BIO NANONET

NEWSLETTER

03/2018

September 2018

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Retrospect

- 11th European and global summit for clinical nanomedicine, targeted delivery and precision medicine - the building blocks to personalized medicine, 2 – 5 September 2018, Basel, Switzerland
- Horizon2020 funded e-infrastructure project – NanoCommons – participated in the 4th International Conference on Research Infrastructure, 12 – 14 September 2018, Vienna, Austria
- BioNanoNet focus on nanomedicine and nanosafety – "bio-nano-interactions: medical breakthrough & safety aspects", 12 September 2018, Graz, Austria
- BioNanoNet strategy workshop & networking event, 13 September 2018, Graz, Austria
- BioNanoNet focus on sensortechnology, 14 September 2018, Graz, Austria

Conference calendar

- BioNanoNet events
- BioNanoNet on-site-events

Finally

Editorial -
Contemporary issues from the network

Dear Ladies and Gentlemen,

the “post-holiday season” started with the BioNanoNet-events as it happens every year in mid of September. Together with the NANOGENTOOLS workshop and thus supporting the community building with additional international partners, it becomes very clear that the potential of this network has reached a high level. Scientific excellence meets translational, up-scaling, as well as piloting competence, and this focussed along the three focus areas, but not limited to them. Well, this is the perfect timing to initiate the further development of BioNanoNet to prepare itself and its members for forthcoming challenges as it will be the new structuring which can be anticipated in the framework programme Horizon Europe.

Strategic developments in European research and development landscape, as well as on regional and national level needs to be integrated into our work. Our objective is to keep our members up-to-date about changes and how to find their way to scientific and research collaboration.

Of course, we are also involved in activities around the Austrian presidency of the council of the European Union. Especially, we like to highlight one great event which is definitely in the core area of BioNanoNet members: the Industrial Technologies 2018 conference in Vienna (30 – 31 October). We are proud to be co-organiser of the pre-conference workshop “2nd EU-Asia Dialogue on Nanosafety”, taking place at the FFG Austrian Research Funding Agency in Vienna on October 29th. We see it of utmost importance to continue and expand this dialogue towards a global communication platform. If you are interested to learn more about this activity, do not hesitate to contact us.

Some important events shall be announced already now to save the date: the Austrian Microfluidics Initiative 1st Scientific Meeting on 28th of February, 2019 in Vienna and the BioNanoNet Annual Forum 2019 on 10th of September, 2019 in Salzburg.

Sincerely,
BioNanoNet-Team

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BioNanoNet *member contributions*

Contribution of FH JOANNEUM (University of Applied Sciences)

FH | JOANNEUM
University of Applied Sciences

FH JOANNEUM: three research projects launched with a total investment of over 3.6 million euros

Over the coming years, FH JOANNEUM will be conducting research in three additional future-oriented fields: projects for the early identification of neurocognitive disorders (such as dementia), Big Data and insects in the food chain will be carried out under the direction of FH JOANNEUM with financial support from the Austrian Research Promotion Agency (FFG) under the COIN programme.

“As part of the projects, around 3.62 million euros will be invested in the expansion of research and development at FH JOANNEUM over the next few years. Federal funding totalling around 2.53 million euros will be provided,” says Martin Payer, Financial Managing Director at the university. Around one quarter of the overall Austrian funding from this COIN call will thus go to FH JOANNEUM – a record sum.

“The funded projects cover a wide range of specialist fields: from the highly topical issue of digitalisation for the regional economy to optimal health prevention and sustainable and innovative food supplies for the future – the wide-ranging spectrum shows just how diverse research and teaching at FH JOANNEUM really is,” says Karl Peter Pfeiffer, Managing Director of Scientific Affairs at FH JOANNEUM.

“The three projects will be supported by around 25 Austrian companies which have expressed their interest and commitment to these future-oriented research topics in so-called letters of intent,” says Roswitha Wiedenhofer, Head of the Research Organisation & Services division, emphasising the close collaboration with business and industry.

Proof of the excellent quality of research

“The fact that we have succeeded in securing for Styria a quarter of the funding distributed across Austria is further proof of the excellent quality of the research here in Styria,” says Regional Minister for Science, Barbara Eibinger-Miedl, clearly pleased with this outcome. “FH JOANNEUM is among the leaders for teaching and research in Austria and is yet again strengthening Styria’s position as a research location with this latest success.”

The projects at a glance

The project **‘Sustainable Proteins: integrated insect innovations across the food chain’** looks at insects as a source of food. The Institute of Applied Production Sciences is leading the project, building on existing expertise from past projects on this topic. The sustainable and efficient production of animal protein is being explored using the example of insects, in collaboration with three other FH JOANNEUM institutes, the University of Wageningen (Netherlands), the University of Graz and the company Hygienicum. 1.03 million euros will be invested in the project.

How can small and medium-sized companies (SMEs for short) benefit from the analysis of Big Data and use of artificial intelligence? The ‘**Big Data Analytics & Artificial Intelligence Research Center**’ explores this and other similar questions relating to IT expertise and infrastructure. The project aims to develop innovative solutions and offer relevant training sessions for companies. Under the direction of the Institute of Internet Technologies & Applications in Kapfenberg, three additional FH JOANNEUM institutes as well as TU Wien, Montanuniversität Leoben and Know-Center Graz take part in the 1.43 million euro project.

Six FH JOANNEUM institutes along with the Austrian Institute of Technology, the Medical University of Graz and JOANNEUM RESEARCH have joined forces in the research project ‘**Smart Cognition and Behaviour Screening powered by AR**’. A new screening tool for the early identification of neurocognitive disorders such as dementia will be developed under the direction of the Institute of Dietetics and Nutrition in Bad Gleichenberg. Both the patients affected and outpatient care are expected to benefit from this multimodal tool. Project investment: 1.17 million euros.

FH JOANNEUM experts use these and other research projects to find solutions to relevant challenges for industry, business and society. The latest funding from the COIN programme will enable a massive expansion of both infrastructure and expertise in the field of research and development at FH JOANNEUM.

Insect waffles: The benefits of insects are being explored across the food chain. Here: insect flour waffles from a previous project (© FH JOANNEUM / Manfred Terler).

Mealworms: Mealworms and other insects can play a key role in feeding the world's growing population. The new projects at FH JOANNEUM also address the topics of Big Data and early identification of cognitive disorders (© FH JOANNEUM).

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Contribution of Graz University of Technology

Material design: START Prize for TU Graz physicist

TU Graz physicist Oliver Hofmann has been awarded the renowned START Prize for his work in the field of material design. He aims to make production of materials with certain properties easier.

Oliver Hofmann won the START Prize of the Austrian Science Fund FWF in 2018 (© Baustädter – TU Graz).

Many material properties depend upon the internal structure of a material. The internal structure can in turn be influenced by the production process. What conditions need to prevail during the production process in order to confer certain properties on the material is valuable knowledge not easily won. This is where Oliver Hofmann's MAP DESIGN project, which was awarded the START Prize, comes in. Its aim is to simulate conditions by means of quantum-mechanical computer calculations which can lead to the production of materials with precisely defined properties.

The START-Price is awarded by the Austrian Science Fund every year to five or six projects selected by an international expert jury. The research funds amount to between 880,000 and 1.2m euros and each project runs for six years. The most recent person to bring a START Prize to TU Graz was mathematician Christoph Aistleitner in 2015. Aistleit-

ner introduces his current project on ‘Probabilistic methods in analysis and number theory’ on Planet research.

International cooperation for improved solar cells

Oliver Hofmann, together with colleagues from USA, Germany and Finland, has spent several years producing efficient materials which should ultimately improve energy production from solar cells. The solid state physicist gives an insight into his research in the article ‘Improved “energy harvest” in solar cells’ on Planet research.
The MAP DESIGN project funded by the START Prize is related to this and it is hoped that work on more effective solar cells and the improvement of many other materials for a wide variety of purposes should be brought a big step nearer.

