water, air or soil. The wool-like nanofibrous structure is structurally very similar to the intercellular matrix, which we try to use in stem cell cultivation to repair damaged tissues and to create replacement organs in cooperation with physicians, biologists and other specialists. Two-component nanofibres, containing nucleus and envelope, are important means to effective delivering



of drugs and nutrients to patients' bodies. Thanks to the construction of a new generation of nanofibres, we are for example able to transport these substances through the gastrointestinal tract to the small intestine without them being significantly damaged by decomposition processes in the stomach.

MANUFACTURE OF NANOFIBRE STRUCTURES FIXED ON MATERIALS

By using the fibre-forming process technology in the electrostatic field, SPUR Zlín produces nanofibrous structures fixed on breathable, synthetic, mostly textile materials commercialised under the trade name of SpurTex®.

The materials are made on the electro-spinning line SpinLine 120 manufactured by the company and equipped with fibre-forming nozzles.

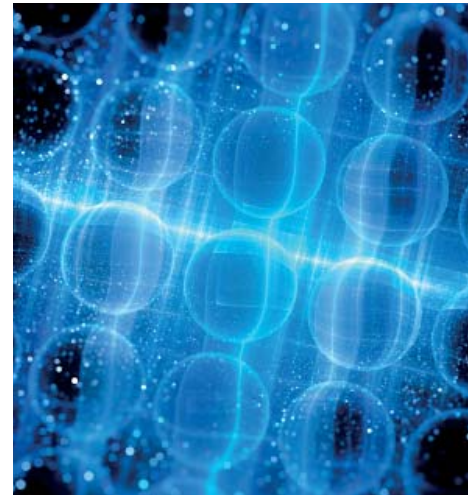
SPUR, www.spur.cz

RESEARCH AND DEVELOPMENT OF FUNCTIONALISED NANOFIBROUS STRUCTURES

The Nanoprogess cluster is focused on the research and development of functionalised nanofibrous structures and their application to a wide range of industries including biomedicine. Nanoprogess is the leader of the European Strategic Cluster Partnership in the emerging

industry of smart packaging and is ranked in the category of European Excellence Clusters within the European Cluster Excellence Initiative.

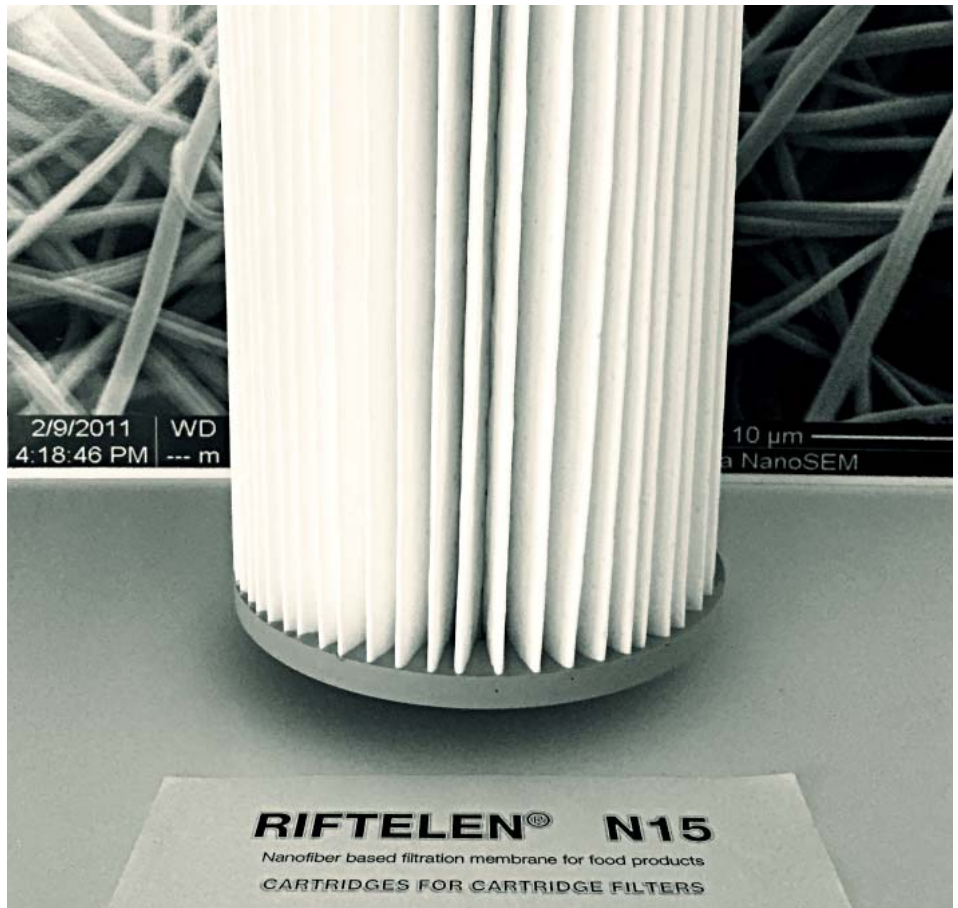
Nanoprogess,
www.nanoprogess.eu



NEW NANOFIBRE MATERIALS AND STRUCTURES

P A R D A M offers to customers and partners on the field of development of new nanofibrous materials and structures, new products based on nanofibres and also services of characterisation of powdered and fibrous materials using SEM, BET and XRD methods. The company also manufactures polymer nanofibrous wool-like 3D structures, which can be used as sorbents for the capture of heavy metals from water, production is in the stage of development and lowering the production process costs.

P A R D A M, www.pardam.cz

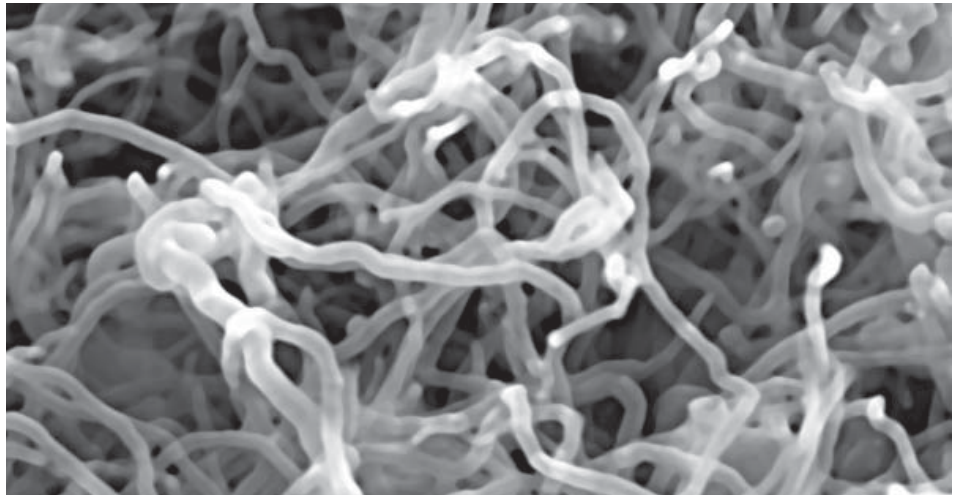




NEW STRUCTURES THANKS TO HYALURONAN NANOFIBRES

Nanofibres made of hyaluronan, its derivatives or composite materials are the domain of another Czech successful company – Contipro. They are produced by using a unique technological device 4SPIN, operating on the principle of electrospinning. This allows nanofibres to form different structures, bulky as well as flat layers with different square

weights. Nanofibres can also be aligned in one direction during the production. Nanofibrous materials can be used, for example, as wound dressings, carriers for sustained release of drugs or as tissue engineering scaffolds. In addition, nanofibres can be combined with other materials such as microfibrils. Contipro, www.contipro.com



RESEARCH AND DEVELOPMENT OF THE APPLICATION OF FUNCTIONALISED NANOFIBROUS STRUCTURES

Research and development of application utilisation of functionalised nanofibrous structures, including coaxial type structures and intelligent nanofibres, is the area in which SINTEX company operates. It deals with textile production at all production levels. SINTEX, www.sintex.cz

NEW STRUCTURES AND UNIQUE PRODUCTS

IQ Structures company designs and manufactures new structures on the surface and inside various materials, bringing unique products to the

market. It was founded by Czech nanotechnology experts, who have 20 years of experience and hundreds of implemented projects in more than 65 countries.

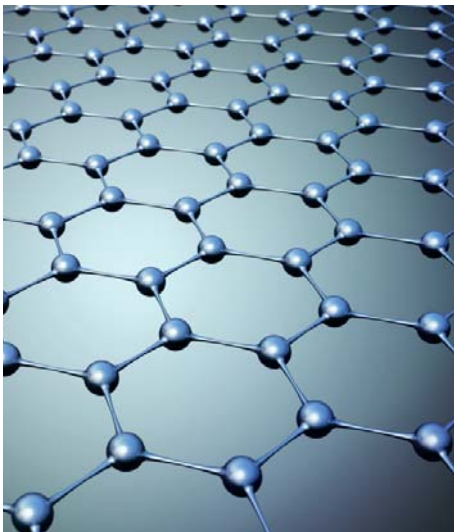
IQ Structures, www.iqstructures.com

4 PHOTOCATALYTIC AIR PURIFICATION

Smart coatings with titanium dioxide nanocrystals clean house facades and the surrounding air in the long term. Each square meter of a facade treated with the smart coating is able to purify more air than a person uses in one year without any maintenance and energy costs. Special photocatalytic coatings can also be used in interiors. Where self-cleaning smart paint cannot be applied to the walls and ceilings, solitary air cleaners are used operating on the same photovoltaic principle. Titanium dioxide in photocatalysis converts the ultraviolet light

component from the sun into energy that purifies the air from dirt including moulds, viruses and bacteria. It breaks them down into molecules of water, carbon dioxide and harmless minerals. Czech scientists have succeeded in creating a unique technology that helps large amounts of titanium dioxide nanocrystals to the surface of the binder in a smart coating. They have thus achieved an extraordinary increase in efficiency in air purification and protecting the surface against microorganisms and dirt deposition. During photocatalysis, the catalyst is

not changed or consumed. A smart coating that protects the facade and purifies the air thus does not need to be replaced frequently. Thanks to this, homeowners will save their money significantly. Because of the weather, it is advisable to replace the smart coating every ten years. Titanium dioxide, commonly known as titanium dioxide, is commonly used as a paint pigment, a food colouring agent or as an active ingredient in some sunscreens. Its safety is proven by many decades of use all around the world.



DID YOU KNOW?

NANOPARTICLES CAN CLEAN AN OLD STATUE AS WELL AS AIR CONDITIONING

Nanosubstances form an active thin self-cleaning layer on the surface of objects and significantly help the environment. Using photocatalytically active nanomaterials, we can destroy very toxic and resilient pollutants in water and effectively clean the air in air-conditioning systems.

UNIQUE PATENTED COATING MATERIAL PURIFIES AIR

The Czech innovative company focusing on nanotechnology – Advanced Materials-JTJ has developed and produced special functional coatings of FN with an extraordinarily strong photocatalytic effect. Thanks to the absorption of sunlight the photocatalytically active coating surface can produce highly reactive radicals, which prevent the growth of mould and algae on house facades and decompose sedimented dirt. In addition, the coating allows for reducing the concentrations of nitrogen oxides, which are particularly dangerous pollutants. The coatings are sold in Western Europe, the US or New Zealand, China is the largest buyer. Advanced Materials-JTJ, www.amjtj.com FN NANO, www.fn-nano.com



DEVELOPMENT AND IMPLEMENTATION OF THE SPECIAL MULTIFUNCTION PHOTOCATALYTIC ANTIBACTERIAL COATINGS APPLICATION

Air pollution does not only concern the external environment. Even the pollution of the interiors in the areas in which we move and live, often many times exceeds the external pollution. Smoke, smog, allergens, as well as volatile organic compounds, which are released from varied materials penetrate the interior. Also, microbiological pollution (bacteria, viruses, fungi), which in particular results from a large number of people in common areas and rooms (schools, offices, hospitals, waiting rooms, etc.) are another source of indoor pollution. All these problems can be solved by an innovative process of purification – photocatalysis. Nano4people company is a specialist in multi-functional photocatalytic antibacterial coatings that can purify

the air using light. The company intensively participates in and collaborates on the development of further modifications of photocatalytic products. It seeks and discovers new possibilities for their further use in practice. It implements specific applications according to the given specifics and requirements of the company for a healthy and clean environment. It develops new and optimises existing application methods of nano materials, taking into account both the different types of bases and their tonal colouring. In cooperation with partners, it also performs testing, monitoring, measuring and evaluating the effectiveness of implemented applications. Nano4people, www.nano4people.cz



DEVELOPMENT AND APPLICATION OF SPECIAL PROTECTIVE COATINGS

NanoTrade company complements applications with coatings to protect interior and exterior materials from soiling. In addition to photocatalytic coatings, it develops and implements other forms of space and material protection in conditions where photocatalysis cannot be used for its technical constraints.
NanoTrade, www.nanotrade.cz/en

KNOW-HOW FOR THE DEVELOPMENT OF NANOFIBRE APPLICATIONS FOR AIR FILTERING

Nanofibre applications by NAFIGATE company are manufactured using Nanospider technology. Nanospider is a unique patented spinning technology from free polymer solution in a strong electrostatic field without the use of nozzles. This technology allows the production of nanofibres with a diameter of 80 nm to 500 nm (or more) with a standard deviation of 30 % or less. It is very versatile and meets all the demanding requirements, such as easy customisation of the production parameters and flexibility of setting according to the individual ideas of production of nanofibres. The know-how for the development of nanofibrous applications for air filtration has been in existence since 2006. During this time, comprehensive know-how

was formed that includes industrial formulas for the production of nanofibrous window netting, including both the production of the nanofibre layer and the so-called after-treatment process. However, it also includes formulas for nanofibre applications in the field of personnel protection (masks), cabin filters for cars, HVAC systems in buildings as well as laboratory procedures for spinning of polymers for industrial filtration at high temperatures. Nanofibre nettings are designed for their unique filtering effect. They have unique properties including high light and air permeability; they act as heat insulation; they are highly resistant to weathering, smog and water.
NAFIGATE Corporation,
www.nafigate.com



NANOPURIFIERS – A NEW GENERATION OF AIR PURIFICATION

With air nanopurifiers, the contaminated air flows continuously through a set of photocatalytic filters that are illuminated across the space with an area of more than 2 m² and UVA radiation of 365 µm. On filters of this type, the toxic gases, microorganisms such as bacteria and viruses, fungi and other organic-type impurities are completely broken down. In nanopurifiers, photocatalysis leads to the breakdown of harmful chemical substances and the destruction of bacteria and viruses in the interior. The purifying system is patented in the Czech Republic with enlargement to the EU. This method of purification will be extended to regenerative units, air-conditioners, etc. The purification method is patented for heating systems using aluminum-coated lamellas on which TiO₂ and SiO₂ are applied with UVA light illumination of 365 µm.

