Foreword

A selection of highly innovative projects, as well as their results and achievements are presented in our project catalogue. Since 2004, more than 200 Austrian companies and research institutions have participated in these projects.

Nanotechnology gives strong impetus for future-oriented innovations – from optics to plastics industry up to food and medicine industries. Nanotechnology provides the basis for smaller data storage devices with increasing storage capacity, for highly efficient sensors and filters for environmental technology, for photovoltaic and solar thermal energy applications as well as for materials that can be used to manufacture ultralight engines and car body components for the automotive and aircraft industries. The advancement of nanotechnology is also crucial for new, gentler diagnostic and therapeutic methods that are better tolerated by the patient, and which will reduce medical costs in the long term.

Nanotechnology is making enormous contributions to technological progress and to the associated economic potential. According to current estimates, the market potential of the products created via nanotechnology is presently set at some €50 billion dollars and this figure is expected to increase by at least a factor of ten by 2015.

Therefore the BMVT is making a crucial contribution to the development and realisation of this future technology in Austria. It is responsible for the success story of this still emerging technology which provides a great opportunity for Austrian companies to open up new markets and business fields all over the world.

Vienna, November 2009

Doris Bures
Federal Ministry for Transport, Innovation and Technology

The Austrian NANO Initiative

There’s Plenty of Room at the Bottom”, is the title of a legendary lecture given by Richard Feynman, Nobel Laureate in Physics, in December 1959. At that time, Feynman first presented the idea of the direct manipulation of individual atoms.

Fifty years later, in November 2009, there is a lot happening in the “room at the bottom”. Nanotechnology has outgrown the laboratory and has become important for economy.

Since 2004, the Austrian NANO Initiative has made a significant contribution to ensuring that this transition from science to industry has been effective and rapid. The professional programme management at the FFG Austrian Research Promotion Agency, under the overall control of the BMVT Federal Ministry for Transport, Innovation and Technology managed to ideally integrate four strategic objectives:

- To strengthen and network Austrian protagonists from science and industry
- To create critical masses and thereby ensure international competitiveness
- To accelerate technology transfer and the economic utilisation of nanotechnology
- To establish nanotechnology in the public perception, in science communication and in the promotion of young researchers

Thanks to these strategic objectives, the NANO Initiative has succeeded over the last five years in supporting protagonists from universities, non-university research organisations and Universities of Applied Sciences as well as enterprises located in Austria.

The purpose of this catalogue is to single out and present the collaborative Cluster Projects from the multifaceted promotion portfolio of the NANO Initiative, which includes national and international cooperative research and technology projects. These Cluster Projects are a substantial contribution to show the potential of nanotechnology and how it can be used to the benefit of business and society.

Cluster projects

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The key visual of the NANO Initiative. All details can be found at www.nanoinitiative.at/presse.

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ISOTEC – Integrated Organic Sensor and Optoelectronic Technologies

Synopsis
ISOTEC opens up new application areas in sensor and optoelectronic technologies - through the use of new types of organic materials and also by harnessing new structuring and production methods from the field of nanotechnology. The development of a flexible optical multi-analyte sensor ranks among ISOTEC’s key objectives. Such sensors can be employed for monitoring foodstuffs or indoor air, for medically-relevant rapid tests in emergency applications or for various applications in workplace safety. The sensors developed by the industrial partner AVL GmbH, then again, are utilized to detect high-temperature redox reactions. The optical connections required for this, such as micro-optics and waveguides with nanoimprint lithography and two-photon absorption, are also manufactured by ISOTEC. These waveguides are integrated into circuit boards by the AT&S industrial partner, enabling broadband data transmission.

Science
The ISOTEC collaborative project is developing a flexible, organic multi-analyte sensor that will be employed to monitor foodstuffs, indoor air and for medically-relevant rapid tests. This flexible sensor can be integrated onto any surface – whether onto clothing for monitoring bodily functions or onto food packaging to monitor the formation of harmful substances. The optical components (waveguides and micro-optics) for the sensor are manufactured by means of innovative structuring methods, such as two-photon absorption and nanoimprint lithography.