This project is anchored in the FoE „Advanced Materials Science“, one of TU Graz' five strategic areas of research.

Visit Planet research for more research related news.

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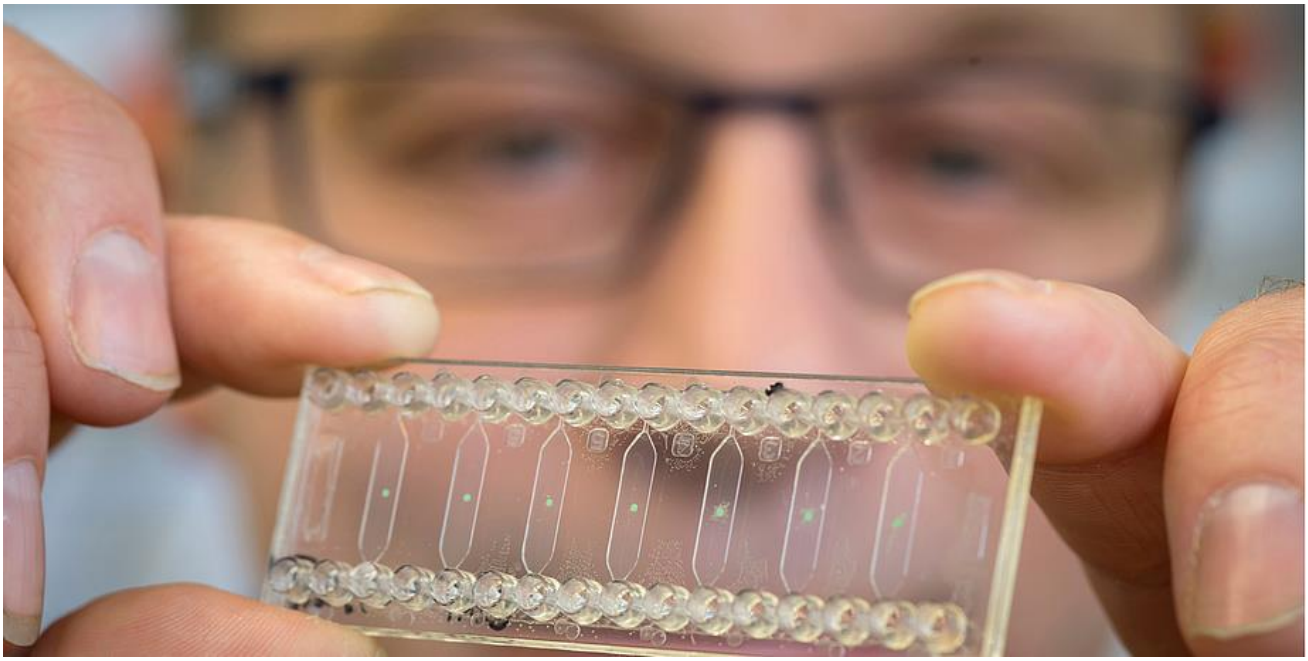
Contribution of Graz University of Technology

“Honey, I shrank the lab”

Microbioreactors with integrated sensors enable improved and well-controlled reaction conditions to be produced and are increasingly used in biocatalysis, process optimisation, diagnosis and cell culturing.



Microfluidic chip for cell cultures with integrated sensors (green spots for oxygen, pH and glucose. The sensors allow for a continuous control of cell viability and metabolism.

Microbioreactors are miniaturised bioreactors with structures on the micrometre scale. They are a special field of microfluidics or lab-on-chip technology and consist of chambers and channels in sizes from 10 µm to 3 mm and depths from 10 to 800 µm. They are made of glass, silicone or polymeric materials. Compared with conventional bioreactors, and thanks to their small volume and shorter transport distances, microbioreactors are characterised by faster heat transport, improved reaction control, reduced safety risk, fewer material and energy requirements, and greater product yield. They allow the production of small amounts in batch, but also continuous production. Microbioreactors allow us to perform experiments in controllable test conditions and have the potential for use in all chemical and biochemical applications, e.g. industrial processing, process optimisation, preparation of personalized medicine and in laboratories for research and development.

Small scale

Microbioreactors are made in customized designs, ranging from simple chambers to meanderlike structures or chambers packed with particles, so-called packed bed reactors. Special structures can be implemented to achieve a good mixing of the reactants.

Typical set-up of microfluidic reactors. Reagents and fluids are injected into the reactor using syringe pumps. The reaction can be controlled in real-time with the integrated sensors.

Microbioreactors are applied in various application fields, e.g. enzymes are immobilised on the surface of the channel walls to perform fast biocatalytic transformations at the micro scale. This enables the reuse or recovery of expensive enzymes or continuous processing in the flow. Microbioreactors are also employed for the investigation and optimisation of diverse process parameters. Researchers in process engineering aim to determine the best process conditions to optimise large scale processes. The newly developed tools will provide a better understanding of processes and simplify and accelerate their optimisation. Microbioreactors are also used for cell culturing. Microfluidic systems and cell cultures are a perfect match because of their comparable sizes. In comparison to static culture dishes or shake flasks, they enable microfluidics nutrient supply under relevant shear force condition to be carried out as they can be found under physiological conditions. In addition, cell culture conditions can be adjusted by automated fluid handling with a high reproducibility.

Accelerated research

Microbioreactors offer the possibility to accelerate research and development in these fields due to the small sizes and a precise control of the micro environment. Integrated analytics are essential to achieve a continuous monitoring and deeper insight into the processes or biological systems investigated. The key parameters measured in microbioreactors are oxygen and pH. Optical chemical sensors are beneficial compared to other analysis techniques. They are easy to integrate, are noninvasive, and can be measured contactlessly from outside the reaction chamber. However, the small-scale demands high-performance sensor materials and measurement systems. Optical chemical sensors are composed of luminescent dyes embedded in a polymer film. The interaction of the analyte (oxygen or hydrogen ions) alter the luminescent properties of the dye which carries the analytical information. The sensors are integrated into the microsystem as thin films or spots in sizes of 100 to 750 µm using inkjet printing and can be read out contactlessly from outside by optical fibres. Alternatively, analyte sensitive nanoparticles are applied, and these can be directly injected into the fluid without an integration step.

The team of the Institute of Analytical Chemistry and Food Chemistry and the Institute of Biotechnology and Biochemical Engineering working with microbioreactors.

The integrated sensors enable biocatalytic conversions to be measured and the nutrient supply in cell cultures to be monitored. The measurement of metabolism rates with oxygen,

pH and glucose sensors tailormade for cell cultures has a high potential. The combination of these sensors allows exploration of the bioenergetics of mammalian cells to be performed. This measurement can deliver valuable information on the toxicity of drug candidates and nanomaterials. These sensors are also important tools in the emerging organ-on-chip technology, which mimics the functionality of human organs using 3D-tissues co-cultures in microfluidic devices.