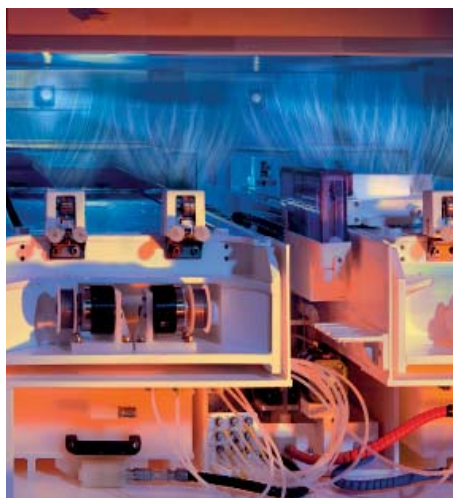
RETAP,

www.nanocisticky.cz

DEEP AIR FILTRATION

The gradual development of technology of Elmarco company enables the use of nanofibres in gradient filter media where particles charged within the depth of the filter structure. The nanofibre layer gives the medium the key features such as high porosity, small fibre and pore size, along with a high specific surface area. These properties then significantly improve the filter media parameters – high mechanical filter efficiency, dust extraction capacity and low pressure drop. As a result, nanofibres bring energy savings in operation and thus lower operating costs.

Elmarco, www.elmarco.com



POLYMER NANOPARTICLES IN VENTILATION AND AIR CONDITIONING SYSTEMS

The company P A R D A M is engaged in research and production of nanofibrous materials. Thanks to its unique centrifugal spinning technology and its own know-how, it is the only company in the world that is able to produce a wide range of both inorganic and polymeric nanofibres on an industrial scale. Due to the many years of practice of nanotechnology specialists, P A R D A M company has a large portfolio of products. Polymeric nanofibres produced by P A R D A M are used in ventilation and air conditioning. Their properties guarantee high breathability while meeting the HEPA filtering conditions. Their long-lasting antimicrobial modification prevents mould growth and bacterial and virus colony growth on the filter surface, as is the case with conventional (HEPA) filters. Thus, nanofibre filtration insets offer effective mechanical filtration and disinfection of air in one step, all at low pressure losses.

P A R D A M,

www.pardam.cz

5 NANOTECHNOLOGICAL SURFACE TREATMENT

Do you want to keep your clothes, interior equipment or car bodywork clean? Do you want parts in components that you manufacture to be more durable? Do you want to increase the lifespan of the tools you use to create your products? Czech companies are able to address clients' demands for higher strength, resistance to a wide range of degrading influences, adhesion or non-wettability requirements, but they can also handle biocompatibility requirements, extremely low friction, and thus offer many further improvements in material properties. It does not matter whether you manufacture medical devices, aviation engines or, for example, machinery parts for pharmaceutical and food production. Czech nanotechnology improvements are unique in that they are delivered both in small and large series. They often replace past expensive solutions and thus reduce the production processes and hence the products of business partners.



NANOTECHNOLOGY IN FIGHT AGAINST COUNTERFEITING

Czech companies can create unique nano and microstructures that can reliably protect personal certificates, documents, valuables or anti-counterfeiting goods. IQ Structures company delivers very sophisticated optical security features around the world, allowing even amateurs to recognise a counterfeit from the original with the naked eye. These optical structures are engraved using an electron beam with enormous resolution, making them so fine and creating unique effects that even the best photocopier in the world cannot copy. Such security is vital to any government that wants to protect its currency,

travel and personal documents, and also for any company that wants to thoroughly protect its products against imitation and fraud at a reasonable price. Thanks to extensive research and development, it is possible to customise existing technologies or create new ones based on specific customer requirements. Smart nano and microstructures that the IQ Structures company can produce can help to change habits in a number of areas, from automobile lights, through energy, to protection against counterfeiting and fraud. IQ Structures, www.iqstructures.com



NANO PROTECTION OF SURFACES

NanoTrade is one of the oldest Czech nanotechnology companies. In cooperation with domestic and foreign research centres, it develops products for the protection of surfaces of varied materials, or additives for modifying material structures in order to influence their final properties. In addition to direct deliveries to end or industrial customers, it also has years of experience in application and implementation.

NanoTrade, www.nanotrade.cz/en/products/material-upgrading



Pikatec is a purely Czech technology company. It cooperates with the Technical University of Liberec on the development of surface protection nanotechnologies. The company thus covers everything from development through production to product dispatch. All these activities take place in the territory of the Czech Republic. Nanotechnology by Pikatec offers complete treatment and protection of cars, households, hotels, offices, boats, public transport and much

more. The main principle lies in a thin layer invisible to the eye, which, thanks to the use of nanoparticles of silicon, titanium and zirconium oxide, smoothes out the surface and delivers properties that make the protected surface more wear-resistant (for example, it is significantly harder, more abrasion-resistant, UV stable), at the same time it gets dirty less and is far easier to clean.

Pikatec Technology,
www.pikatec.cz

ANTI-CORROSIVE, INSULATING AND LUBRICANT SPRAYS AND SOLUTIONS USING NANOTECHNOLOGY

ELF Logistic is a manufacturer and distributor of anticorrosive, lubricating and electro-insulating sprays using nanotechnology. Their composition has been developed since 2007 and after three years of testing, the products were first introduced to the public under the name of Nanoprotech. Nanotechnology allows that the particles, thanks to their minimal size, are able to get into the micro cracks and pores of the metallic

surfaces and at the same time to create a layer that, in addition to smoothing the unevenness, it also acts as a lubricant, anticorrosive and insulating protection or moisture protection. Nanoprotech company offers sprays to protect cars and motorcycles, all electrical equipment or bicycles. It also provides a spray variant for house, garden and workshop. Nanoprotech,
www.nanoprotech.cz

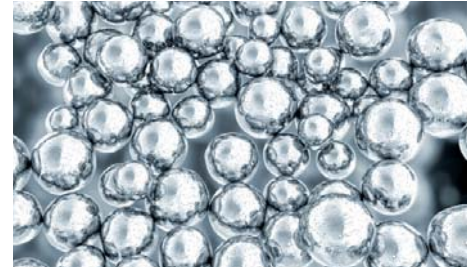


REFINING MATERIALS

NanoTrade company is one of the oldest Czech companies in the field of nanotechnology, founded in Olomouc in 2004. It closely cooperates with research institutes and universities in the Czech Republic, Europe and overseas. The company carries out its own applied research on the development of new materials, technologies, processes and end products at all levels for many applications. NanoTrade specialises in packaging materials, functional textile clothing, surface protection products, liquid and solid fuel additives, treatment of wounds and special technologies. NanoTrade,
www.nanotrade.cz/en/products/additives-and-energy



A HIGHER STANDARD OF CLEANING OF INTERIORS



Czech nanotechnology companies have created the concept of the first truly hypoallergenic interior in the world. The high purity of the environment is suitable not only for allergic persons and people with weakened immunity, but also for those who are interested in higher standards of cleanliness in homes, health and school facilities, hotels, restaurants, wellness and fitness centres and other places. A higher standard of interior cleanliness is achieved by photocatalytic purification of the air by self-cleaning smart coatings with titanium dioxide crystals or solitary air purifiers operating on the same principle. The ultraviolet

component of light excites electrons in crystals, which, thanks to oxidation, break down pollutants including toxic gases, moulds, viruses and bacteria. According to long-term statistics, children in nursery schools in classes treated with smart coating are 30 % – 40 % less sick during influenza epidemics than those from neighbouring classes. Nanomembrane window netting prevents smog, fine dust and other allergens from entering the rooms during ventilation. Anti-allergy bedding prevents the spread of dust mites and allergens created by them, viruses and bacteria produced in mattresses, pillows

and blankets. Beddings containing nanomembrane release air molecules, but prevent the movement of fine dust and other allergens. They thus provide a suitable basis for the calm sleep of allergic people. Hydrophobic sprays protect exposed areas in the interior from wear and dirt. They also save time and cleaning costs and reduce the consumption of cleaning chemicals. Applied hydrophobic coating repels liquids that easily slide down the surface taking the dirt particles with them. Hotel and restaurant operators appreciate the effects of hydrophobic sprays, especially in protecting upholstered parts of furniture.

SMART COATINGS AND NANOPURIFIERS

Photocatalytic purification of the air using self-cleaning smart coatings with titanium dioxide crystals is handled by several specialised companies in the Czech Republic because the Czech Republic is a world leader in this field.

The most important results of the application include the extension of the service life of facades, the destruction of moulds and fungi, a significant decrease in sickness rate and the potential to clean city air.

Advanced Materials-JTJ,
www.amjtj.com
FN NANO,
www.fn-nano.com
Nano4people,
www.nano4people.cz
RETAP,
www.nanocisticky.cz

Another way of purifying the air is to use nanopurifiers. In nanopurifiers, there is a photoactive filter that requires no maintenance or cleaning. Unlike other purifiers, the nanopurifier is not a “dust and dirt trap” in which dust and filter dirt need to be washed, cleaned or filters changed. Nanopurifiers break down chemical harmful substances and destroy bacteria and viruses in the interior.

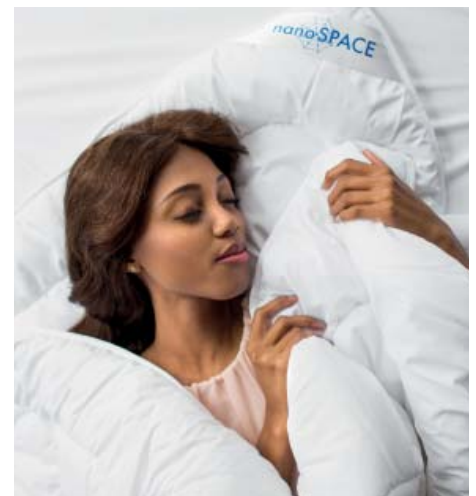


NANOIRCLEANER

Nanoaircleaner nanopurifiers are made of natural materials such as solid wood, artistic glass fusing, mirror glass, canvas with no harmful binders and ceramic tile. RETAP, www.nanocisticky.cz

ANTI-DUST MITE BEDDING

NanoSPACE operates on both Czech and foreign market in the field of anti-allergy products with a nanofibrous membrane. It is the first company in the world to produce anti-allergy beddings with nanofabric. This completely innovative way of protection against dust mites and their allergens puts the nanoSPACE company at the forefront of world-class manufacturers of protective anti-allergy beddings for allergic people. The entire manufacturing process of their products takes place in the Czech Republic. nanoSPACE, www.nanospace.cz



REVOLUTIONARY NANOFIBRE NETTING IN WINDOWS TO PURIFY AIR

The NAFIGATE company has developed a comprehensive know-how that includes industrial formulas for the production of nanofibre window netting, including both its own production of the nanofibre layer and the so-called after-treatment process. However, it also includes formulas for nanofibre applications in the field of personnel protection (masks), cabin filters for cars, HVAC systems in buildings and laboratory procedures for