Industry
ISOTEC links basic and applied research to regional industries that are pursuing a common goal. The university partners are concerned with the development of materials. The non-university based partners develop new sensor concepts and translate them into prototypes. The industrial partners provide input in terms of electrical metrology or optical structures, and, on the other hand, are already integrating partial results from ISOTEC into their ranges of products.

During their four years of cooperation, the collaborative partners have already been able to achieve initial laboratory results by virtue of the interdisciplinary linking of materials, characterisation technologies, structuring technologies and components – while ISOTEC secured the intellectual property rights. During the second extension, the eleven original individual projects were focused on two demonstrator fields of work and two virtual supporting fields of work. The demonstrator fields of work develop the integrated multi-analyte sensor and integrated waveguides and optics. The supporting fields of work provide the analyses of the sensors and optics, as well as the required algorithms.

Impact
Since 2000, the activities initiated have also been developed in the NanoTechCenter WeiR Forschungsgesellschaft mbH and transferred into commercial applications in order to establish ISOTEC in a sustainable manner. The high-temperature redox and gas sensors developed by industrial partner AVL GmbH are being utilized to monitor reactions in fuel cells. In 2005, the research work carried out by AVL GmbH as part of ISOTEC was awarded the 2005 Styrian Research Award for Nanosciences and Nanotechnologies presented by the Province of Styria for “Commercial Applications”.

Optical connections, such as micro-optics and waveguides – manufactured with the new nanoimprint lithography and two-photon absorption structuring technologies – are being integrated into circuit boards by AT&S AG, enabling broadband data transmission. The transmission of video signals with data rates of 1.5 gigabit/s has been successfully demonstrated, and has already been awarded two honours – the 2006 Styrian Research Award for Nanosciences and Nanotechnologies of the Province of Styria and the 2007 Freihuber Prize.

Image top left:
Structuring of a micro-diagnosing by means of two-photon absorption in Germanium-Silicon nanostructures.

Image bottom left:
Electron microscope image of a 5-layer protein film on Si with quadratic symmetry.

Image top:
Illuminated sensory scattering centres of the optical multi-analyte sensor.
NANOCOAT – Development of Nanostuctured Coatings for the Design of Multifunctional Surfaces

Synopsis
The aim of the NANOCOAT cluster project is the knowledge-based development of multifunctional surfaces on the basis of nanostuctured coatings. This is accomplished particularly through:

- creating the necessary theoretical fundamentals and experimental techniques including: interrelationship between material system, deposition conditions, nanostructure and properties of coatings and coated parts.
- developing new coatings
- developing new coating processes
- developing new coating plants
- and developing new coated products

“...The investigative techniques developed as part of the NANOCOAT cluster project enable us to now specifically develop nanostuctured layers and suitable processes to this end.”

Dr. Arno Kripp, R&D Product Development Coating, Böhler GmbH & Co KG

“The successful development of high-tech products within the NANOCOAT cluster would not have been possible without basic research.”

Prof. Reinhold Eberle, Cluster Coordinator
Managing Director of Materialien Center Leoben Forschung GmbH

Science
The scientific activities of the NANOCOAT cluster focus on investigating the relationship between structural systems, deposition conditions, nanostructure and the properties of thin layers and coated components. NANOCOAT develops the theoretical fundamentals and simulation methods, as well as new methods of structural and mechanical characterization and deposition.

The developed techniques and fundamentals are available to all partner companies as part of the project collaboration with the goal of subsequently transferring the findings into commercial applications.

Industry
The fundamentals and methods for deposition and characterization of nanostructured coatings developed within NANOCOAT serve as a sustainable, long-term foundation for the development of new coatings, new coating processes, new coating plants and new coated products.