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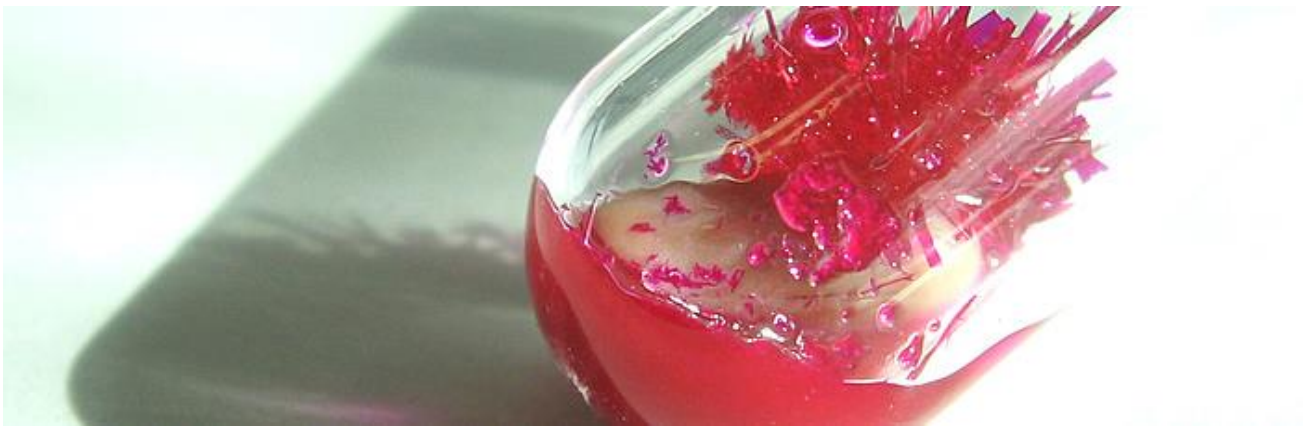
Contribution of Graz University of Technology

Interior architecture at the nanoscale

Although microporous crystals are tiny, their potential is enormous. To exploit this, TU Graz has initiated the interdisciplinary lead project Porous Materials@Work.

Our life occurs in voids; for example, rooms in buildings are nothing but voids and these rooms and the furniture in them consist of materials full of voids. Porous materials are omnipresent – both in nature and in technology. Even the bodies of our cars become increasingly porous – in this case to reduce weight and to save fuel. Voids are extremely powerful, determining and changing the character of substances. Making a material porous by inflating it with air can change it into a detergent, trapping dirt in its voids. “The chemical composition of a material does not change by making it porous. Its modified architecture, however, completely changes its properties and, thus, its fields of application,” attests Christian Slugovc from the Institute for Chemistry and Technology of Materials, stressing the enormous relevance of voids. Many applications rely entirely on the porosity of a material. This applies, for example, to catalytic converters, which are mostly based on highly porous ceramics filled with catalysts.



When crystals start to grow in the reaction vessel, joy breaks out in the lab.

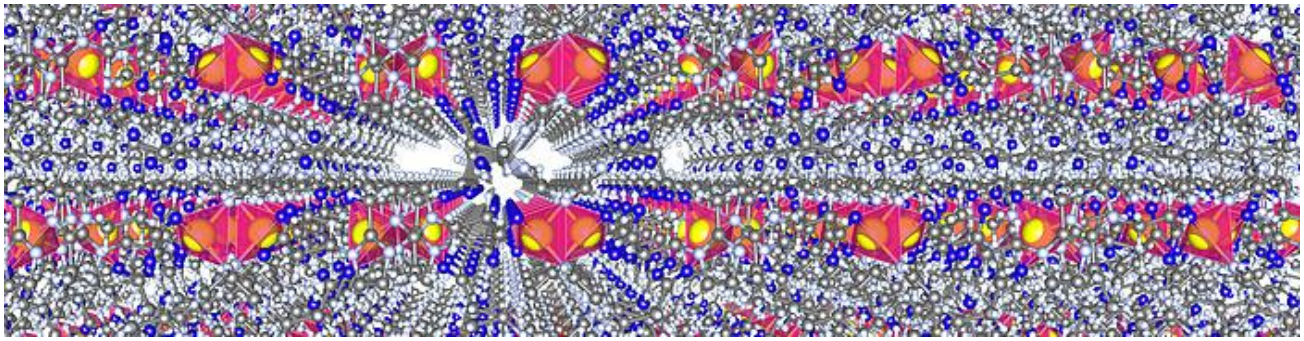
Tiny pores, huge reservoir

At TU Graz, a multidisciplinary consortium consisting of 14 scientists from the areas of materials science, chemistry, physics, electrical engineering and biotechnology is concerned with a special type of porosity relying on pore sizes in the nanometer range. An important

role in this context is played by microporous crystals, in which metal ions are connected by organic linkers (so-called metal-organic frameworks or MOFs). Due to their high porosity they make up a huge internal surface area providing them with an enormous potential for a variety of applications. A few cubic centimeters of these metal-organic scaffolds, for example, contain the surface area of a soccer field. The tiny pores can accommodate a variety of substances ranging from dirt to medicines.

Crystals of GUT-2. For the choice of the name of a metal-organic framework, in any cases the acronym of the research institution is chosen followed by a consecutive number.

Using funding to the amount of 1.5m euros from the interdisciplinary large-scale project, the scientists don't want to focus solely on MOFs, but also other important porous materials, such as nanoporous metals and paper. "Our goal is to control the properties of the pores in a precise manner, manipulating their size, distribution and also the ratio between pores and dense material," stresses Paolo Falcaro who, together with Christian Slugovc and Egbert Zojer of the Institute of Solid State Physics, leads the Porous Materials@Work project. "These characteristics of porosity have a decisive impact on the quality of a material." As soon as one can control the growth of MOFs, materials for a variety of applications can be "designed". "Depending on the arrangement and texture of the crystals the same material can exhibit different properties," stresses the Professor for Biobased Materials Technology at TU Graz.



Depiction of the molecular structure of GUT-2.

Focused TU Graz expertise

For years, a number of scientists at TU Graz have been concerned with a variety of aspects of porous materials, as they are needed in many areas for numerous applications. A goal of the lead project is to focus this scattered expertise. Moreover, by hiring Paolo Falcaro at the Faculty of Technical Chemistry, Chemical and Process Engineering, Biotechnology two years ago, an internationally established expert and scientific pioneer in the area of porous materials, TU Graz has significantly strengthened its knowledge base and reputation in this seminal field. For his research on microporous materials, he has recently been awarded approx. 2m euros of funding through a Consolidator Grant from the European Research Council (ERC).

So far, apart from TU Graz there is no other institution in Austria that explicitly focuses its research on porous materials. Even worldwide, there are only few centers concentrating on this crucial interdisciplinary topic. The ambitious goal of the TU Graz scientists is to “eventually become one of the top three research centers for porous materials”, as Paolo Falcaro has stated. A big advantage in this context is that at TU Graz it is not necessary to start from scratch, rather the focus has to be on joining existing knowhow and combining different views to generate new insights and a comprehensive understanding of porous materials. “Interdisciplinarity will be the key to success,” states Paolo Falcaro. “Therefore, even at this stage the project comprises scientists from four faculties.” The expertise on porous materials at TU Graz, however, reaches out far beyond the people already involved in the lead project: “For this reason it is one of our key goals to attract an even greater pool of scientists in this way laying the foundation for a sustainable development,” stresses solid-state physicist Egbert Zojer, one of the coinitiators of the project. The scientists are unanimously convinced that “fundamental discoveries will allow us to optimize porous materials to a degree that will make possible not only improved but also entirely new applications. At TU Graz we are definitely ready to enter into yet unexplored terrain.”

Well-protected drugs

The intensive link between basic research and experience in applications will trigger innovations, for example, in the area of environmental engineering and the fabrication of photovoltaic cells or the realization of energy storage applications. Also in the areas of medical and pharmaceutical engineering, the envisioned research activities will have a profound

impact. For example, many drugs currently need to be stored at low temperatures, which increases costs and complicates their transport These problems can be avoided, provided that a porous “packing material” becomes available. “We are working on the encapsulation of enzymes, proteins and DNA in the pores of MOFs to make them insensitive to temperature variations,” Paolo Falcaro explains. “The crystalline structure around the “guest” in the pore protects it like a tough coat.”