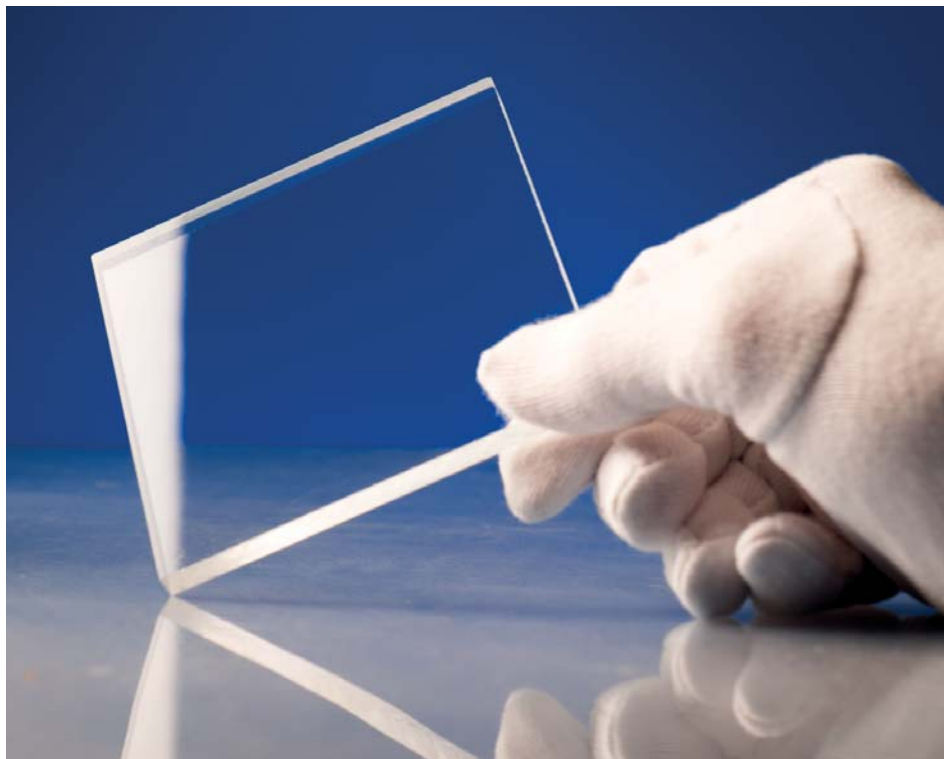
spinning of polymers for industrial filtration at high temperatures. NanoCleaner – a window netting with a nanofibrous layer, will not let smog or allergens to the interior. It can filter all the particles that can damage the lungs. It looks like a normal mosquito net with a nanofibrous layer that gives the product revolutionary cleaning capabilities. NAFIGATE Corporation, www.nafigate.com

PREVENTIVE PROTECTION AND HYPOALLERGENIC SPACE

Complete interior protection is also possible with nanotechnology resources. The Czech company NanoTrade specialises in this area. Among its tried and tested products are titanium and silver-based products, which can create a reliable barrier to emissions, viruses or moulds in the interior, will also reduce the concentration of dangerous microorganisms, suppress the risk of disease transmission and eliminate

unwanted odours. Its application combined with other means of surface protection for textiles, ceramics, glass or plasters creates a new standard: hypoallergenic space. The company has more than 12 years of experience in this field and knows how knowledge of products and technical support is important to customers.

NanoTrade,
www.nanoapplication.eu



NANOTECHNOLOGY ENTERS THE WORLD OF LIGHT TECHNOLOGY

VYRTYCH company offers innovative access to light fitting protection using nanotechnology. The Czech Republic was the first to develop a special technology for the application of a nano layer to the covers and bodies of light fitting. Nano-layer coated light fittings have features such as long-lasting, resistant hydrophobic and oleophobic protection, reducing dust and dirt adhesion, UV resistance, antibacterial effect and protection, easy cleaning. VYRTYCH, www.vyrtych.cz

CLEAN SPACE WITH NANOTECHNOLOGY

NanoSPACE and NanoTrade specialise in complete clean rooms. Using nanotechnology, they achieve clean rooms without allergens, bacteria, viruses, microbes and fungi. They thus offer solutions for customers who want to have modern living for their family, clean environment at a hotel, their doctor or their favourite fitness centre, but especially for people with respiratory problems, allergic people and people with asthma or for people with a requirement for clean environment. Within application, walls and ceilings are treated with photocatalytic coatings that cleanse the air from

all microorganisms. Beds are fitted with anti-allergic beddings with nanofabric that remove mites and allergens. The bed is clean and does not stir up dust. Other rooms or furniture are treated with effective anti-microbial materials. Glasses and sanitary equipment are also treated by means against soiling so that the surfaces are kept clean for a long time. This will reduce the consumption of cleaning chemicals during cleaning by up to 30 %. nanoSPACE, www.nanospace.cz, NanoTrade, www.nanotrade.cz/en/products/clean-areas



BUILDING MATERIALS WITH NANOPARTICLES

Rokospol offers a complete range of selected coatings and building materials with antibacterial, fungicidal and antifungal effects as well as photocatalytic ones, too. Rokospol is a functional precursor with nanoparticles of selected materials.

ROKOSPOL, www.rokospol.cz

Another Czech company – Teluria – offers a transparent nanocomposite system with a solar photocatalytic self-cleaning biocidal function for surface treatment of facade and mineral bases.

TELURIA, www.barvyteluria.cz



7 NANOTECHNOLOGIES IN HEALTH CARE

Nanotechnology solutions are having a major impact on the development of medicine and pharmacology. Czech nanotechnologists have already created the first replacement organ of nanofibres and stem cells. Fully functional thymus is a hope not only for people with impaired immunity but also for other patients in whose bodies in the future doctors will operate substitute human organs

created using nanotechnology from patients' own stem cells. Before these methods become a common part of treatment, they will require some years of testing to be put into practice given the legislative context. Nanofibrous structures can be found in surgical masks, surgical gowns and other items where they are used as very effective barriers to microorganism's penetration. In many healthcare facilities plasters

and dressing material containing nanosilver help patients to better heal wounds. It is because nanosilver prevents the growth and survival of bacteria. In antibacterial knits for orthoses, bandages and corsets, this substance helps patients to maintain a higher degree of purity after complex operations and reduces the possibility of possible complications throughout treatment.



UNIQUE KNOW-HOW IN THE FIELD OF APPLICATION OF HYALURONIC ACID AND NANOTECHNOLOGIES

Hyaluronic acid is one of the building blocks of the human body and, given its favourable properties, is used in health care. However, its processing into nanomaterials on an industrial scale is very difficult. The Contipro company is able to do this and also has an authentic experience with placing medical devices on the market. At present, Contipro thus offers not only its nanofibres from hyaluronan, but also the custom development and

production of medical means to partners around the world. There is a big demand for these materials and, in addition to internal products, custom-made materials developed for important foreign companies are in the company pipeline. Examples of developed materials include small wound covers, drug delivery systems, and implant biocompatibility enhancing materials. Contipro, www.contipro.com

ANTIBACTERIAL NANOSTRUCTURES AND ADHESIVE PLASTERS

Antibacterial surface treatment uses silver salts immobilised by a patented method in the nanostructure. The products of this series have a proven highly antibacterial and antimycotic efficacy, and due to their cost-effectiveness of the technical solution, they mean a considerable progress in improving health care and providing long-term antibacterial protection in healthcare as well as veterinary or food processing environments. The main application of antibacterial nanostructures in fabrics are StopBac products, which have been licensed for production in the Czech Republic and have been already successfully launched in the EU. These are footwear inserts, plasters and sterile adhesive surgical covers. This new generation of plasters with special

pad treatment provides, besides high-quality wound dressing and its surroundings, also the highly effective antibacterial protection described above, which, by significantly reducing the occurrence of bacteria, prevents the penetration of the external bacterial infection into the wound. By significantly reducing the risk of sepsis, the product thus significantly contributes to better healing of injuries. The high-quality materials used in the product provide both effective and comfortable wound coverage. The active pad zone provides an antibacterial effect throughout the application period, which is often not ensured for other products and does not release any fibres into the wound.

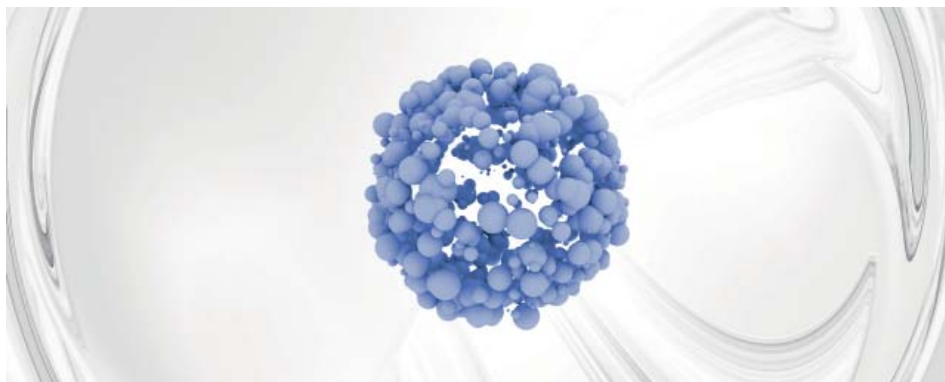
ING MEDICAL, www.stopbac.cz



NANOFIBRE SUBSTRATES OF MEDICINE QUALITY

Other highly innovative products of the company include nanofibrous medical grade substrates and proprietary patent-protected functionalisation (especially drug delivery systems) for the preparation of special wound covers. The ING MEDICAL company has prototypes and is successfully completing the necessary tests to incorporate products using this technology into series production and their launch. These highly innovative technologies of the nanofibrous structure functionalisation represent another significant benefit for an entire range of new medical applications.

ING MEDICAL,
www.ingmedical.cz



HIGHER SAFETY IN HOSPITALS

The concept of hypoallergenic space thanks to nanotechnologies is used by many health and social facilities, including birth halls, infectious wards of hospitals, oncology centres, children's hospitals, hospices and private clinics. Special coatings by Nano4people and NanoTrade companies protect the walls of hospitals through protective coating with titanium and silver particles. This coating destroys viruses and bacteria, maintains a clean surface and at the same time cleans air from harmful substances, microorganisms or odours. A protective spray protects patients and staff, improves the cleanliness of the hospital environment, reduces the risk of infections and removes fumes from disinfectants and other possible substances. The NanoTrade company complements the implementation of protective coatings with supplies of functional work clothes with microbial protection. Nano4people,
www.nano4people.cz,
NanoTrade,
www.nanoapplication.eu



TISSUE ENGINEERING AND NANOTECHNOLOGY

The Czech biotechnology company Bioinova focuses on research and development of modern cell therapy. It develops therapeutic preparations based on stem cells and other cells derived from bone marrow and adipose tissue. In addition, the company is engaged in the commercial use of cellular products in fields that do not require clinical trials. Bioinova is the submitter

of several clinical trials and a manufacturer of stem cell-based medicine for further studies. In addition to the Academy of Sciences, it cooperates with universities and companies engaged in research in regenerative medicine. It also deals with cell therapy, tissue engineering and nanotechnology. Bioinova,
www.bioinova.cz

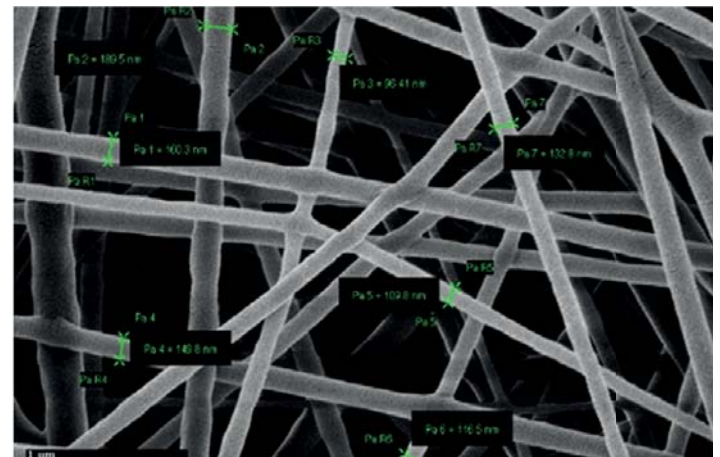
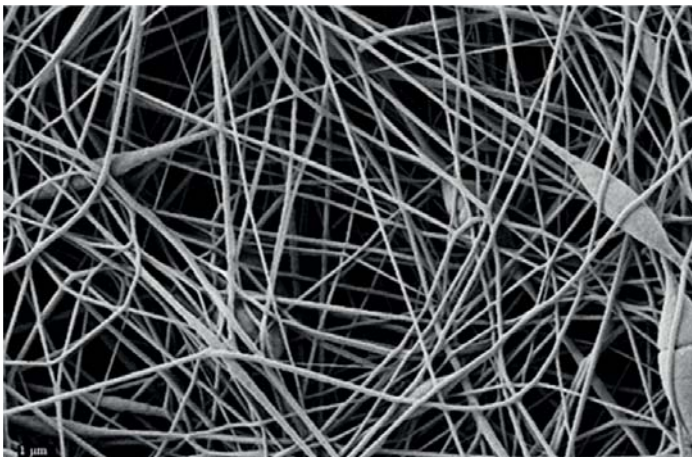
REGENERATIVE MEDICINE WITH THE USE OF NANOTECHNOLOGIES

Nanopharma specialises in the research and development of nanofibrous materials for many years. The result is a broad base of used and mutually combinable technologies for their preparation, as well as a rich portfolio of distinct types of structures and spinned materials that it is capable to produce for its clients as custom-made or assemble customised structures tailored to their needs. The company is engaged in the production of classical nanofibres, which are widely used in medicine. It is also a specialist in the area of coaxial nanofibres, which have a nucleus/shell structure and are prepared by coaxial electrostatic spinning. The application is suitable for dermatology (skin

covers), surgery (functional networks), cosmetics (coaxial nanofibres added with active substances), drug delivery (immobilisation of nanoparticles, controlled release of active substances), tissue engineering. The Nanopharma company responds to current needs in regenerative medicine, which deals with the replacement, repair or improvement of damaged tissues and organs. For tissue engineering, which is part of regenerative medicine, it is necessary to develop cell carriers – so-called scaffolds that serve as support structures for cell growth. Due to the size of the cells, nanofibres proved to be useful for the production of scaffolds, with their undisputed advantages being the nanometre diameters and the large specific surface of the fibres. The functional cellular carrier must be

structurally close to the extracellular matrix, i.e. the intercellular matrix, so that the cell culture and proliferation environment is as natural as possible. For this reason, the Nanopharma company develops and manufactures, in addition to 2D structures, also 3D cellular carriers from biocompatible and biodegradable materials that have proven to be good for cultivation of many types of cells (stem, differentiated – fibroblasts, osteoblasts, hepatocytes, endothelial cells, etc.). The shape and properties of 3D nanofibrous structures can be designed according to the customer's requirements after agreement.