Impact
In the course of recent research work, it has already been possible to develop various products. The stages of development range from test systems to products that are already available on the market. For example, the targeted preparation of interfaces has led to the development of ceramic layers for the surface finishing of plastic-filled CFC at SECAR. These coatings are currently being launched onto the market and significantly reduce the friction of CFC components. Another company, ionbond Austria, is also already making use of initial results. It is now possible to produce high-strength, sturdy and dense hard coatings with low friction coefficients for the automobile industry with a coating process developed as part of the NANOCOAT collaboration. The functionality of this coating is based on the specifically-adjusted nanostructure, is currently in the test phase at customer reference customers.

The development of new techniques and equipment for the deposition of diamond-like carbon layers has also been successful. Conventionally, these can only be deposited at high temperature or via expensive methods. The company RÜBIG now offers coating plants and contract coating using the technology started as part of the NANOCOAT collaboration. The company BOCHERER T.E., the renowned manufacturer of hard metal-coated tools, represents an additional business partner. As part of NANOCOAT, it has developed new tool coatings for processing of aluminium and brought them to marketability. The company also has a patent on the manufacturing of coated wear-resistant coatings.

Overall, the participating companies have been able to safeguard their market positions with their innovative products - also in the international arena - and to enhance their reputation. The scientific partners involved have benefited from the close collaboration with industry and have been able to gain new partnerships for both scientific and technological topics with the help of the Austrian NANO Initiative.

INFOBOX
Duration of the cluster project: February 2006 to January 2012

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Laser Center Leoben,
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Vienna University of Technology

Business partners
BÖHLER T.E. GmbH & Co KG
Ionbond Austria GmbH
RÜBIG GmbH & Co KG
SECAR Technologie GmbH
Böhler Edelstahl GmbH & Co KG

Image on left:
PAVD-coating process
Picture top left:
Diamond like carbon coating of tools
Picture top right:
Coated hollow wheel, diamond-coated cutter after use
NanoComp – Performance Optimization of Polymer NanoComposites

Synopsis
In 2006, research institutions and companies from the Austrian polymer industry joined forces under the overall leadership of the Polymer Competence Center Leoben GmbH (PCCL) to form the research cluster known as NanoComp – Performance Optimization of Polymer NanoComposites. The overriding objective of the research activities is to develop expertise in the field of polymer nanocomposites. The possibilities that result from the use of polymer-based nanocomposites will be used to develop new materials and products, and to open up new markets in order to increase the competitiveness of the partner companies.

Science
NanoComp is working on new types of composites involving the use of nanofillers. This produces material properties that cannot be obtained with conventional, micro-scale fillers. The work encompasses manufacturing processes for polymer-based nanocomposites, the development of processing technologies for their industrialisation, and the characterisation of the nanocomposites obtained – the focus being on mechanical and optical properties, as well as the internal structure of the nanocomposites.

Moreover, NanoComp has also developed modification techniques for nanoparticles in order to achieve better embedding into the polymer matrix. Special compounding technologies have been developed for several classes of materials which make it possible to use environmentally-compatible and health-friendly processes to work nanoparticles into polymers. In addition to mechanical and spectroscopic methods, NanoComp has mainly applied X-ray and electron-microscope techniques for the characterisation. NanoComp has also developed spectroscopic and rheological methods for the in-line characterisation of nanocomposites in manufacturing processes.

Industry
The success of NanoComp is based on the close cooperation of participating business partners with scientific partners. Only by combining scientific approaches with technical processes has it been possible to generate new materials which are relevant for the technical and commercial realisation. Thanks to the collaboration, competences have been amassed in the field of nanofillers and their technical processing, and the basic structure-property relationships for nanocomposites have been elaborated.

Nanofillers have been used in composites to improve their material properties – such as fracture mechanical behaviour, wear resistance and optical transparency. Results that are relevant for the whole industry include new compounding technologies for the homogenous dispersion of nanoparticles in a polymer matrix, new materials with barrier and fire-retardant properties and new in-line characterisation methods for nanocomposites.