Strict order

In nature the internal architecture of porous materials is often quite chaotic. In contrast, in artificial materials the quest is usually for strict order regarding size, orientation and arrangement of the pores. “In many technical applications porosity only creates real benefits when pores are not strongly disordered,” explains Christian Slugovc, as a motivation for the scientists search for perfect order. “Typically, pores fulfill their tasks best, when they are strictly aligned like soldiers.” The degree of order can be controlled by crystal growth. “With Paolo Falcaro we have a clear competitive edge in this context,” the chemist states enthusiastically. Another goal of the research in Porous Materials@Work is the realization of material with a perfect horizontal arrangement of the pores to bring about high electrical conductivities. Combined with ionic conductivity achieved by filling the pores with an electrolyte, such materials will be highly attractive for many applications, including batteries, light-emitting devices and solar cells. “The controlled fabrication of crystals will boost our possibilities for developing such materials,” Christian Slugovc explains. A further advantage of the interdisciplinary consortium is also that it will allow ideas developed in basic research to be tested and transferred to a broad field of applications. There will be many exciting possibilities ahead on this voyage of discovery into the smallest voids of matter.

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Contribution of Graz University of Technology

Manipulated enzymes: TU Graz researchers set milestone on biocatalysis research

TU Graz researchers managed for the first time ever to 'retrain' an enzyme to build ring-shaped molecular structures instead of performing its natural task of reducing double bonds. The work was published in *Angewandte Chemie*, and is relevant for the production of pharmaceuticals and plant protection products.

Rolf Breinbauer and Kathrin Heckenbichler from the TU Graz Institute of Organic Chemistry set a milestone in biocatalysis research with the manipulation of enzymes © TU Graz

Biocatalysis uses enzymes to bring about chemical reactions. This kind of 'soft chemistry' replaces the use of poisonous reagents or solvents in existing syntheses to a high degree. However, a major challenge in biocatalysis is extending this concept to completely novel chemical reactions so far not accessible to enzymes found in nature. One such new design was created by a team of researchers at TU Graz led by Rolf Breinbauer, head of the Institute of Organic Chemistry, and Kathrin Heckenbichler, who pursued this research in the framework of a doctoral thesis at the Institute of Organic Chemistry. Breinbauer explains: 'For the first time, we've succeeded in manipulating an enzyme to carry out not its natural function, but rather a much more interesting function in terms of synthesis. Instead of reducing double bonds in a catalytic process, the enzyme now creates molecular structures in the

form of small rings. By exchanging only one amino acid in the active centre of the enzyme, we've managed to suppress the natural reaction and facilitated a new reaction course.' The team led by Heckenbichler and Breinbauer was able to produce cyclopropanes – extremely small ring-shaped molecules in the shape of a triangle – using biocatalysis. Such ring systems, also called three-ring systems, occur not only in many biomolecules, they are also an important structural element in plant protection products and in pharmaceuticals such as contraceptive pills, drugs used to treat asthma and AIDS medications. The work has been published in the current issue of *Angewandte Chemie*.

The good and the bad 'hand' of the molecule

Parallel to this, the researchers also managed to master the chirality of the produced molecule, which is of great importance in the production of medications. Chirality, or the 'handedness' of molecules, describes how two molecules of the same atom can be structured in a mirror-image way – either right handed or left handed. One variant of these enantiomers can be useful and the other damaging, and great value is placed today on using only the curative variant in the production of medications. This ensures that medications work very specifically and that no undesirable side effects occur due to 'chiral twins'. Kathrin Heckenbichler explains the process and result of the biocatalytic implementation of the substrate: 'To enable an optimum chiral recognition between enzyme and substrate, we designed a substrate with a large residue. By doing this we could ideally exploit the spatial conditions in the active centre of the enzyme to produce a cyclopropane in high enantiomeric purity.' The researchers managed to produce only the desired enantiomer from the two possible chiral three-ringed molecules.

TU Graz as international centre of biocatalysis research

TU Graz ranks among the world's top institutions in the field of biocatalysis research, and this new study confirms this once more. The research team from TU Graz managed to carry out an important extension of their biocatalytic repertoire to open the door to diverse applications particularly in the 'green' production of new medications and the economical pro-

duction of generic pharmaceuticals, aromatic substances and plant protection products. The aim of this so-called green chemistry, to which biocatalysis can be attributed, is to employ mild and environmentally sound reagents, contain environmental pollution, and save energy and costs. The research work of Kathrin Heckenbichler was initially given start-up funding from acib – Austrian Centre of Industrial Biotechnology and supported by the Austrian Science Fund (FWF). In the NAWI Graz alliance – the inter-university cooperation between TU Graz and the University of Graz – Peter Macheroux, head of the TU Graz Institute of Biochemistry and Karl Gruber from the University of Graz's Institute of Molecular Biosciences were also involved in the research.

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Contribution of the Human.Technology.Styria GmbH

Upcoming Human.Technology.Styria events

Medizin trifft Technik: „SmartReality“, 9 October 2018, Graz

Neuer MED Uni Campus Graz (HS05), Neue Stiftingtalstrasse 6, 8010 Graz

Participation is for free!

Please register HERE.

Lifescience PubCamp, 16 October 2018, Graz

You are invited, together with selected companies, physicians, researchers, users and students, to explore possible cooperation potentials and common topics in the field of Virtual/Augmented Reality.

The aim of this workshop is to give the companies a deeper insight into current research topics as well as medical challenges, to increase the knowledge of physicians and users

regarding the latest technical possibilities and in the best case, to initiate cooperations among the participants.
In addition to the focus on the keynote speeches, selected companies will present their products and services at their test stands.

Life Science Pubcamp

The Dublin Road, Abraham-a-Santa-Clara-Gasse 2, 8010 Graz

Participation is for free!

Please register HERE.

The second Pubcamp takes place on 16 October 2018 in Graz. Four topics will be discussed in different pubs during the evening.
Together with our partner, the world usability congress, we are proud to announce that this year there will be a Life Science Pub-Camp location in Graz. Please find more information to all Pubcamps at www.pubcamp.at
After an introduction round and a vote for topics the chosen propositions will then be discussed for about 30 minutes. Breaks in-between will give space to side-discussions and in-depth talks.

Quality Management in Life Sciences, 12 October 2018, Graz

In cooperation with UNI FOR LIFE the Human.technology Styria Cluster made it possible to organize customized qualification courses for students and alumni.
Karl-Franzens-Universität Graz, Universitätsstraße 15, SR 15.33, 8010 Graz
Start: 12.10.2018, 15:00 – 19:00
Participation fee: 50€/students, 75€ alumni & university employees
Certificate: yes
For more information and registration click HERE.

Behaviour in cleanrooms and disinfection in labs

Karl-Franzens-Universität Graz, (more infos tba), 8010 Graz

Start: 16.11.2018, 9:00 – 16:30

Participation fee: 50€/students, 75€ alumni & university employees

Certificate: yes

For more information and registration click HERE.

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Contribution of the Institute of Technology Assessment of the Austrian Academy of Sciences, Austrian Academy of Sciences

NanoTrust – Austria's Path to a Successful Early Stage Risk Management for Nano-Technologies

New technologies such as nanotechnologies involve new materials and products, e.g., in medicine, cosmetics, optics, or construction. Safety and governance issues, however, have not been an equal object of systematic investigation. The NanoTrust project, which has been up and running since 2007, was therefore established to collect the knowledge available on safety and regulatory issues and to analyse it. The communication of this knowledge to the public as well as to decision-makers has been a vital part of our work from the beginning, with the aim to bring about an exchange of knowledge and to contribute to qualified political decision making.

NanoTrust is a key player in developing the Austrian nano risk-governance landscape and plays an important role in maintaining the different instruments and networks developed to tackle safety and risk issues. It is backed by several ministries and the AUVA, a public insurance giant, and led by André Gazsó, senior-researcher at the Institute of Technology Assessment (ITA) of the Austrian Academy of Sciences and chair of the Nano Information Commission (NIK). The NIK is an advisory board of the Ministry of Labour, Social Affairs, Health and Consumer Protection. The regularly published NanoTrust Dossiers take a close look at current developments such as "Nanotechnological applications for food contact materials" or "Positive environmental effects through the use of nanotechnology" or "Environmentally relevant aspects of nanomaterials at the end-of-life phase".

Why technology assessment for nanotechnologies?