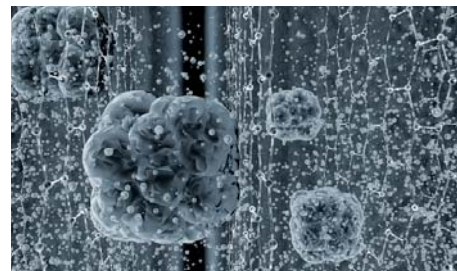
Nanopharma,
www.nanopharma.cz



8 CLEANING WATER AND WASTE AND OTHER FILTRATION

Czech nanotechnologists have developed a unique cleaning system that will transform any contaminated water into drinking water. Cleaning works purely on physical principles, without the addition of chemical additives. Water purification uses low pressure, separation, ionisation and filtration up to the level of nanofiltration. Cleaned and oxygenated water contains, after passing through the device, desirable ions, selected minerals such as calcium, magnesium and rare salts, to be ideally suited to the needs of the human body. Final drinking water is also suitable for infants. A unique purification method also removes the dead bodies of bacteria, viruses, spores and moulds, but also pharmaceutical toxins, trace elements of antibiotics and hormonal contraceptives. Conventional water purifiers do not even deal with this pollution at all and release them in water supply line of households. In order for Czech nanotechnologists to prove that their water purification technology is economically advantageous and that they are able to clean contaminated water from any pollutants, including hormones and other pharmaceutical

substances, they have prepared the project "Drinking water and pellets from pig manure" for pig breeders. The investments in the necessary technology returns to breeders within six years. The water can be purified nanotechnologically with respect to the specific conditions and the required quality level for technological, drinking or irrigation water. Nanotechnology equipment purifying water at the technological level consumes only 35 watts per hour, which is comparable to the consumption of energy saving light bulb. Each impurity is filtered off one hundred percent; the concentrate is dried up and disposed of by two-stage combustion. Thanks to this, nobody needs to burden the environment with new wastes when cleaning water.



LESS THAN ONE PERCENT OF THE TOTAL VOLUME OF WATER ON EARTH IS DRINKING WATER

Drinking water reserves on Earth are decreasing every year. It is reported that one-fifth of world's population has no access to safe water, and three million people per year die from contaminated water. In the Czech Republic, a unique filtration system has emerged that promises to turn any polluted water into drinking water.

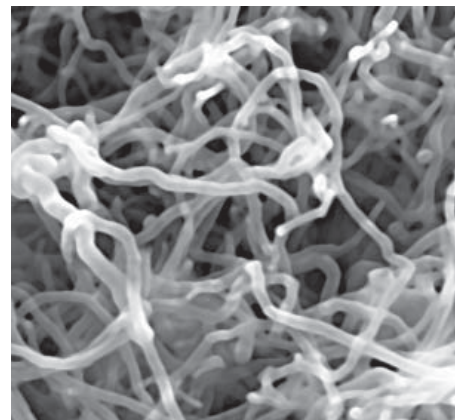
Výzkumný Technologický Institut,
www.vti-cz.com



TECHNOLOGICAL AND MANUFACTURING KNOW-HOW APPLICATION FOR WATER FILTERING IS IN THE CZECH REPUBLIC

NAFIGATE Corporation brings to the global market projects focusing on the development and production of a new energy-efficient generation of nanofibrous membranes for water and air purification technologies, textile industry and cosmetics. NAFIGATE Corporation know-how for the development of nanofibrous applications for water filtration has been emerging since 2006. During this time, comprehensive know-know has emerged that includes a formula for producing a fourth generation nanofibrous microfiltration membrane for water filtration; a formula for producing a nanofibrous filter membrane for Forward Osmosis and a prototype filtering device for water filtration without the use of electrical energy. NAFIGATE Corporation, www.nafigate.com

Another key activity of NAFIGATE Corporation is transfer biotechnology called Hydal, which is the world's first to use used frying oil in the industrial scale of 100 % waste – to produce PHA biopolymer. The first pilot factory is being built in Suzhou, China. Hydal Biotech acquired the Frost and Sullivan Technology Innovation Award in 2015 with an excellent technology and business strategy rating.



WATER PURIFICATION USING UNIQUE MATERIALS

By using the fibre-forming process in the electrostatic field, the company SPUR Zlín produces nanofibrous structures fixed on breathable, synthetic, mostly textile materials commercialised under the trade name of SpurTex®. The materials are made on an electrospinning line of the company's own design, SpinLine 120 (the electrospinning line is in the below picture), equipped with fibre-

forming nozzles. Nanostructured SpurTex® materials are offered as microfiltration membranes for water filtration and as highly efficient filtration materials for air filtration, characterised by the latest EN779 and EN1822 standards. The surface of the nanofibres is usually modified advantageously by antibacterial agents limiting biofilm formation. SPUR, www.spur-nanotechnologies.cz

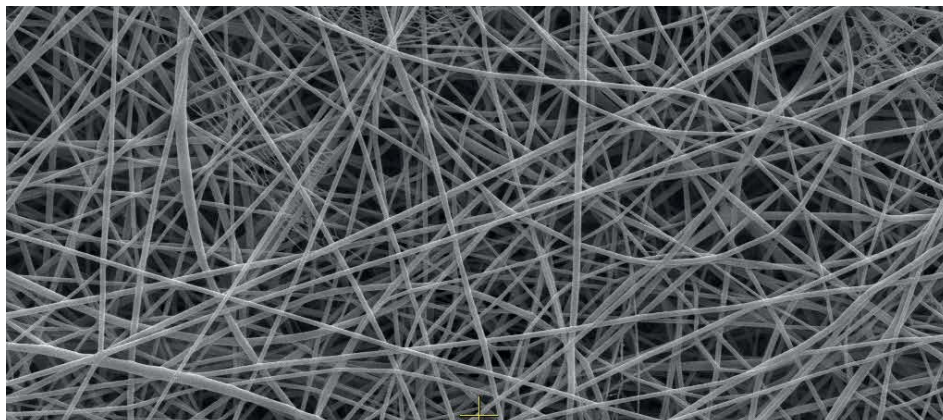


NANOFIBRES APPLICATION

Nanospider™ technology is an affordable industrial technology capable of producing a miniature nanofibrous layer with the exact properties and dimensions of the nanofibres. The nanofibres made with this needle-free electrospinning technology excel in their high homogeneity and have contributed many times to improving the final products in various industries. Homogeneous layers of nanofibres are particularly suited to the needs of the filtration industry, and their properties in most cases outweigh the materials used so far. Nanofibres bring key features such as high porosity, small dimensions of fibres and pores, together with a high specific surface area. Combinations of these features bring benefits in a number of areas, in addition to filtration, it is medicine, acoustic materials, battery separators or membranes for performance apparel.

Elmarco,

www.elmarco.com



NANOTECHNOLOGY APPLICATIONS IN WATER MANAGEMENT

The application of nanotechnologies in water management can be seen primarily in purification and remediation, sensing and detection and protection against pollution. Among the most interesting areas of nanotechnology applications in the field of water purification are nanofiltration, the application of nanofibrous structures to water filtration, the use of antimicrobial materials to remove undesirable microbial life in waters and the use of advanced nanomaterials for potable and waste water treatment. An important representative in the field of research, development and application in practice is the Czech company ASIO, which deals with the application of nanofibrous structures and nanomaterials for

potable water and wastewater treatment and the elimination of microbial contamination from water. Another area of research is nanofibre filtration materials and elements for air purification for applications in water management. It cooperates on development and application of these materials and technologies with SPUR company, which provides development and production of nanofibrous layers and with a number of leading research and university departments (Palacký University in Olomouc, Mendel University, Brno University of Technology, Technical University of Ostrava, Centre of Organic Chemistry and others). ASIO, www.asio.cz

IN CZECH REPUBLIC WE CAN PRODUCE DRINKING WATER EVEN FROM PIG MANURE

Even pig manure may be a source of drinking water after appropriate technological modifications. The company Research Technology Institute – Výzkumný Technologický Institut (VTI) deals with the development and production of devices for modification of drinking water from contaminated water sources in this example has shown the high efficiency of its method. The technology removes hormones, contraceptives, antibiotics, heavy metals, but also toxic and synthetic

substances from contaminated water. Separation of water and pellets from pig excrement is just one example of how this technology can be used. After centrifugation, by a filtration cascade through ultrafiltration, nanofiltration, ozonisation and mineralisation, drinking water can be obtained and after drying of the concentrate also non-smelling pellets for heating and electricity generation. Drinking water that flows out of the system is sterilised by ionisation, free from any chemicals and bacteria. VTI further mineralises water

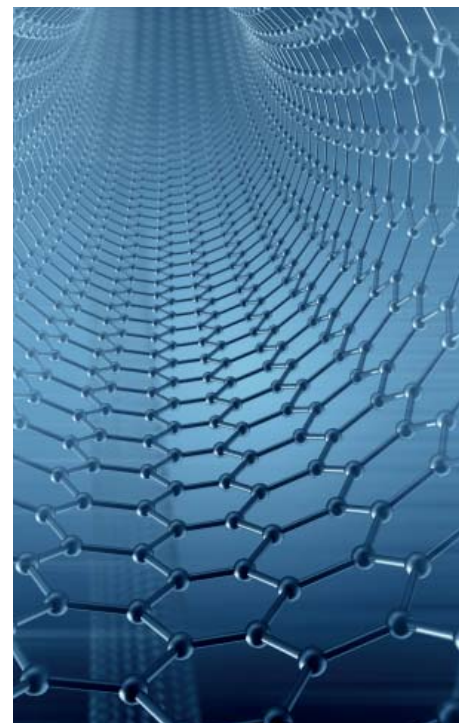
to mineral levels that are optimal for the human body. The technology for contaminated water purification and power generation supplied by VTI company has a wide range of uses. It can be bought in a small version by an owner of a family house for the use of rainwater and waste, as well as in larger scale, for example, a whole city for a wastewater treatment plant.