Impact
Several of the newly developed materials are considered to offer good sales opportunities as a result of their property profile. These materials include nanocomposites based on reaction resins that have very advantageous mechanical data. They find use as high-performance material in the aviation and automobile industries. Thanks to the advantageous gas barrier effect and good wear resistance, sealing materials, which are based on a combination of elastomers and nanofillers, also represent excellent market opportunities. There are also good prospects for using nanocarbon silicates to achieve a fire-retardant effect for plastics.

INFOBOX
Duration of the cluster project: November 2006 to December 2009
www.nanocomp.at

Project management:
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Materials Center Leoben Forschung GmbH,
Polymer Competence Center Leoben GmbH,
Upper Austrian Research GmbH

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Bovisols Polymer GmbH,
Economer Austria GmbH,
FACC Foerder Advanced Composites Components AG,
Gabriel Chemie GmbH,
Isovolta AG,
Onisa AG,
Poreplast GmbH & Co KG

Picture on left:
Fire test with plastics. Right: polypropylene with 1% nanofiller,
Left: unplasticised polypropylene
Picture top:
Plastic granulate and semi-finished product
Synopsis
Nano-HEALTH is a cluster project in the field of nanomedicine which runs for a total of seven years and currently combines 16 project partners. During the first four years of the project, the nanomaterial platforms consisting of four nanoparticle families (NPs) were developed and optimised for their use in the targeted transport of active ingredients and for diagnostic purposes. Starting from this NP platform, the remaining term of the project will be used to optimise selected NPs to ready them for use in different fields, e.g. for oral administration, the development of a contrast medium for magnetic resonance and for SPECT/PET, the in-vivo tracing of stem cells and the early diagnosis of atherosclerotic plaques. Responsibility for the overall coordination of Nano-HEALTH lies with JOANNEUM RESEARCH and the project is co-ordinated by BioNanoNet Forschungsgesellschaft mbH.

“One strategy for preventing unwanted side effects is to transport the active components to the diseased tissue with targeted accuracy. Nanomedicine can help here. In the Nano-HEALTH cluster project, which is coordinated by JOANNEUM RESEARCH and BioNanoNet, 16 national partners are taking up this challenge.”

Dr. Di Frank Sinner, Cluster Coordinator

Science
Nano-HEALTH is developing pharmaceutical nanocarriers. These are intended to prevent side effects and improve the distribution of the active ingredient in the tissue. Furthermore, the use of nanoparticle families (NPs) in diagnostics is being developed for magnetic resonance imaging (MRI), for example. Nano-HEALTH has grouped four NP types to form a nanoparticle platform: liposomes (phospholipid double layers), protides (proteins), PLA-HSA (polylactic acid - human serum albumin) and thermonses (particles with hydrogen sulfide groups). The objectives here are to:

- advance the thinner NP technology for the oral administration of medications
- scale up the thinner NP production to the ton scale and also scale up the PLA-HSA NP production.
- develop targeted NPs for cancer and further development of liposomes and protides for gadolinium(Gd)-based MR
- develop Gd- and iron-based NPs for stem cell monitoring
- diagnosis of atherosclerotic plaque. Adiponectin as target molecule for NPs for the development of a contrast medium for early diagnosis with MRI
- develop standardised tests to determine the chronic toxicity of nanostructured materials and their integration into the EURL-Nano-Tox (www.euro-nanotox.at)

Industry
Thirteen BioNanonet partners collaborate in Nano-HEALTH with three additional partners. Nano-HEALTH has developed and optimised the NP platform. In the meantime, at medical and four further Austrian universities, two non-university based research institutions, three SMEs, one Competence Centre and one leading international diagnostics and instrumentation company are involved. They are currently working on transforming the results into application.