The ITA studies the impact of new technologies on the environment, economy and society. The results of its scientific work support policy-makers, administration and the public with regard to issues of technology policy. The ITA carries out interdisciplinary technology studies with three aims:

- to understand the complex interplay between technology and society from multiple perspectives,
- to concomitantly analyse technology development, and
- to contribute to socially responsible technology policy by advising policy-makers and society.

In particular, the ITA analyses unintended impacts of technological change: many new technologies make life easier, enhance productivity, or diminish environmental impact. However, they may also lead to new dependencies, social conflicts and environmental problems. Technology assessment investigates these impacts and deals with topical issues in specific subject areas. At the ITA, researchers from natural and social sciences as well as engineering work together in multidisciplinary cooperation.

Nanotechnologies bear the promise of providing novel solutions for many global problems, such as improvements in solar panels, new methods of water filtration or rehabilitation of contaminated soil. While this offers a broad range of possibilities in providing solutions for sustainable development, it also bears uncertainties and risks in the areas of environment and health.

How to deal with uncertainty when it comes to nano materials

In our experience, effective measures can be taken to handle situations of high uncertainty. Key for early-stage risk management in Austria was an independent committee or organization with the capacity to handle knowledge acquisition and an interdisciplinary evaluation process.

The Nano Information Commission (NIK), the Nano Information Platform (NIP) and the Nanotechnology Action Plan (NAP) are all elements of implementing the precautionary principle and are attempts to get a handle on uncertain situations.

A bit of history

NanoTrust is now in its 12th year running. It initially started in 2007 with the aim of collecting knowledge available on safety and regulatory questions, and to organize and analyse this knowledge. These are tasks one is always confronted with when dealing with new technologies or new materials and products, as they always go hand-in-hand with the need for safety and governance issues to be object of systematic investigation. At an early stage of a new development one is often working with uncertainties rather than risks (risks have un-

known outcomes with probabilities which can be measured, while uncertainties have unknown outcomes with unmeasurable probabilities). It is vital to create robust and regulatory relevant knowledge at stages with high uncertainty. In the case of NanoTrust this process of knowledge creation was primarily organized in the form of transdisciplinary expert dialogues.

Within NanoTrust we dealt with the identification of potential dangers for health and environment at a stage in development where not much could yet be determined, due to lack of experience in the field. We now wish to make use of the experiences in early-phase risk evaluation gained over the past decade in other related areas. Of particular interest to us are areas in which the precautionary principle applies, namely areas with a justified benefit and reasons to assume there are potential risks, as well as an expected need for regulation to arise in the next few years.

The role of technology assessment when it comes to emerging technologies

The NanoTrust project shows several distinctive features that may be indicative for the role of technology assessment when it comes to emerging technologies. TA topics include the study of relationships between societal problems and technology, and governance of emerging technologies. The interactions between technological and societal change are dynamic processes which require continuous observation, analysis and adaptation of scientific approaches addressing them.

The main project aim was to create robust and regulatory relevant knowledge. The high level of uncertainty, however, required that the process of knowledge creation was mostly organized in the form of transdisciplinary expert dialogues. As a consequence, NanoTrust indulged in a variety of expert networks and risk assessment committees right from the beginning. These developments were extensively presented and discussed in the book “Nano Risiko Governance” (Gazsó & Haslinger, Springer 2014).

As the project developed into being a part of the regulatory system, NanoTrust not only provided reliable information and evaluated risk and safety relevant knowledge. Its role grew to also include the task of initiating joint activities, coordinating and eliciting discussions, and even suggesting aims and visions to be shared among partners in order to jointly organize the generation of new knowledge. These activities can only be credibly performed if the TA researchers’ roles within such networks are unambiguous and are openly commu-

nicated to the partners. Therefore, the role of the NanoTrust project members had to (and still have to) be carefully reflected.

The Austrian Academy of Sciences (OEAW)

The Austrian Academy of Sciences (OeAW) is Austria's leading non-university research and science institution. Its statutory mission is to "promote science in every way". Founded in 1847 as a learned society, today the OeAW has over 770 members and 1,700 employees dedicated to innovative basic research, interdisciplinary exchange of knowledge and the dissemination of new insights with the aim of contributing to progress in science and society as a whole. (*Source: OEAW Website*)

Links

The NanoTrust project
ITA – Institute of Technology Assessment
NanoTrust – the Dossiers
OeAW – The Austrian Academy of Sciences

Bios: André Gazsó , Anna Pavlicek, Gloria Rose

Coffee Capsules (© ITA).

Millions of coffee capsules are used every day. They are made of either aluminium or polymer composites. The project SafeNanoCap aimed to assess the applicability of the Safe-by-Design Concept based on the product development of nanomaterials in coffee capsules.

Purification Plant (© Louis-F. Stahl / WikiCommons. CC BY-SA 3.0; Link).

Where does all the nano waste go? In the course of the project NanoMia, ITA researchers André Gazsó and Daniela Fuchs have taken a closer look at how nanomaterials are handled within waste management systems. Nanomaterials can enter waste streams in a number of ways. I.e., the majority of sunscreens ends up not in lake or seawater, but in drains as part of shower water.

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Contribution of Montanuniversität Leoben – Department of Polymer Processing & Science

NATURAL3D: Bio-based fibre/particle reinforced thermoplastics efficiently used by additive manufacturing in the load path direction

In the project Natural3D, an Austrian Chinese Consortium of research institutes makes joint efforts to bring additive manufacturing (3D printing) to the next level. Materials and processes for additive manufacturing will be improved to realize true 3D printed parts with high-strength reinforced bio-based materials.

Natural3D combines the competence of the Shanghai University with three leading Austrian research institutes and six Austrian companies along the whole value chain of additive manufacturing (Figure 1). All aspects from material development, process development, testing, prototyping and dissemination to companies outside of the project consortium are covered.

Figure 1. Members of the Natural3D consortium

Goals of the project include:

- Development of continuous natural fibre reinforced filaments for additive manufacturing.
- Development of filaments for additive manufacturing with nano-scaled crystalline cellulose and/or carbonized bio-based nano-fillers, also in comparison to graphene reinforced filaments.
- Development of a nozzle for extrusion additive manufacturing for continuous fibre reinforced composites.
- Establishing new 5-axis and 6-axis additive manufacturing methods for load path-oriented fibre placement on freeform surfaces.
- Printing demonstration parts in structural and, decorative applications with the new process including new high-strength materials.

The project started in March 2017 and some result highlights are presented here:

- Low-twist flax yarns have been impregnated with bio-based PA11 powder by using powder coating equipment and an oven to melt polyamide powder and coat the yarn by the melt. These coated yarns will be the base for the continuous natural fibre-

reinforced printed parts. Equipment for the production of reinforced filaments has also been built and is shown in Figure 2.