Výzkumný Technologický Institut,
www.vti-cz.com

CZECH NANOFIBRE MEMBRANE FOR WINE FILTERING SETS OUT TO CONQUER THE WORLD

The Nanotechnology Company P A R D A M in cooperation with the Czech food filter manufacturer FILTREX developed a unique RIFTELEN N15 membrane for filtration of oil, spirits and pharmaceutical products. After successful tests and food certification, nanomembrane from P A R D A M sets out to conquer world markets. Target customers are mainly food companies. The nanofibre membrane has a lower pressure drop, can be regenerated, does not have to be rinsed before filtering,

and increases the performance of the filter. The advantage is financial savings for cellulose plates. The Czech company FILTREX has been producing filters with high reliability and performance for 21 years already. The filters differ from conventional ones by the fact that filtration is ensured by flow instead of one straight by two inlet and outlet ducts. This reduces the pressure drop in the filter device and generates energy savings. FILTREX, www.filtrex.cz



NEW NANOFIBRE MATERIALS AND STRUCTURES FOR EFFICIENT FILTRATION

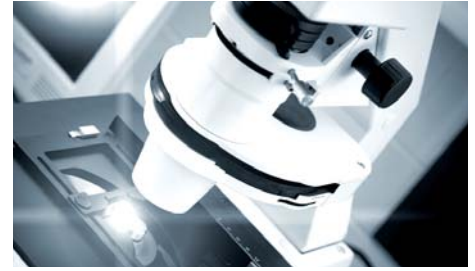
The company P A R D A M is engaged in research and production of nanofibrous materials. Thanks to its unique centrifugal spinning technology and its own know-how, it is the only one in the world to produce a wide range of both inorganic and polymeric nanofibres on an industrial scale. Due to the many years of practice of nanotechnology specialists, P A R D A M company has a large portfolio of products. In the field of filtration, these are mainly NnF MBRANE polymer nanofibres, which are the main application in the filtration of both liquids and air. PUR, PA6, PAN, PVB, PVDF, PET and PCL can be found in the standard offer. Nanofibres are applied to the carrier fabric and can be laminated to prevent breakage. Unique technology also

makes it the world's only production of polymer nanofibres in 3D wool structure. As a commercial product in the current offer, there is RIFTELEN N15 – a nanofibrous membrane with a food contact certificate. The membrane is widely used for plate filtration of food oils, distillates, liqueurs, sweetened beverages, etc. Due to the thin structure of nanofibres, a fast transfer of matter with high filtration efficiency is achieved. Compared to commonly used cellulose plates, the RIFTELEN N15 membrane increases the filtration performance by from 100 up to 200 %. In addition, filtration runs at lower operating pressures, which ensures its gentler process and reduces energy costs. In addition to that during filtration, no particles are released from the membrane and there is no unpleasant taste as it is when using cellulose plates. The RIFTELEN N15

membrane can be easily washed and reused for several cycles. The membrane is also available in a sleeve design and in a stacked star-shaped, respirator BreaSAFE. Nanofibre respirators are another product that uses high breathability of nanofibres together with effective particle capture in different filter classes. Respirators manufactured by P A R D A M company are breathable throughout their entire area and the air does not pass only through the valve as with competing products. Antimicrobial modifications ensure that moulds or bacterial and viral colonies are not formed on the respirator surface. In addition, the versions available include activated carbon for odour absorption. P A R D A M,
www.pardam.cz
www.riftelen.com



NANO OPTICS AND ELECTRONICS



Czech nanotechnologists are nowadays able to control light rays by creating very sophisticated micro and nanoreliefs in plastics or metals. Nanooptics is thus considerably smaller, lighter, more versatile than normal conventional optics, and can be produced efficiently in enormous quantities. Lenses made with nanotechnologies are flat, thin and well-suited for indoor and outdoor lighting. They send light only where it is

needed. It is also possible to use fewer light fittings, which, moreover, do not shine unnecessarily into the eyes. We can also direct the light from streetlights exactly to the places we need to illuminate, thus avoiding unnecessary waste of energy, lighting into people's windows and limiting light smog in cities. Nanooptics, thanks to its small size and light control accuracy, perfectly fits into the car lights and the various

sensors and cameras used by the new car models. Small dimensions combined with high efficiency will save much more weight and energy in car light design. In the nanooptics, each point is accurately counted and can bend the rays as desired by the lamp manufacturer. Light fitting is economical, healthy, comfortable, and easily adaptable to the demanding requirements of both people and technology.

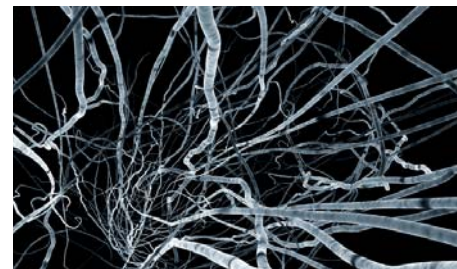
NANO AND MICRO LENSES

Consumer light technology has made considerable progress over the last time, which has been reflected, for example in the field of LED sources, both in utility quality and in price declines. Conventional glass lenses or injected plastic ones are often expensive, large and inefficient. The solution is the technology from the Czech nano company IQ Structures, which offers solutions in the form of unique flat micro lenses using nanotechnology. Calculated nano structures allow precise

managing of the light to optimise the overall effect, light distribution and properties. New technology has the potential to replace qualitatively, technologically and economically lagging and demanding moulding and grinding of glass or injection moulding that use expensive moulds and replace it with a very productive printing of plastic microoptics. It offers not only better light properties but also mass production possibilities. Thanks to its dimensions, it also gives freedom to the constructors, designers of products

and light fixture manufacturers. "Lightshaping" structures are created using an electron-beam lithography, UV lithography, or the IQ Structures nano printer. Then a production tool is created, and the lens can be reproduced in huge series. Another area of development is 3D micro and nanoprinting. It is also used to create special security features in the fight against counterfeiting. IQ Structures, www.iqstructures.com

10 NANOFABRICS



At present, the standard is so-called functional clothing, which warms perfectly in the winter, cools and removes moisture in the heat. Functional clothing with nanosilver adds further significant improvements to these features. The silver component contained in the fabric prevents the growth and decomposition of bacteria in the user's sweat and prevents the formation of an unpleasant body odour. It also serves to prevent mould, mycoses

and eczema, while helping to overcome these problems. Antibacterial silver is nontoxic and does not irritate the skin. The silver molecule particles are firmly and evenly attached to yarn fibres and act throughout the whole lifespan of the clothing. The quality and efficiency of the branded clothing containing nanosilver does not drop even after 100 washing cycles. Nanofibrous structures can be used as very effective membranes in outdoor clothing but

also in hypoallergenic bedding. The membrane made of nanofibres is usually placed in two textile layers as a sandwich. Therefore, for example, a user of bed linen containing a nanofibrous membrane senses only a soft cotton satin. Textile materials with nanofibres are perfectly breathable and meet the highest health standards. Thanks to this, Czech nanotechnology manufacturers can also produce textile toys.

NANOSILVER® FUNCTIONAL CLOTHING IS AT THE MARKET FOR 13 YEARS ALREADY

The base of this functional clothing is nanosilver® yarn that is enriched with firmly attached silver atoms. They do not loosen from the yarn and thus do not harm the environment or the human body. Nanosilver® yarns are combined with other functional materials – Coolmax®, Coolmax® All Season, Thermo® Cool™, Lycra®, Merino or Bio Cotton in the knit. By such combination knits and final functional clothing are made that

are designed for different activities or purposes (thermal, cooling). Thanks to silver molecules, all products have antibacterial effects. Modern technologies are thus used in the first layer of clothing that forms underwear, socks or T-shirts. The product designs are custom, but the company is also able to deliver according to specific customer requirements. In addition to common colours, finished products can be complemented by embroidery, prints or photorealistic prints. Products

have been tested for a long time in laboratories as well as in extreme climatic and stress conditions. The nanosilver® brand is the holder of the CZECH MADE certificate. Products with this brand are used not only by people with excessive sweating, but also athletes, travellers, rescue and security staff or company employees, not only in the Czech Republic but also around the world. NanoTrade, www.nanosilver.eu

THE FIRST COMPANY IN THE WORLD TO PRODUCE ANTI-DUST MITE BEDDING WITH NANOFABRIC IS FROM THE CZECH REPUBLIC

NanoSPACE is a new emerging company operating on the Czech and foreign markets especially in the field of anti-dust mite products with a nanofibrous barrier. It is the first company in the world to produce nanofabric anti-dust mite bedding. This completely innovative way of protecting against dust mites and their allergens puts nanoSPACE company at the forefront of world-class manufacturers of anti-allergy bedding. NanoSPACE products

include anti-dust mite covers, pillows and blankets with a nanofibrous barrier, anti-dust mite linings and sheets made of nano-cotton. The range includes anti-allergy toys and covers and pillows with child motives. NanoSPACE products are suitable not only for allergy sufferers, but for those who want to improve the quality of their sleep. The whole production process takes place in the Czech Republic. nanoSPACE, www.nanospace.cz



FUNCTIONAL CLOTHING WITH NANOTECHNOLOGIES

The use of nanotechnologies for the functionalisation of textile substrates is one of the often cited innovative and promising possibilities of achieving interesting functional effects, be it with the help of classical or new advanced technologies using known as well as newly developed nanomaterials, often applied in terms of nanoparticles character in a minimised amount (dematerialisation). INOTEX company has extensive experience in the field of textile refinement using nanosystems. INOTEX is the successor organisation of the Research Textile Finishing Institute. It carries out technological research, innovation and technology transfer in the wet processes of textile production. The development of the company supports small-scale production of (bio)chemical specialties – textile auxiliaries, small-scale capacity for finishing and coating of textiles, and production of additional machinery. The company has an accredited testing room. INOTEX, www.inotex.cz



SMART TEXTILES

ARBIS company is engaged in the production of thermal underwear, functional second-layer products, swimwear and other knitwear and fabrics. In production the company uses high quality and state-of-the-art materials, in principle made only in the Czech Republic and the EU. The main ARBIS customers are companies like ALPINE PRO, ANITA, DIRECT ALPINE, SINTEX and TAO.
ARBIS, www.arbis.cz

ANTIBACTERIAL NANO-KNITS

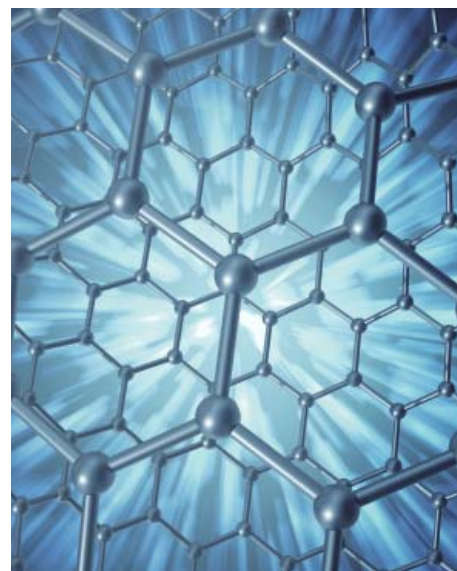
Jimiplet company was established in 2000 with the intention of producing and selling knitted garments for underwear, clothing for sports and leisure time, medical and technical purposes. At present, its wide assortment includes antibacterial nano-knits with nanoparticles of silver, which prevent bacterial growth and survival. In 2012, it won, with its corset linings after spine surgeries, the Czech Innovation Award in the category Innovation Star. In 2013, it

became the visionary of the year for technological and social benefits in the field of biology and healthcare. Jimiplet was selected in 2015 among the best innovations of the year. The registered product KANGER – “Men’s ventilating underwear” with NanoAg application was awarded 3rd prize. The company continues to develop and utilise knitted materials containing silver nanoparticles in all areas to improve quality of life.
Jimiplet,
www.jimiplet.cz

NANOMEMBRANE

Thanks to the unique nanofibrous structure with a fibre diameter of up to 150 nm, NANOMEMBRANE nanofibrous membrane has a 25 % larger pore size than microporous membranes, making it able to reach unique properties that no other membranes in the world can compete with. It is no secret that NANOMEMBRANE's nanofibrous membrane is very similar to human skin, so it can boast an extremely high vapour permeability, or the ability to remove body moisture from the human skin to the external environment. The permeability of the bilayer laminate with the nanofibrous membrane is from Ret 0.89. In addition to that the NANOMEMBRANE nanofibre membrane is 100 % windproof with extreme hydrostatic resistance. The NANOMEMBRANE nanofibre

membrane is not only highly hydrophobic, thanks to which it has such a high-water column, but is also highly oleophobic. A thin layer of nanoparticles is applied to the NANOMEMBRANE nanofibrous membrane to create a so-called lotus effect that prevents the contamination of unique pores and thus prevents the deterioration of the excellent properties of NANOMEMBRANE nanofibrous membrane. Additionally, the same technology is applied to top fabrics and knitted fabrics to which NANOMEMBRANE nanofibrous membrane is laminated. Therefore, it is not only impurities do not have the chance to stick to the surface of fabric or knitwear. NANOMEMBRANE,
www.nanomembrane.cz



ANTIBACTERIAL INNER SOLES FOR FOOTWEAR

One of the highly effective applications of antibacterial fabrics are antibacterial inner soles for StopBac footwear. This new generation of footwear inner soles with described unique active nano-layer not only prevents the odour in the long run, but also contributes significantly to the improvement of hygiene and thus to the health-conscious microenvironment of the feet. In addition, not only the effect of a significant reduction in bacteria but also fungal foot disease is demonstrated.

ING MEDICAL, www.stopbac.cz



11 NANOCOSMETICS



Czech nanotechnology companies operating in the cosmetic segment have two basic approaches to using nanotechnologies in their production. Some of them use nanofibres as carriers to help open skin pores and distribute cosmetics to the skin effectively; some of them use the active ingredients such as hyaluronic acid to make nanofibres applicable, for example, in face masks directly on the skin. Consequently, they reduce the amount of preservatives used in cosmetic products. Also in the area of distribution and branding, there is a dual approach among Czech producers. One production group produces its own brands and cosmetic series, the other supplies cosmetic raw materials to global cosmetic manufacturers, including semi-finished products made of nanofibrous structures and the wholesalers then produce their own brands using these products.