Impact
Nano-HEALTH can claim many successes in the field of active ingredient transport via the mucous membrane of the intestines (theta)meral for example:

- reproducible manufacture of theta (theta)meral NPs by means of "jet milling"
- increased loading with active ingredient by optimized manufacturing processes
- loading of NPs with different hydrophilic macromolecular active ingredients
- absorption of a specific contrast medium (Gd-DTPA) via the intestines using functionalized thomers
- optimisation of the so-called efflux inhibitory effect in the field of diagnosis:

- bonding of three different targets to liposomes NP
- fluorescence marking of liposomes for the tracing of stem cells, atherosclerotic plaque, and for nanotoxology studies
- manufacture of protides loaded with Gd with a signal increase of 170 per cent in MRI
- manufacture of functionalised anti-VCAM Fab and globular adiponectin) liposomes and protides by retaining the biological activity of the targets
- tracing of stem cells in vitro.

Nano-HEALTH has also been successful in the field of nanochemistry. Methods have been established here to determine the toxicological profile of nanostructured materials. Thanks to the research results to date, negotiations are already underway with industry for several NPs.

Image bottom left:
Bone marrow multipotent mesenchymal stem cells

Image top left:
SIM image NP protide

Fluorescence imaging: Rhodamine-coated beads, plates, Nano-Pot
NILaustria – Nanoimprint Lithography in Austria: enabling emerging high added value applications

Synopsis

Large-area nanostructuring is one of the main challenges Nanotechnology faces. NILaustria uses Nanoimprint Lithography (NIL) to produce ultra-precise nanostructures on large areas. NIL has many advantages in comparison to conventional nanostructuring techniques. It enables simultaneous maximum resolution and high throughput and can be used to manufacture multilevel nanostructures in a single processing step, for example. Furthermore, the process is fast and cost-efficient. The idea of NILaustria is to use NIL for various applications – in basic, as well as in applied research – and to use the synergies to achieve significant progress in the nanoimprint process itself as well as for the applications.

Nanolithography (NIL) is a technique to replicate nanostructures on a large area. NIL's aim is to pursue an application-oriented approach in Austria and to achieve outstanding results with global relevance in this field.

Science

The challenges facing NIL lie mainly in adapting the processes for different applications and in the manufacturing of templates. In this context, it has been successfully demonstrated that the CHARPA technology from IMS Nanofabrication is suitable for manufacturing master templates with structures below 50 nm. By using 43,000 parallel ion beams, it will be possible to decrease the costs for high-resolution NIL master templates. EVO has shown the fabrication of large-area working stamps with structure dimensions down to 50 nm. Both results are significant steps for the further commercialization of NIL.

JOANNIUM/RESEARCH fabricated the worldwide first organic complementary inverters using NIL and also develops so-called NIL processes in this context. Micro- and nanostructuring for the electrochemical deposition of metal clusters on biochip substrates is of great importance to Happy Pating and AIT. Further basic research is being carried out on negative index mate-materials in a project led by PROFACTOR. These materials can be used in many optical-related fields. At the Johannes Kepler University, substrates are being structured for the growth of quantum dots, which are particularly well-suited for optoelectronic applications. By the end of 2009, the consortium will have presented 56 contributions at 24 international conferences. This also includes invited talks of IMS Nanofabrication and JOANNIUM/RESEARCH. At the NNT Conference 2009, only the USA, Japan and South Korea present more contributions than Austria.

Industry

The applications that are relevant to NIL today range from flat screens and LEDs to hard disks, biochips, organic electronics, refractive optical elements and micro-lenses through to microchips and MEMS. The ultra-high resolution, as well as flexibility and low costs are important advantages of NIL in this respect. The market for NIL is growing strongly, with predicted annual growth rates of 50 per cent. It has therefore been particularly important to establish an international Business Interest Group.

Impact

NIL represents a new possibility for industry to combine ultra-high resolution with high throughput and low costs. NIL Austria is already achieving relevant results, for example in the area of master and working stamp fabrication, and the alignment, process integration and direct structuring of functional polymers. The project thus makes nanostructuring feasible for companies that have so far not been able to make use of the potentials offered by nanotechnology. The development of competence in this future-oriented field will strengthen Austria as an industrial base in the long term.