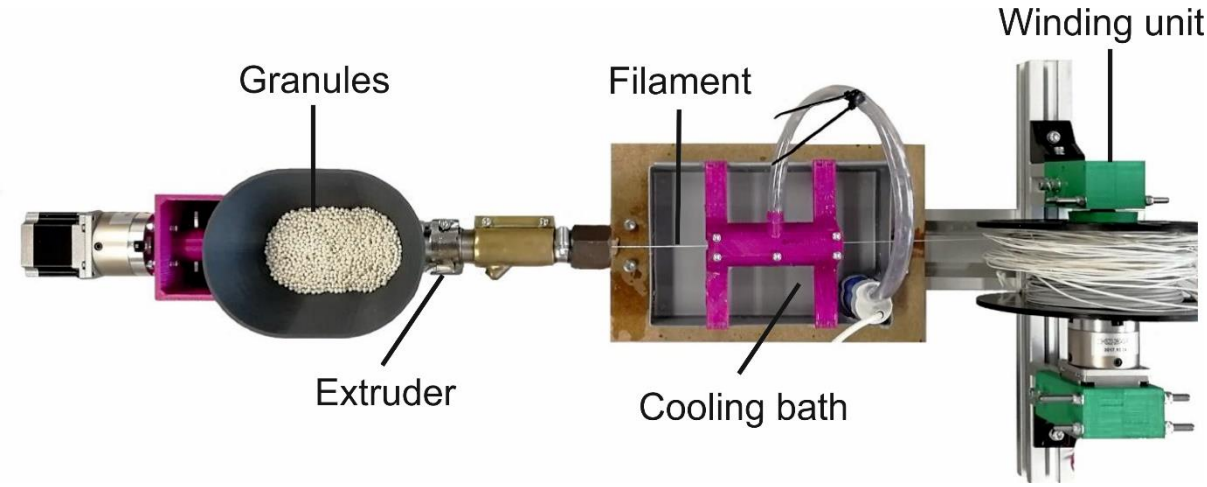

Figure 2. Example of lab scale extrusion equipment built for filaments

- Polyamide and recycled polypropylene filaments have been reinforced with nano-crystalline cellulose and with carbon fibres for comparison. First technical parts have been produced with these filaments and are shown in Figure 3a.
- A5-axis material extrusion additive manufacturing machine and the operating software have been developed; one part produced by this technology is shown in Figure 3b.
- An extrusion head has been developed and it has been mounted on a robotic arm to obtain a 6-axis material extrusion additive manufacturing machine shown in Figure 3c. The software for controlling the 6-axis-printer has also been developed by consortium members.

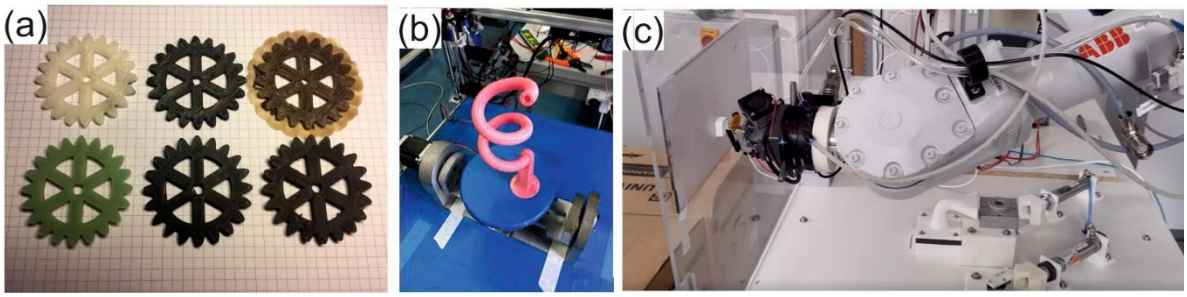

Figure 3. (a) Parts printed with bio-based nano-fillers and carbon fibres, (b) part produced using the 5-axis material extrusion printer, and (c) part being produced by the 6-axis material extrusion printer.

The project Natural3D is jointly funded by the Austrian Research and Promotion Agency (FFG) and the Shanghai University, under grant agreement No.860384.

Contact:

For more information regarding the project, please contact the project coordinator DI Herfried Lammer from Wood K Plus (h.lammer@kplus-wood.at) or Prof. Dr. Clemens Holzer head of the Institute for Polymer Processing at the Montanuniversität Leoben (clemens.holzer@unileoben.ac.at), all are members of the BioNanoNet Association.

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Contribution of RECENDT

PSSP, OnRoadCO2 and FLOIM: RECENDT launches new projects

Three new projects are about to start during these weeks at RECENDT GmbH:

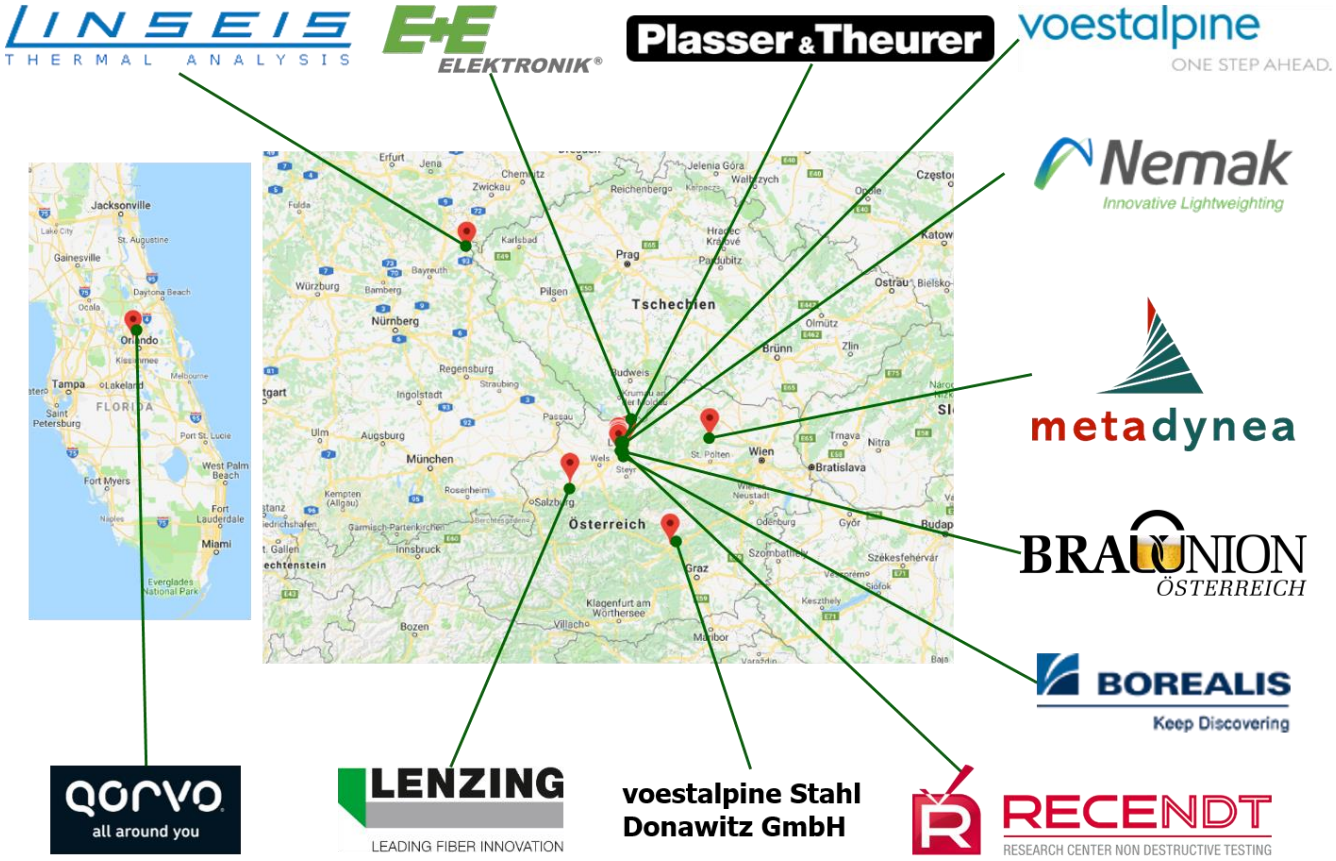
PSSP – Photonic Sensing for Smarter Processes:

Non-destructive Measurement is key. Often. For various targets and tasks.

In the case of the new COMET K-project “PSSP” led by RECENDT, photonics based measurement technologies will be key for the optimization of production processes in industry.

Generation of in-line measurement data (by use of non-destructive testing techniques, NDT) and the intelligent real-time utilization of such data will enable smarter processes. In this context, “smart” opens up a wide variety of interpretations: you can think of Industry 4.0, but also of being smart when saving resources; sometimes it is the closed-loop-control which makes smart process possible, enabling production of a new and improved generation of goods; and definitely it’s smart to embed automatic measurement and control tasks in the processes to have personnel resources available to use their smart brains on how to further optimize production processes and products.