REVOLUTIONARY CONNECTION OF NANOTECHNOLOGY WITH COSMETICS

NAFIGATE Cosmetics company is a subsidiary that interconnects science with cosmetics. In 2008, the idea of developing an under-eye mask was born. Thanks to nanotechnology research, unique formulations containing a high proportion of hyaluronic acid have been successfully developed and in 2016 the Nano Eye Lift nanofibrous mask was patented. Nano Eye Lift is a non-invasive and instant wrinkle removal thanks to a nanofibre mask, hyaluronic acid and a nourishing cream. It immediately smooths the wrinkles, reduces under eye bags and circles under the eyes. It

is designed for women and men from the age of 30 with signs of aging in the eye area and for all skin types including sensitive skin. The effect on the structure and the wrinkle surface has a stable, prolonged effect, up to 48 hours after application. All products are non-fragrant and paraben free and thus do not harm the skin or the environment. Nano Eye Lift was tested by more than 20 women and more than 90 % of them were satisfied with the product. NAFIGATE Corporation, www.nafigate.com



CONTAINING HYALURONAN UNDER THEIR OWN BRAND

The Contipro company offers as the world's only company a cosmetic raw material made up of nanofibres of hyaluronic acid. Nanofibrous cosmetics, as well as creams, contain a range of substances, but it has one great advantage – no preservatives or stabilisers are needed, and nanofibres take on this role. It is because it is a dry matter material that does not have to be artificially protected in any way against degradation and bacterial contamination such as creams, gels or emulsions. If we want to apply hyaluronic acid to the skin, the form of nanofibres will help in rapid application and

immediate effect because in contact with the skin only pure substances get through without any artificial additives thanks to its composition. Nanofibrous cosmetics is offered to customers as a cosmetic raw material, the composition and shape of which can be varied according to the wishes of a particular client who subsequently sells the product under their own brand. Due to increasing demand, the company is working on developing a fully automated line for the production and packaging of nanofibre masks, which will be one of the most advanced in the world thanks to its sophistication.

Contipro, www.contipro.com

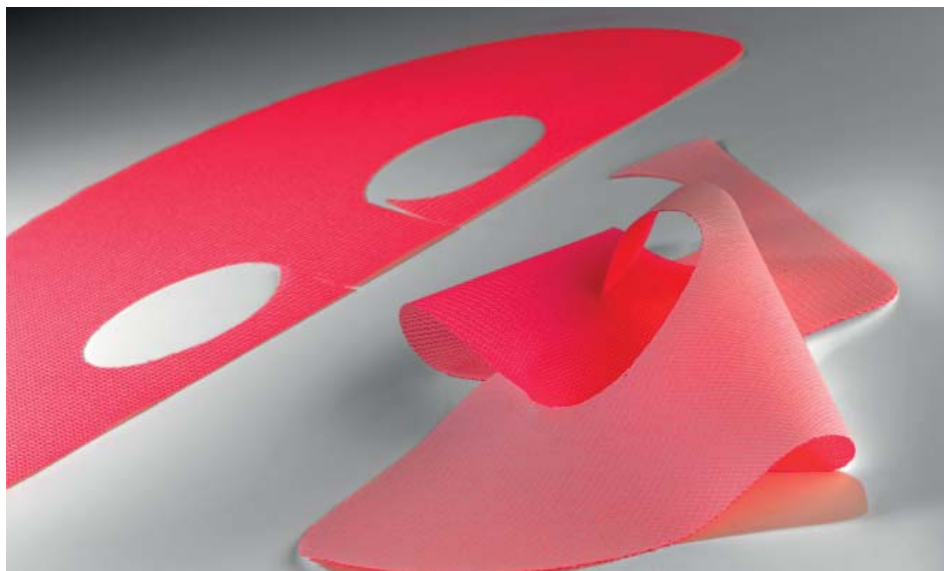


CUSTOMER DEVELOPMENT OF COSMETICS AND HEALING AGENTS

The NanoTrade company carries out customer development of cosmetics, enriched with functional nanomaterials. Thanks to the successful project with the UPOL Medical Faculty in the area of development of healing agents, we are ready to implement projects for pharmaceutical or distribution companies.

NanoTrade,

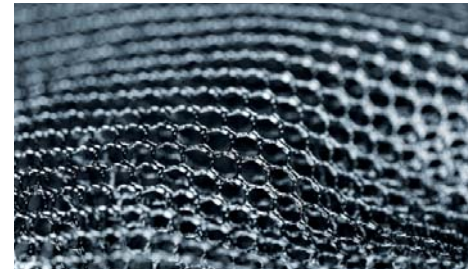
www.nanotrade.cz/en/products/health-veterinary-cosmetics



12 NANOTECHNOLOGY IN ENERGETICS

The new technology of producing so-called 3D batteries will save about half of the cost of production in large-scale production compared to today's most common battery manufacturing technologies. In addition to that, Czech 3D batteries are much safer thanks to inorganic separators made of nanofibres. They do not overheat and cannot explode. They are the only ones in the world

that are 100 % recyclable. The present most commonly used technologies of lithium battery production store energy into thin accumulation layers in anodes separated by many separators. In 3D batteries, the accumulation layer has been successfully enhanced by a significant degree and the number of separators was reduced. 3D batteries achieve a lifetime of over 5,000 charging cycles and an efficiency of



more than 95 % per cycle. In addition to robust power cells, the capacity of 3D cells offers up to 500 Wh/litre. The thickness of the electrodes can regulate the magnitude of the current and the kilowatt cell can provide several times the maximum power of the currently most commonly used lithium batteries.

BATTERY TECHNOLOGIES

The technical and economic parameters of the HE3DA technology enable mass use in power engineering. The parameters of cells and the entire battery system can be set according to customer specifications or the needs of the given segment. The construction of the basic 1 MWh module for power engineering consists of 125 pieces of 8 kWh cells and the volume of this module is 8.6 m³. Modules can simply be combined into large systems. Thanks to the small number

of cells and the innovative concept, the installation of the HE3DA battery system is very simple and the entire system is virtually maintenance-free. Usage options are very wide, such as in the automotive industry. HE3DA technology delivers a real alternative to lead-acid batteries and also allows a procedural shift in the development of electromobility. The HE3DA comes with the alternative of a safe and affordable lithium starter battery. The battery pack meets all the necessary parameters – power, mechanical resistance and

operating temperature up to 80 °C. Likewise, a 50 V car battery will allow a number of innovations in the automotive industry. Once the car manufacturers are ready to use them, the HE3DA is able to supply these batteries with the dimensions and weight of today's lead-acid batteries, so without the necessity to change the design of the body of the car. The HE3DA is also a way to a safe and affordable high-performance, fast-charging battery. HE3DA, www.he3da.cz

DID YOU KNOW?

CZECH NANOTRACE IN THE FUTURE OF SOLAR PANELS

The combination of nanotubes with light-absorbing substances (chromophores) can lead to more efficient solar panels.

Jan Macák's basic research already has an obvious application potential. Besides photovoltaics for example in biotechnology or medicine, as titanium dioxide is a biocompatible substance.

CZECH PEOPLE WILL DRAMATICALLY REDUCE THE PRICE OF HYDROGEN FUEL CELLS USING NANOTECHNOLOGY

Czech companies bring to the energy industry a much-needed result of applied research enabling the further development of fuel cells. Hydrogen, which is the most common fuel in the cells, is also a promising medium for the storage of electric energy, and so the patent of Professor Ing. Vladimír Matolín may be a significant contribution to the development of these systems. One of the drawbacks of fuel cells has so far been a high price caused mainly by the platinum used on both electrodes. It is with the help of Czech nanotechnology that the amount of platinum on the cathode can be significantly reduced and thus the anode can achieve a saving of up to 99 % while maintaining the performance and life of the cell. Reducing the amount of precious metals is one of the breakthrough technologies that are

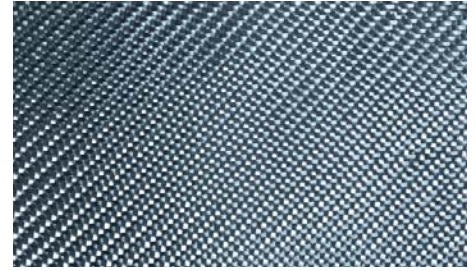
necessary to start using fuel cells in everyday life. The fuel cell is the result of the effective collaboration of a scientific team led by Professor Matolín and Czech companies of Jablotron and IQ Structures. New metal electrodes with a specific micro and nano structured surface perfectly meet the necessary requirements – gas permeability, high conductivity, inertness to processes and large active surface. The procedures developed by IQ Structures at the Nanotechnology Centre in Brno (Optix subsidiary APIx subsidiary) will be used and electron and UV lithography or 3D nanoprinting will be used for the production of relief and microstructural designs. IQ Structures, www.iqstructures.com, Jablotron, www.jablotron.com

REDUCING EMISSIONS, INCREASING EFFECTIVENESS, REDUCING COSTS

Envirox™ special additives for liquid fuels based on cerium oxide have the ability to improve the combustion process due to the positive influence of oxidation and catalytic combustion processes. By achieving higher combustion efficiency and lower combustion temperatures, it reduces fuel consumption by 5–12 %, reduces emissions by up to 14 %, and extends the life of injectors or cleaner combustion chamber space. Another positive effect is the reduced clogging of DFP filters for modern diesel engines. Liquid canvas will help reduce the energy requirements when heating water in the pool. It is a material that creates a monomolecular layer on the water surface and prevents the evaporation of water and hence the energy loss, needed to heat the water.

NanoTrade,
www.nanotrade.cz/en/products/additives-and-energy

13 NANOMATERIALS AND NANOFIBRE STRUCTURES



Your products can achieve a higher quality level using nanotechnology semi-finished products. We can supply both polymer and ceramic nanofibrous membranes, knit yarn with nanosilver for clothing and technical purposes and many other nano materials. You can also make your production more efficient or improve your products by using raw materials in nano form. Nano-sized chemicals change their properties or enhance the existing ones. Improvement often results from a larger surface area, which is manifested in a higher activity of the material in nano form, resulting in a better interaction with other substances. For example, manufacturers of rubber products may use nano zinc oxide to reduce the amount of this raw material in their products by up to three quarters. Nano zinc oxide also helps manufacturers of plastics, paints, lacquers, filters, membranes, cosmetics and other products. Knowing the unique properties of nano materials, you can discover benefits for your products as well. Obtain information, get inspired and innovate with us.



A GLOBAL LEADER IN THE FIELD OF NANOMATERIALS IS FROM THE CZECH REPUBLIC

The P A R D A M company is engaged in research and production of nanofibrous materials. Thanks to its unique centrifugal spinning technology and its own know-how, it is the only one company in the world able to produce a wide range of both inorganic and polymeric nanofibres on an industrial scale. Given the many years of practical experience of nanotechnology specialists, the P A R D A M company has a large portfolio of products.

The inorganic nanofibres of the NnF series CERAM[®] offer various types of metal oxides such as Al_2O_3 , TiO_2 , SiO_2 , ZrO_2 , Ce/Zr bi-oxide composites, etc. The materials are made in a 3D wool-like structure that can be ground to a powder with a defined fibre length of 5 μm and more. Diameters of such nanofibres are from 100 nm. The main application fields are

in absorption processes, as catalytic particle carriers, insulators or (semi) conductors, battery separators, etc. The specific surface of nanofibres ranges from 50 to 1200 $m^2 \cdot g^{-1}$.

Services: The P A R D A M company offers to customers and partners services in the field of development of new nanofibrous materials and structures, new products based on nanofibres, as well as services of characterisation of powdered and fibrous materials using SEM, BET and XRD methods.

P A R D A M is the world's manufacturing leader of ceramic nanofibres on an industrial scale.