NILaustria

INFOBOX

Duration of the cluster project: From April 2008 onward

www.nilaustria.at

Project management:

PROFACTOR GmbH

www.profactor.at

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Functional Surfaces and Nanostructures

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FzK-IFM Gru Centre for Electron Microscopy,

University of Applied Sciences Welsberg GmbH,

Johannes Kepler University, Linz

JOANNIUM/RESEARCH Forschungsgesellschaft mbH

PROFACTOR GmbH

Graz University of Technology,

Vienna University of Technology

Business partners

FV Group, F. Thalhammer GmbH,

Happy Pating GmbH,

IMS Nanofabrication AG,

MB Technologies GmbH

Images on the left, clockwise from top left: Waxed organic thin film transistors with different channel lengths between 300nm and 2400nm; fluorescence image of a protein chip for the diagnosis of sepsis; AFM image of silicon-germanium quantum dots grown using molecular beam epitaxy on substrate pre-structured with NIL. The holes etched into the silicon substrate before the dots are grown permit the nucleation of individual quantum dots at well-defined locations; microscopic image of stacked split ring resonators; the number of layers increases from right to left.

Picture on the top: LIWAI on 100 nm silicon wafers

Picture on the right: CHARPA tool with Three Photomasker 1000 of IMS Nanofabrication AG
NSI – Nanostructured Surfaces and Interfaces

Synopsis
NSI draws on the expert knowledge in the Linz/Upper Austria region in significant core fields of nanotechnology in a high-grade interdisciplinary approach, linking bio-nanotechnology, nanocomposites and nanoanalysis. This creates synergies that would not be conceivable with the juxtaposition of individual projects. In the NABIOS project, for example, biologists, chemists and semiconductor physicists collaborate to localise and characterise individual biomolecules on a nanostructured platform. This approach, applicable in a similar form to most NSI projects, is exemplary for nanotechnology, which can only be efficiently utilised if the traditional boundaries of the individual disciplines are overcome.

Science
Nanostructured surfaces and interfaces are significant for three reasons:
1. Biointerfaces: Surfaces are nanostructured and provided with biological functionalities. Individual biomolecules can thus be localised or cells selectively grown.
2. Nanocomposites: Specifically produced nanocrystals or nanoparticles are embedded into a polymer matrix to modify its optical, electrical, thermal or magnetic properties.
3. Metal clusters: Their properties are analysed using newly developed, process-compatible techniques.

Industry
NSI’s primary objective is to create a centre of excellence in the Linz/Upper Austria region and to develop cooperation activities with other national and international partners. Thanks to interdisciplinary research topics, NSI also makes a lasting contribution to the "NanoScience/Technology" master’s course at the Johannes Kepler University in Linz.

In its third funding period, NSI comprises a total of eight projects in bio-nanotechnology, nanocomposites and nanoanalysis. Fields allowing multi-faceted application potential include organ reconstruction, printable safety labelling, coatings with long-term UV-protection, and many more.

Impact
The NABIOS project makes use of nanostructured substrates for bio-nanotechnology in order to localise individual biomolecules and characterise them using fluorescence or atomic force microscopy (AFM). Possible applications are fast DNA sequencing and screening techniques using minute volumes of biomolecules. NABIOS is closely related to the FABICAN industrial project, which develops AFM cantilevers for biological and medical applications. The NBPF project investigates cell growth on nanostructured polymer films for controlled cell differentiation. In the field of nanocomposites, the NanoShape project deals with the synthesis and optimisation of magnetic nanocrystals for magneto-optical devices. The Nanolink industrial project scours the synthesis method from NanoShape for the production of technically relevant quantities and produces printable inks from the nanocomposites. The Polytube industrial project develops nano-composites based on carbon nanotubes and carbon nanofibres for thermal management. The NanoPow industrial project is introducing inorganic nanoparticles into polymeric systems for the realisation of transparent coatings with stable UV-protection. The NanoProbe project fulfills the requirement for the further development and application of nanomechanical measurement methods. NanoProbe is, on the one hand, a scientific project based on the methods of electron microscopy and optical metrology on magnetic nanocrystals. On the other hand, NanoProbe provides and applies these techniques as a service function. With the strategic partner FELM from the TU Graz, the project fosters the long-term cooperation of leading Austrian centres of nanoanalysis.