The Researchers in the K-Project are from RECENDT, FH OÖ (Wels), JKU Linz (Institutes IAP and IME) and SCCH. Together with staff from 11 Company Partners from Austria, Germany and USA they will strive to develop new and improve existing technologies for such photonic sensing approaches.



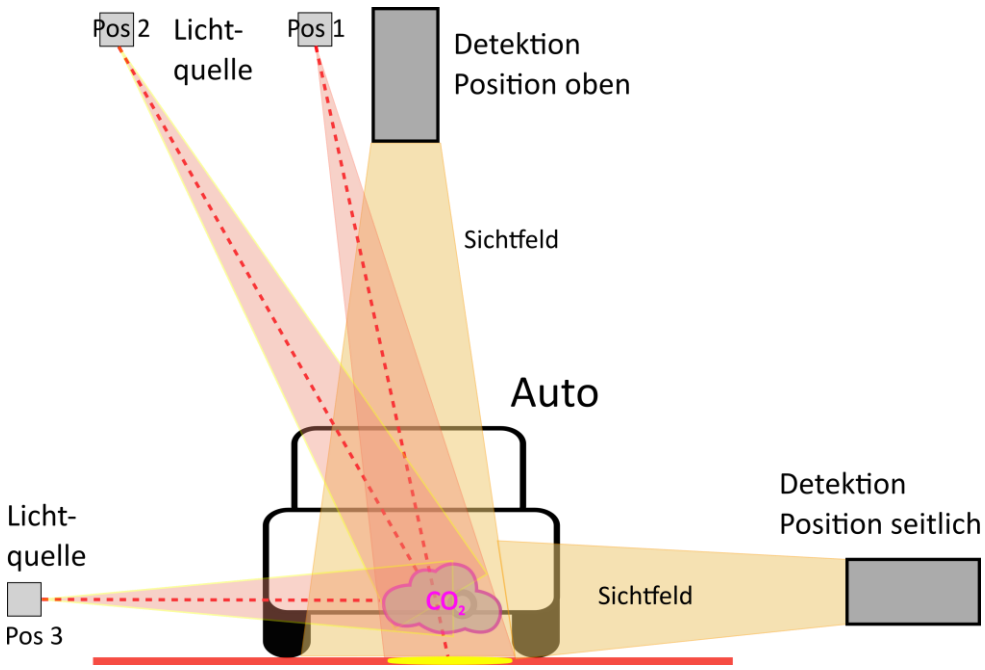
The project with a budget of nearly 6 Million EUR will run for four years.

OnRoadCo2:

Lord Kelvin once noted „If you cannot measure it, you cannot improve it“.

So, in order to reduce CO_2-Emission from traffic, first a CO_2 sensor capable of measuring the CO_2 emission of cars in real-time is necessary. This will enable to identify cars emitting non-tolerable emissions in reality.

The project will develop such a sensor, based on a novel spectroscopic measurement set-up. The benefit of such a configuration is that this sensor can be used to detect other gases, like NOx as well.



FLOIM – Flexible Optical Injection Moulding of optoelectronic devices

The aim of FLOIM is the development of an automated process for the production of optoelectronic components, which is based on overmoulding of plastics with optical quality. Freeform and microstructured optical surfaces are created directly on the components by microreplication using microstructured inserts. The goal of this technology is to simplify assembly and to produce integrated optoelectronics with decimated costs, higher productivity and improved device performance.

The task of RECENDT in this European Project (H2020-NMBP-TR-IND-2018, 42 months) led by AIMEN is the inspection and quality assurance. For this purpose, two specially adapted OCT systems (one of them is designed for inline measurements in injection molding) will be developed. Moreover, RECENDT is Work Package Leader for "Sensors, Inspection and Machine Intelligence".

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Contribution of TEMAS AG

TEMAS Safe-by-Design Implementation Platform The realisation of Safe-by-Design

Currently the uncertainties surrounding the environmental, health and safety risks of manufactured nanomaterials threaten their great potential to contribute to innovation and economic growth. Within the European Union only the regulation of nanomaterials and nano-enabled products is constantly being reviewed, with the REACH regulation taking the lead on nanomaterials. On this front, an amendment to REACH annexes was voted by Member States on April 2018, providing clarity on the characteristics of the nanomaterials, and addressing the knowledge gaps on substances on the market. ECHA is evaluating any change necessary in REACH guidance documents to address the new annexes version. This effort will be supported by work done since 2017 by reference organisations such as the OECD and CEN as well as initiatives spanning from the H2020 program of the European Commission, with the aim to validate and standardize testing methods for nanomaterials. Further work is planned as the so-called Malta project.

Unfortunately, the rate at which regulatory relevant tests and results are published is too slow to keep pace with innovation, and initiatives from the OECD and others are measured in the range of years. Thus, nanomaterial manufactures should keep themselves active in different fora to address safety issues of nanomaterials as chemicals, but also look for the particulars of the applicable regulation regarding their potential use in products (e.g. cosmetics, medical devices, automotive, biocides, foods) as well as regulations regarding processes (occupational health). One further issue is the intermediate materials being produced within a process but never commercialized. The current situation is the natural outcome of a key enabled technology, where different disciplines with their corresponding different regulations are required for Nanotechnology to become a reality.

A possible way out

The Safe by Design concept regarding nanomaterials came into the picture due to increase pressure from industry and regulators to address the above. The main aim of such concept is to provide methods and approaches to anticipate uncertainties and risks as early as possible in any innovation process regarding nanomaterials, so actions can be taken in good time and in a cost-efficient fashion, following both regulatory and voluntary (hard and soft law) requirements.

The Safe by Design Implementation Platform was further developed by TEMAS to materialise the Safe by Design concept into an easy and user-friendly web-based interface (Fig 1). *For further information on how the Platform can help your company please refer to Annex 1.*

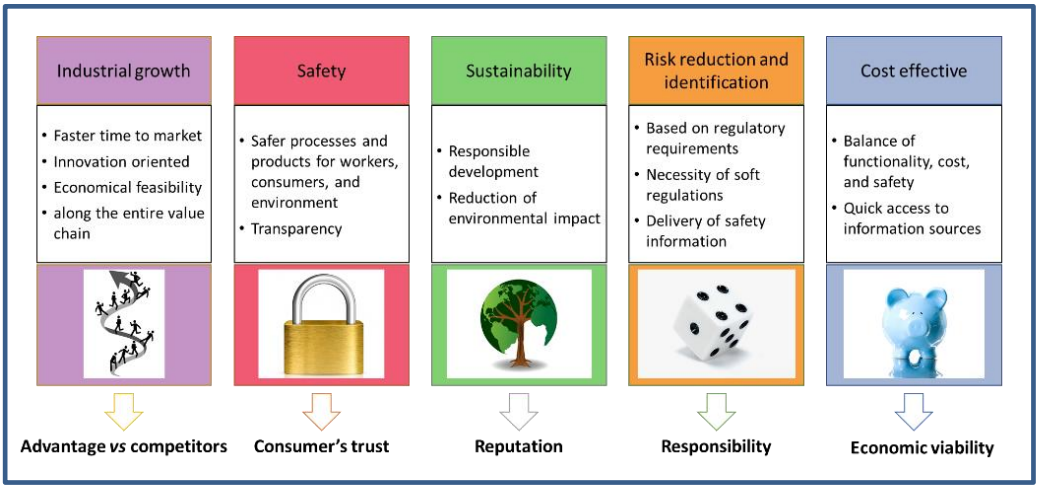

Fig 1. The concept was developed to help industry cover future regulations in a cost-efficient way.