At present, P A R D A M company is the world's leading manufacturer of inorganic nanofibres on an industrial scale, capable of development of new inorganic materials with nanofiber structures. For research and material

development P A R D A M uses two different technologies (Electrospinning for lab scale special products) and (Centrifugal spinning for large volume production). This highly efficient and cost-effective technology works on the principle of spinning nanofibres from polymer solutions by centrifugal forces. Inorganic nanofibers find its applications in several products such as Battery separators, Fuels cells, Catalysts, Sorbents and Composites. P A R D A M collaborates with academic and commercial partners globally trying to develop unique products based on inorganic nanofibers. Recently P A R D A M has launched a new partnering company NANO4FIBERS Group, which will be selling nanofibrous products and materials developed at P A R D A M. P A R D A M, www.pardam.cz



NANO ZINC OXIDE "nZ-BOCH"

Bochemie is a manufacturing chemical company with more than 110 years of tradition. History of Bochemie as an independent entity dates back to 1991. In 1994, the company was privatised and from that time until the end of 2007, its name was Bochemie s.r.o. (Ltd.). Now, it is Bochemie a.s. (joint-stock company). However, chemical production on the premises of the current company started as early as 1904. Since then, it has continued until these days and the current form of Bochemie, which is a continuator of the original chemical plant. Bochemie manufacturing programme is comprised of four

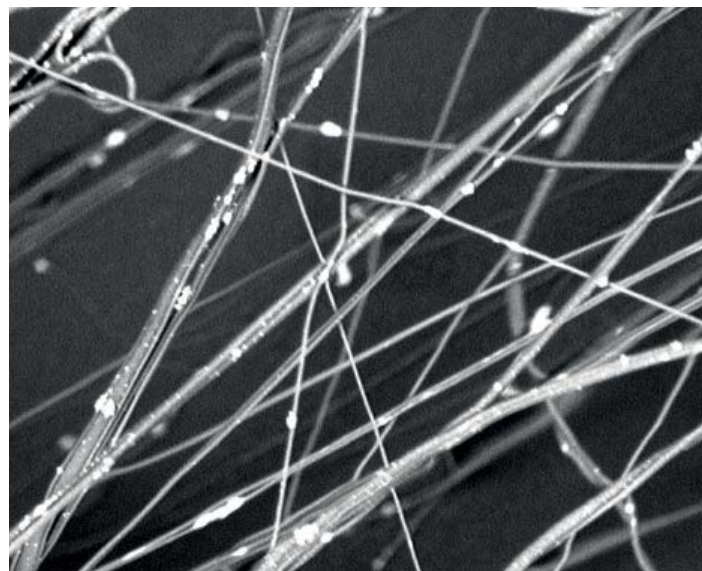
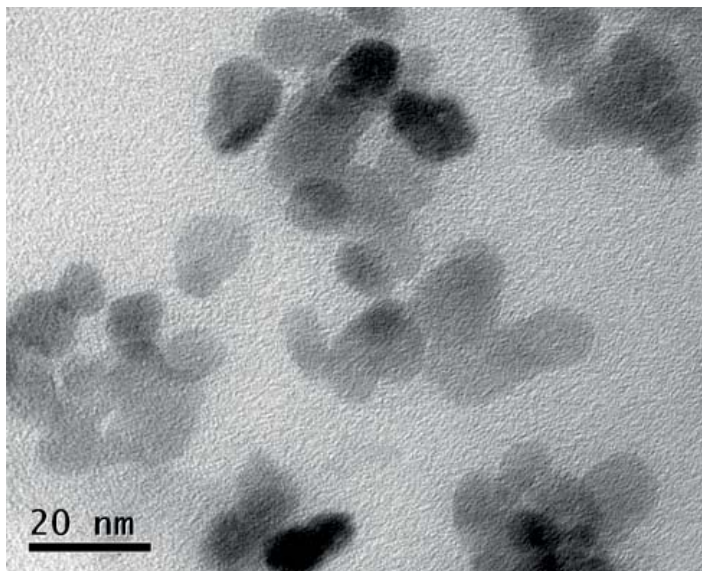
basic groups which are specific with their specialisation, target groups and export territories:

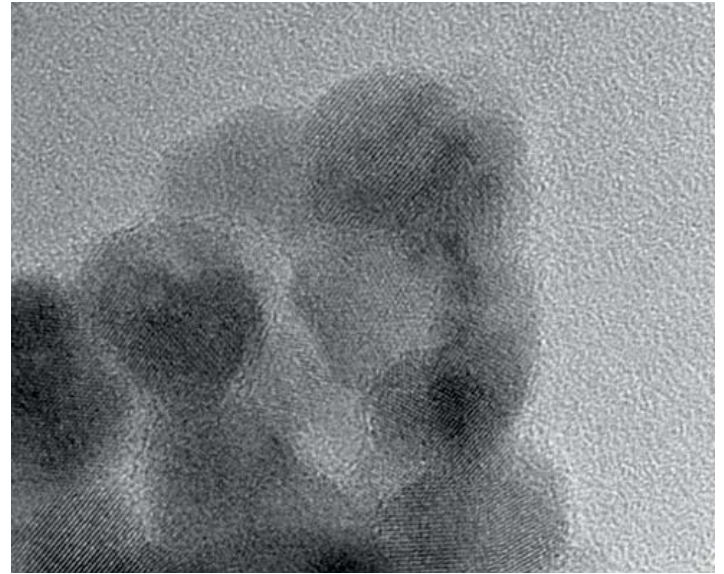
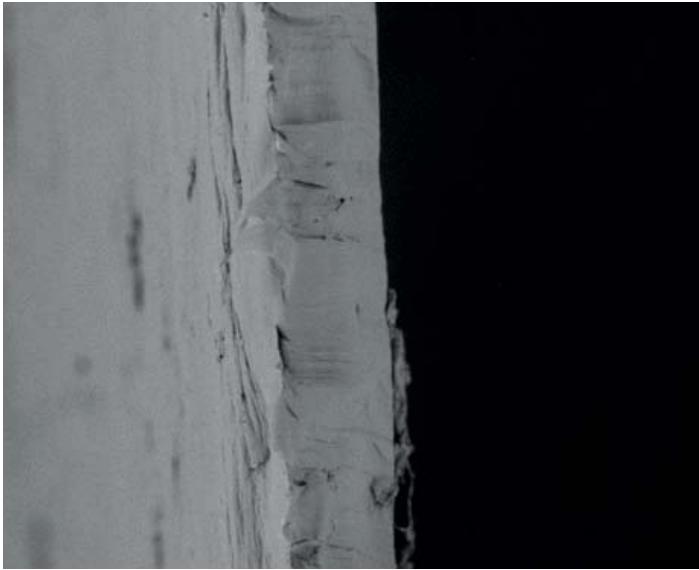
- Metal Surface Treatment: zinc chemistry and FEROPUR,
- Material for Accumulators,
- Protective of Wood: preparations for wood and masonry protection,
- Manufacturing contractor for a wide range of disinfectants and detergents.

The key to success is the constant search for the best solutions. For that reason, the research and development department is inextricably linked with Bochemie.

Nano Zinc Oxide "nZ-BOCH"

Nano zinc oxide is an advanced type of ZnO, which currently ranks among the most in-demand nanomaterials. The growing interest of nano ZnO is due to its unique functional properties. Bochemie has dealt with zinc chemistry almost for a half of a century and in recent years has exerted considerable effort to become a major producer of nano ZnO. In terms of research and development, Bochemie has developed a unique technology of manufacturing nano ZnO with an extremely high specific surface area (nZ-BOCH 01). The resulting technology is ecological and the





product ranks among the top of nanomaterials thanks to its unique characteristics. Together with the powder form, Bochemie has also developed three types of long-term stable water suspensions (differ in a ZnO content and in a type of dispersing system) and two organic suspensions (solvents PMA and butylacetate). Bochemie deals with the production of nano ZnO, preparation of its new forms and its application. Bochemie offers technical support and also is looking into the question of toxicity and safe handling with nano ZnO.

Selected functional properties of nano ZnO:

antimicrobial; antifouling;

vulcanising; anticorrosive; UV-protective; (photo-) catalytic; electrical (semiconductor, piezoelectric and pyroelectric material); dermatological; optical and others (drying agent, improve physical-mechanical properties of final nanocomposite).

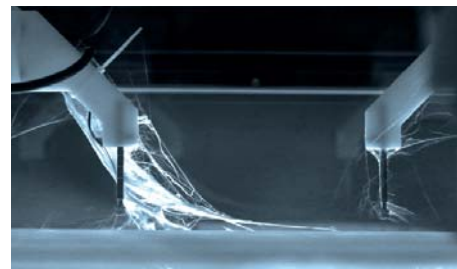
Potential applications of nano ZnO:

- Paints and Lacquers (Coatings): multifunctional transparent additive, antimicrobial, antifouling, photoprotective, anticorrosive behaviour, accelerate lacquer hardening, improve physical-mechanical properties (e.g. hardness) etc.
- Plastics and Silicones: antimicrobial, photoprotective, anti-flammable properties (medical plastics, food contact etc.).

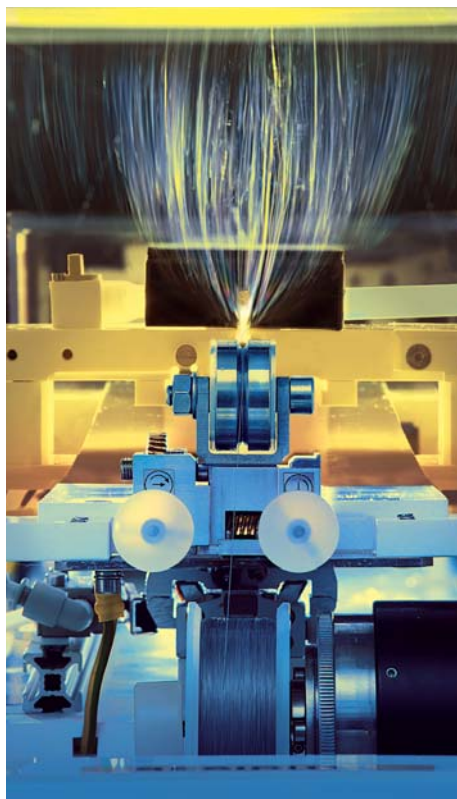
- Filters, Membranes and Textiles: reduction/elimination of irreversible biofouling, increase of lifetime, improving physical-mechanical properties (e.g. thermal stability).
- Rubber industry: ecological replacement of bulk ZnO – dosage decrease to 25 % of original amount of ZnO; high purity from the perspective of heavy metal content; better dispersibility, positive effect on ageing, adhesion improvement.
- Cosmetics: UV filter – transparent sunscreens.
- Catalyst, Glass and Ceramics, Electronics etc.

BOCHEMIE, www.bochemie.cz

14 MACHINES FOR MANUFACTURING NANOFIBRES



There are several companies in the Czech Republic that supply nanofibrous structures for individual customer needs even at the industrial level. This is why the Czech Republic is unique because it belongs to the world leadership in the production of these machines.



THE ONLY COMPANY IN THE WORLD PRODUCING AND SELLING EQUIPMENT FOR THE MANUFACTURE OF NANOFIBROUS MATERIAL ON AN INDUSTRIAL SCALE IS FROM THE CZECH REPUBLIC

Nanospider™ from Liberec, a nanofiber production machine, is the most significant Czech technical invention since 2000. Its producer, the Elmarco company from Liberec, has opened the way to the industrial use of nanotechnologies for the world. Thanks to Nanospider™ and Elmarco, the Czech Republic has gained a reputation as a global nanofiber power. Elmarco is currently a global leader in the production of nanofiber materials. The headquarters of the company are located in Liberec, Czech Republic, where a research and development centre with an area of 3000 m², was also established in 2008. The European market is secured from the Czech headquarters of the company and the American market is supported

by the US subsidiary of Elmarco in North Carolina. In 2004, Elmarco and the Technical University of Liberec (TUL) presented the first prototype of Nanospider™ equipment designed for the use of water-soluble polymers and production of nanofibers at a width of 1.6 m. Nanospider™ is a unique patented spinning technology from free polymer solution in a strong electrostatic field without the use of nozzles. This technology is based on an interesting discovery: it is possible to spin not only using a capillary from a polymer droplet passing through the nozzle into an electric field but from a whole thin layer of polymer solution. Elmarco,
www.elmarco.com

GLOBAL LEADER IN THE MARKET WITH HYALURONATES EXPANDED ITS PORTFOLIO WITH ITS OWN NANOFIBRE PRODUCING MACHINE

The manufacturer of cosmetics and medical products, Contipro, who uses nanofibrous membranes as carriers of its medication, has not been satisfied with the original version of Nanospider and has gradually developed its own machine – for its own needs, but also for other customers. And so a research company, which controls about 60 percent of the European and one third of the world market with hyaluronan (useful for cosmetics and pharmacy as well),

enters the field of nanotechnologies with its own 4SPIN machine. The smaller 4SPIN Lab offers a wide range of possibilities for the development of nanofibrous materials, and thanks to the larger 4SPIN Conti machine, innovative nanofibrous materials can be produced. Nanomaterials from hayluronan then offer a broad use in biomedical applications for tissue engineering, wound healing, or targeted drug delivery. Contipro, www.4spin.info

NANOTECHNOLOGIES FOR MANUFACTURING PURPOSES

At present, the only validated method, which is also used on an industrial scale, is the electrostatic spinning method where the solution of a particular polymer passes through a high voltage electrostatic field and the finished nanofibres are collected on the collector. Nanofibres are made from several types of polymers, including biocompatible and biodegradable ones that are environmentally friendly. The SPUR company offers

the production of nanofibres on its own electrospinning device – SpinLine production line. The research team is currently engaged in electrospinning – a method of spinning polymer solutions, synthesis of optimised polymer solutions for the preparation of nanofibres, the production of nanofibrous formations and their application in the field of filtration and medicine. SPUR, www.spur-nanotechnologies.cz

3D NANOPRINTER

IQ Structures operates its own nanocentre in cooperation with the Institute of Scientific Instruments of the Czech Academy of Sciences. Together with the ISI and the ELTEK company a 3D nanoprinter was developed. Compared with conventional 3D printer, it is therefore the same printing principle, but with the ability to print objects with dimensions much smaller and with much higher accuracy. This printer allows to write even very complex structures that are of the size of a few hundred nanometres to several hundred micrometres and even those that cannot be generated using conventional lithographic techniques. Within the Czech Republic, this is something unique, and it is among the world's best. It is a technology 100 % developed in the Czech Republic, not purchased somewhere in the world. This is of significant importance for the future because it is possible to invest in its further independent development. IQ Structures, www.iqstructures.com

15 CONTACTS

Czech Nanotechnology Industries Association,
www.nanoasociace.cz

Czech Nanotechnology Industries Association was founded on 27th November 2014 by representatives of Czech nanotechnology companies at the CzechInvest Agency. The association aims to represent the interests of Czech companies and research in this field at both a national and European level, in the business, research and educational sphere. It builds on the good name the Czech Republic has in this field in the world and is trying to spread the positive awareness about nanotechnologies in society. It also focuses on active search of support and opportunities for cooperation between the commercial and research spheres. The Association currently has 19 members.