INFOBOX
Duration of the cluster project: March 2005 to February 2012
www.nanoscience.at/nsi.html

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Business partners:
Profactor GmbH, Igor Coatings GmbH & Co. KG, SCL SensorTech GmbH, Textproject Company, C-Polymers GmbH
TCFT – Transfercenter für Kautschuktechnologie GmbH

Image on the left:
Mixture of Au and Fe2O3 nanocrystals. The Au nanocrystals serve as nucleation sites for the iron oxide nanocrystallites during chemical synthesis.

Image top:
Schematic representation of a linker molecule, between a nanostructured substrate and a DNA strand under investigation. The linker molecule itself is made to measure from DNA strands in the form of a tetrahedron and has thiol groups at the three lower corners (red), which bond to Au, and a DNA sequence (blue) at the upper corner, which bonds the DNA strand under investigation.
PHONAS – Photocatalytic nanolayers

Synopsis
PHONAS consists of five complementary individual projects with strong links to each other. It comprises five renowned R&D partners and eight partners from industry – with an SME share of 50 per cent. This creates a multi-disciplinary team with high expertise in chemistry, physics, material sciences, processing technologies and mechanical engineering on the scientific side, and with industrial competence in the areas of furniture composite boards, sanitary ware, stone, glass, cleaning & coating and plant construction. The overarching objective is the development of scientific and technical foundations for new transparent, self-cleaning coatings based on photocatalytically-active nanoparticles (PCNP) for special indoor and outdoor products.

Science
Today, technologies for self-cleaning applications concentrate mainly on two effects: 1. Changes to the surface structure: This reduces the adhesion of dirt and thus produces the so-called “lotus effect” – the surface repels the water, exhibiting a hydrophobic effect. 2. The use of photocatalytically-active nanoparticles (PCNP). These allow organic compounds on the surface to decompose under UV and/or visible light, and have superior hydrophilic properties.

PHONAS creates the scientific and technical basis for the development of new transparent, self-cleaning coatings based on photocatalytically-active nanoparticles. These find application both indoors and outdoors.

Industry
Both methods have great economic significance as they can dramatically reduce, for example, building-cleaning costs, and limit the adhesion of bacteria and fungi. Moreover, the photocatalytic process can also counteract air pollution. A few commercial applications are already based on these processes - self-cleaning windows, for instance. The economic relevance of PHONAS thus results from the development of new, competitive, added-value coatings with self-cleaning properties that can be applied to various materials – even wood and polymers. PHONAS represents five interdependent and complementary individual projects. They pursue their scientific goals within the projects JANPAR and BANPA:

JANPAR develops photocatalytic nanoparticles based on titanium dioxide (TiO₂) with selective surface functionalization – so-called “Janus particles”. These direct a photocatalytic effect outwards and thus prevent damage to the substrate, provided it contains organic substances. First coating prototypes have already been produced with industrial partners. BANPA is developing the Janus particles in combination with photocatalytically-active coating solutions and testing methods that are suitable for light in the visible range and therefore for interior applications.

The following sub-projects build on the results of JANPAR and BANPA:

TESET: Development of methods for the continuous manufacturing of top-quality PCNPs by means of chemical precipitation reactions.
TEPCO: Realisation of new coatings with self-cleaning effect on a pilot scale, while retaining important secondary properties (hardness, wear resistance, etc.).
WoodPCO: Development of photocatalytically-active coatings for real wood laminates.

Impact
A total of more than 25 scientific publications and conference contributions have been published so far, and several successfully tested prototype plants have been built. Furthermore, the project partner Fabrchem has launched its first cleaning products onto the market.

INFOBOX
Duration of the cluster project: October 2006 to March 2011
www.phonas.at

Project management:
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CEST Centre of Competence in Applied Electrochemistry GmbH

Business partners
FundaMet GmbH,
Arvenberger GmbH & Co.,
Engineered nanoproducts Germany AG Austria,
R. Rupert Fehlinger GmbH,
Forschungsprodukte Morschacher- und Appartestbau GmbH,
Fabrchem Aktiengesellschaft,
Peschauer Natursteinwerke GmbH & Co KG,
Liegie Pulverbeschichtung GmbH
PLATON – Processing Light: Advanced Technologies for Optical Nanostructures

Synopsis

PLATON (Processing Light – Advanced Technologies for Optical Nanostructures) photonics collaborative project started in March 2007 with six sub-projects and is designed to run for seven years. The Austria-wide collaborative project now links 15 partners who cooperate intensively. Main objective of the initial phase has firstly been to prepare for and exploit synergies secondly to foster excellence and thirdly to combine existing Austrian scientific as well as industrial expertise in the area of photonics and nano-technologies in order to increase viability of Austrian activities in these fields. Results out of PLATON in terms of manufacturing and material science contribute to securing Austria as a strong player in manufacturing in a globalised supply chain.

Science

Austrian companies and research institutions involved in PLATON – the second youngest Cluster under the Austrian Nano Initiative – have been to the forefront internationally in the fields of environmental technology, solar cells, medical engineering, euro banknotes, lithography, telecommunication technology, quantum cryptography and the atomic chips. During the developmental phase, PLATON succeeded in introducing the latest results from basic research and transforming them into the development of completely new types of measuring instruments and measuring processes. Here, they achieved the breakthrough for the laser-based determination of pH values. The simplicity of the radically new process for determining the pH values will open up a large number of entirely new applications.

Industry

Results PLATON project has delivered to date contribute to safeguarding Austria as a manufacturing base in a globalised value-creating chain. On the one hand, the research results help to avoid in totally unexplained interfering phenomena for quality assurance. On the other hand, since completely new properties can be taken advantage of that ensure ever-increasing data rates and speed for computers and networks. And it is also thanks to PLATON that completely new types of measuring instrument, tools and applications based on photonics will safeguard and enhance Austria as an industrial base. Without sound applied knowledge of quantum physics, the industrial production in numerous high-technology fields is in danger of collapsing in the years to come. The main added value for industry results from network-based collaboration. The direct help and support made available immediately upon request for the Austrian companies could not have been realised without PLATON.

Impact

PLATON has already contributed to overcoming bottlenecks and technological-scientific challenges caused by continuous miniaturisation. To this effect, PLATON helped a small company to overcome significant hurdles in the production of a prototype for a radically new manufacturing process. The company subsequently became a globally recognised technology leader and is now a European champion of essential manufacturing technology for the future. Several professors from PLATON have designed a continued education programme for 150 employees in Burgenland and Styria. The industrial partner Blue Chip is therefore in a better position to react to the niche market of high-value solar cells for solar power stations in order to succeed in a global price competition from their base in Austria. PLATON partners were coordinator of the S.T research project SUPERSMART – sponsored by the European Commission – and have participated in the integrated TERAMOV project (the same S.T programme), as well as in several STREPs and Networks of Excellence. PLATON plans to develop at least six high-performance innovative devices during its seven-year duration.

Image:

Lab-sharing between world-class laboratories has become reality for the young scientists involved in PLATON.

INFOBOX

Duration of the Cluster project: March 2007 to February 2014

www.platon-photronics.at

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Kdg mediumtech AG,
Blue Chip Energy GmbH,
Ferchel Gesellschaft mbH,
Fritberts Goller GmbH,
VBC-GEROMICs Bioscience Research GmbH

“Basic research forms the foundation of all technological developments. Without fundamental knowledge, there would be no revolutionary new technologies and products.”

Jörg Schmiedmayer