Advamat s.r.o., **www.advamat.cz**

Research and development of thin layers and materials with special properties, e.g. with very low friction. The company was founded as a spin-off of ČVUT in Prague. In the academic environment, it deals with the development and testing of predominantly super-hard and tribological layers.

Advanced Materials-JTJ s. r.o., **www.amjtj.com**

Advanced Materials-JTJ (AMJTJ) is a Czech innovation company focused on nanotechnology. Since 2003, it has been involved in the development and production of nanomaterials and their use. The company has developed and manufactured special FN[®] functional coatings with an extraordinarily powerful photocatalytic effect.

ARBIS spol. s r. o., **www.arbis.cz**

The ARBIS company deals with the production of thermal underwear, functional products of the second layer, swimwear and other knitwear and fabrics. The company uses high quality and state-of-the-art materials, on the principle made only in the Czech Republic and the EU. The main customers of ARBIS are companies like ALPINE PRO, ANITA, DIRECT ALPINE, SINTEX and TAO.

ASIO spol. s r.o., www.asio.cz

ASIO is a Czech engineering and supply company with international scope established in 1993. The company is active in the field of development, production and supply of technologies for wastewater treatment and recycling, treatment of drinking and technological water and air purification. A wide range of its supplied water management products are used for cleaning and recycling of water from industrial plants, in the communal sphere and in family houses.

Bioinova s.r.o., www.bioinova.cz

Czech biotechnology company Bioinova focuses on research and development of modern cell therapy. It develops medicinal preparations based on stem cells and other cells derived from bone marrow and adipose tissue. In addition to that, the company is engaged in the commercial use of cellular products in fields that do not require clinical trials.

BOCHEMIE a.s., www.bochemie.cz

Bochemie is one of the strongest Central European manufacturers of branded products of chemical specialties and disinfectants and detergents. Its latest achievements include the development of a technology for producing zinc oxide nanoform, which, given its properties, ranks among the most advanced nanomaterials.

Contipro a.s., www.contipro.com

Contipro is one of the world's largest manufacturers of hyaluronic acid. The 4SPIN[®] device series is designed for the preparation of nanofibres not only from this substance but also from other polymers. 4SPIN[®] Lab is commercially available and as well as manufactured nanomaterials that are used in cosmetics, pharmacy and medical devices.

Elmarco s.r.o., www.elmarco.com

Elmarco is the first company in the world to manufacture and sell devices for manufacture of nanofibre material on industrial scale. The entire portfolio of Nanospider™ machines includes laboratory equipment for research and development, small-scale production equipment and industrial high-capacity lines. All these mentioned devices work on the same Nanospider™ technology, i.e. on the principle of polymer spinning using needle-free electrospinning. This makes it easy to transfer production from laboratory conditions to industrial scale. The core of the company's success is the continuous development of technology and collaboration with leading world universities and industrial companies operating on the global market. The Elmarco company has its headquarters in Liberec and uses its North Carolina branch to support the US market.

FILTREX s.r.o., www.filtrex.cz

Czech company FILTREX has been manufacturing filters with high reliability and performance for over 21 years. The filters differ from conventional ones in the fact that filtration is ensured by flow through two inlet and outlet ducts instead of one. This reduces the pressure drop in the filter device and generates energy savings. At present, the company supplies filters for production of wine, beer, spirits, beverages, food, pharmacy, biotechnology, cosmetics and oils.

HE3DA s.r.o., www.he3da.cz

The HE3DA deals with applied research and development of battery technologies and their marketing. The company has developed the technology and process of producing batteries with 3D spatial electrodes based on lithium nanomaterials (HE3DA[®]).

ING MEDICAL s.r.o., www.ingmedical.cz

The main goal of the company is the development and production of high-quality healthcare products using mainly nanotechnology and the promotion of an innovative series of these highly technologically advanced products on the market within the Czech Republic as well as other EU countries. Key products of the company are antibacterial surface treatments and functionalised nanofibrous substrates for which the company has a high capacity manufacturing technology. The company also focuses on custom-made research and development, particularly in the field of nanotechnology, commercialisation of technical solutions in the field of medicine, testing of medical devices and development of specialised production facilities.

INOTEX s.r.o., www.inotex.cz

INOTEX is the successor organisation of the Research Textile Finishing Institute. Organised research textile activity dates back to year 1949 when the predecessor of RTFI was founded, Research Institute of Czechoslovak Textile Enterprises. After initial personnel and space problems, the Research Finishing Institute, later the Research Textile Finishing Institute, became well known to the European textile public as an organisation disposing with excellent experts reaching significant achievements in principal branches of textile finishing, especially with a focus on cellulose materials and their blends. Since 1993, INOTEX, s.r.o. is a member of the Society of Science and Technology Parks of the Czech Republic and also operates the "Textile Technology and Education Centre" as a science and technology park.

IQ Structures s.r.o., www.iqstructures.com

IQ Structures is a young technology company that works as an architect and builder of structures of human hair size, but also a thousand times smaller. These structures are so small that they can bend a light beam, create a supporting scaffold for cell growth or help to produce clean energy. Its clever nano and micro structures thus help to change habits in many areas, from automobile lights, through energetics, to protection against counterfeiting and fraud.

Jimiplet s.r.o., www.jimiplet.cz

The Jimiplet company is a small research and development innovation textile company in the field of nanotechnologies. It manufactures knitted garments for clothing, medical and technical purposes.

NAFIGATE Corporation a.s., www.nafigate.com

NAFIGATE Corporation subject of business is nanotechnology and biotechnology. It brings to the global market projects focused on the development and production of a new energy-saving generation of nanofibrous membranes for water and air purification technologies, textile industry and cosmetics.

Nano4people s.r.o., www.nano4people.cz

The Nano4people company is a new, innovative company that deals with and participates in the development, optimisation and implementation of specific applications of special multifunctional photocatalytic antibacterial coatings that can purify the air using light.

Nanopharma a.s., www.nanopharma.cz

Nanopharma is a technology company active in the field of nanomaterial engineering. Already since 2008, the company has been intensively engaged in the research and development of nanofibrous structures for niche clinical and technical applications.

NANOPROGRESS, www.nanoprogress.eu

The Nanoprogress cluster is focused on the research and development of functionalised nanofibrous structures and their application to industry and medicine. Nanoprogress is the leader of the European Strategic Cluster Partnership in the newly emerging industry and is included in the European Excellence Cluster category within the European Cluster Excellence Initiative.

Nanoprotech, www.nanoprotech.cz

The company ELF Logistic s.r.o. is a manufacturer and distributor of anti-corrosion, lubricating and electro-insulating sprays using nanotechnology. Their composition has been developed since 2007 and after three years of testing, the products were first introduced to the public under the name of Nanoprotech.

nanoSPACE s.r.o., www.nanospace.cz

NanoSPACE produces anti-allergy barrier covers and bedding made of nanofibres. This completely innovative way of protecting against dust mites and their allergens puts the nanoSPACE company among the world's leading manufacturers of bedding protective covers. The novelty in the assortment are anti-allergy toys with nanofibres.

NanoTrade s.r.o., www.nanotrade.cz/en

The NanoTrade company is one of the oldest Czech companies in the field of nanotechnology, founded in Olomouc in 2004. It cooperates closely with research institutes and universities in the Czech Republic, Europe and overseas. The company carries out its own applied research on the development of new materials, technologies, processes and end products at all levels for many applications. NanoTrade specialises in packaging materials, functional textile clothing, surface protection products, liquid and solid fuel additives, wound healing products and special technologies. Recently, it has included a project for the use of nanotechnologies in the development of Motion Simulators (www.ski365.eu) to its portfolio.

P A R D A M s.r.o., www.pardam.com

P A R D A M is a Czech company that has been engaged in the development of nanofibre materials and their subsequent production and functionalisation for the needs of specific products and applications since 2009. P A R D A M is the holder of three patents and several patent applications. Currently, it successfully commercialises several nanofibres based products, either in cooperation with its partners or directly. The main added value of the company is the transfer of laboratory results of research into industrial practice and specific final products.

Pikatec Technology s.r.o., www.pikatec.cz

Pikatec Technology is a purely Czech technology company. It cooperates with the Technical University of Liberec on the development of surface protection nanotechnologies. The company thus covers everything from development through production to product dispatch. All these activities take place in the territory of the Czech Republic. Pikatec nanotechnologies offer complete treatment and protection of cars, households, hotels, offices, boats, public transport and much more.

RETAP s.r.o., www.nanocisticky.cz

A traditional tile stove maker who has launched a nanoaircleaner air purifier. In nano air purifiers, photocatalysis leads to the decomposition of chemical harmful substances and the destruction of bacteria and viruses in the interior.

SinBio, www.sinbio.cz

SinBio is a unique Central European project that has been focused since 2010 on asset management in young biotech and nanotechnology companies with global market potential. The Group aims to achieve synergistic effects in the development of solutions for regenerative medicine, bio- and nanomaterials and cell therapies. It focuses on the field of veterinary as well as human medicine.

SINDAT s.r.o., www.sindat.cz

Sindat financially supports basic research activities, working with major domestic and foreign university and scientific workplaces. At the same time, it creates an administrative, personnel and financial environment for applied research activities in the areas of functionalised nanofibrous structures, tissue engineering for veterinary practice and projects aimed at creating cellular products for medical purposes.

SINTEX a.s., www.sintex.cz

The SINTEX company was founded in November 1992, and the company's activities were originally built to produce high-quality knitted fabrics and ready-to-wear garments with the aim to continually innovate the existing production and product range. When a merger took place with an affiliated society of Spolsin in 2009, SINTEX's product portfolio was expanded to product groups such as special fabrics, warp knits, filters, yarns and their semi-products.

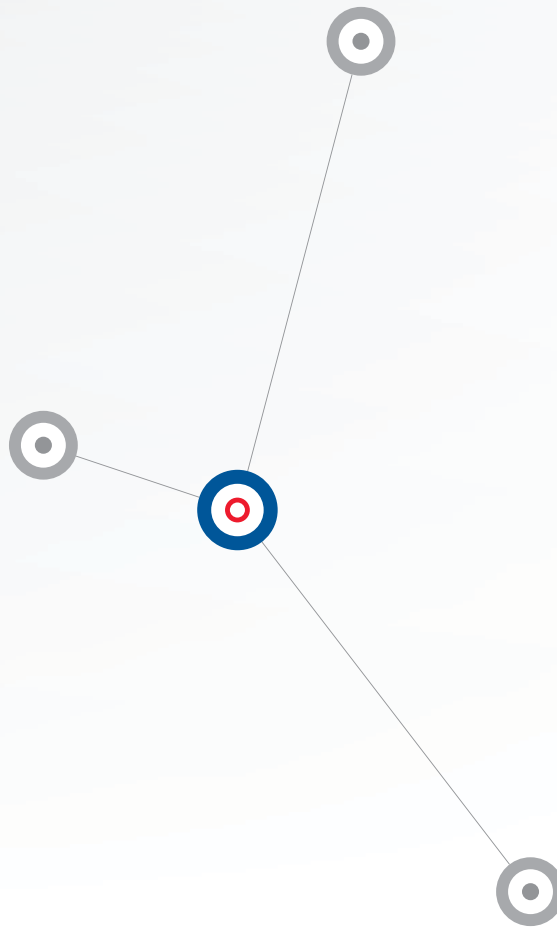
SPUR a.s., www.spur-nanotechnologies.cz

The SPUR company has been engaged in research in the field of nanotechnologies since 2006. In 2011, a trial production of filtering materials with nanofibres on their own electrospinning production device was launched. The product portfolio offers filtering materials based on SpurTex® nanofibres designed for air filtration, effective primarily in the field of ultra-fine particle capture, microfiltration of liquids, production of clima-membranes, chromatographic cartridges or medical and cosmetic products.

Výzkumný Technologický Institut s.r.o., www.vti-cz.com

The company of Výzkumný Technologický Institut (Research Technology Institute) deals with the development and production of devices for drinking and technological water treatment from any contaminated water source. The device is based on hybrid asymmetric selective membrane separation technology (THASMS).





CONTACT

Czech Trade Promotion Agency / CzechTrade
Dittrichova 21
128 01 Prague 2
Czech Republic
www.czechtrade.eu