Safe by Design Implementation Platform

The Safe by Design Implementation Platform is a web-based management tool which supports industry working with nanomaterials both in processes and product development. The final aim being that safer products arrive to the market in a cost-efficient manner always taking into account hazard and exposure issues to workers, consumers and environment. The Platform is Regulatory driven and, as such, it is fed by both hard regulation (e.g. REACH, Occupational Health, Cosmetics, Biocides, Pesticides) and soft regulations (e.g. Voluntary Standards, Quality Labels), Life Cycle Assessment (LCA) and Socio-Economic Analysis (SEA) anticipating future requirements so our customers are better prepared for

upcoming regulations in a cost-efficient way. The Platform also benefits from Consultancy Services provided by TEMAS expertise in the areas of Risk Assessment (both qualitative and quantitative tools), (eco)toxicology and testing strategies both at earlier developmental phases (cost efficient strategies) and at later developmental phases (regulatory driven strategies). It is based on a structured project approach so each project is divided into phases and gates. Gates represent key instances where developers will stop and analyse the position of a particular phase regarding safety (Fig 2 and 3). The Platform represents an excellent place for data storing and sharing.

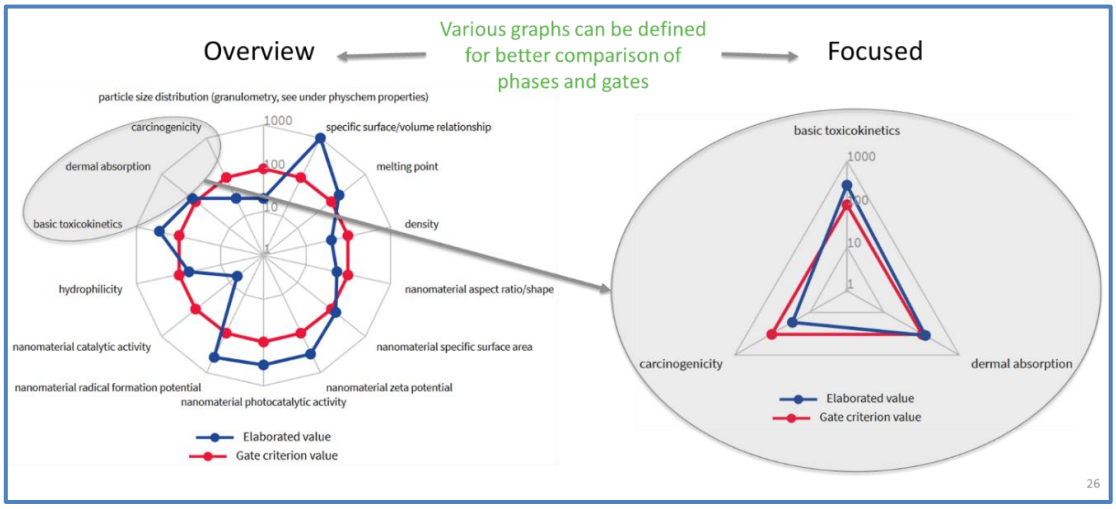

Fig 2. The Platform is fed, where available, with both regulatory accepted toxicological values (gate keepers, red) and experimental values (from case study, blue). The customer can assess at any time the position of their product/process compared to the accepted/regulatory situation.

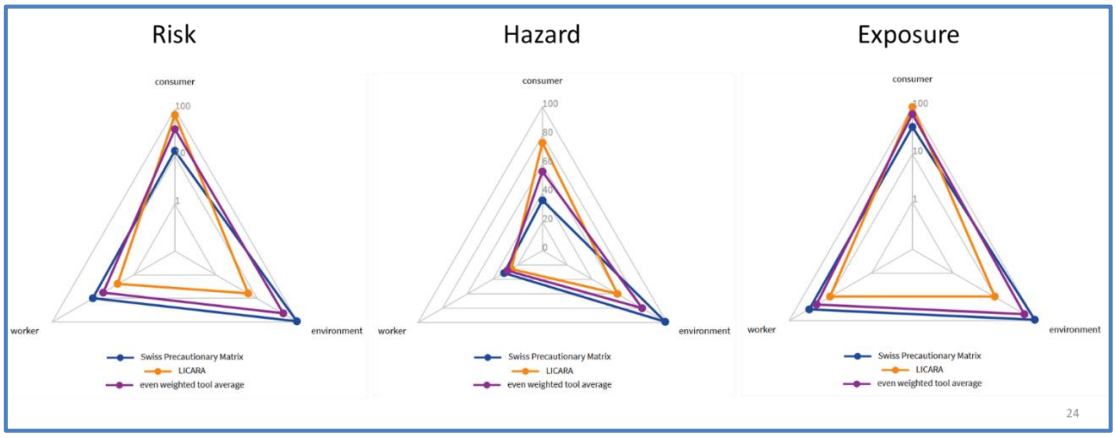

Fig 3. The Platform compares the outcomes of different risk assessment tools so the customer is able to identify risks/uncertainties and measures can be taken in good time.

Example cases where the Safe by Design Implementation Platform can successfully be used (three cases outline below):

Example 1 Regulatory driven:

Identification of the requirements for the REACH regulation for a given nanomaterial X

This case study will deal with a situation where:

1. A company (supplier) manufactures a novel nanomaterial X to be sold to other downstream users.
2. The company is located outside the European Union however the main customers of such nanomaterial X are located within the European Union.
3. The manufacturer needs to comply with the REACH regulation and on-going amendments.

What the Safe by Design Implementation Platform does for you in this case study:

1. Structure the project in an easy to follow path based on:
    a. Both project family and individual project are represented by nanomaterial X.
    b. Individual project phases are represented by the parameter categories under REACH.
2. Identification of all relevant parameters requested by the REACH regulation.
3. Direct link to Standard Operating Procedures (SOPs) where available.
4. Direct link to relevant documentation for experimental waiving if relevant.
5. Final collection of information in the format of a dossier.
6. Output graphs with the nanomaterial X data (toxicological and physico-chemical) compared, where available, to recommended values provided by regulation.
7. Continuous update on the REACH regulation.
8. Consultancy services provided by TEMAS expertise on the REACH regulation.

Example 2 Product driven:

Identification of the best nanomaterial solution for antibacterial textile applications (textiles include complex materials with different textures)

This case study will deal with a complex situation where:

1. Different types of silver are assessed toxicologically as pristine materials (literature review)
2. Different types of silver in suspension are assessed toxicologically as in 1).
3. Different types of silver coating procedures to embed textiles are also toxicologically assessed (spraying, dipping, painting of reduced areas).
4. Properties of the coating on the textile will also be assessed.

In all cases different types of silver are used and decisions are made on each individual step, which may run in parallel or in a stepwise approach. In this project 3 different types of silver are assessed and compromises must be met while selecting only one for further processing. The project will deal with a large amount of both experimental and literature based data, as well as different applicable regulations.

What the Safe by Design Implementation Platform does for you in this case study:

1. Structure the project in an easy-to-follow path based on:
    a. Project family (silver for textiles).
    b. Individual projects (silver nanomaterial1, silver nanomaterial2, silver nanomaterial3)
    c. Individual project Phases (silver nanomaterial1/pristine, silver nanomaterial1/dispersion, silver nanomaterial1/spraying, silver nanomaterial1/dipping).
2. Store locally the data from all the different projects and phases in one platform.
3. Give an exhaustive parameter-based list as required per different applicable regulation.
4. If information on the different regulatory based parameters is available the Platform is able to compare project-based results to those requested from regulation so the customer knows where they stand to the applicable regulation.
    a. Examples include baseline for genotoxicity, cytotoxicity, etc.

5. Provide masks to four main qualitative risk assessment tools (in this particular case we will use the Swiss Precautionary Matrix and LICARA) since consumers, environment and workers should be addressed.
6. Comparison on risk assessment outputs for guidance purposes.
7. Give an exhaustive list of relevant information per parameter including Standard Operating Procedures, methodologies, etc.
8. Produce tailored-made output graphs and dossiers to be share with different interest groups.

Example 3 Process driven:

Selection of one particular carbon nanofibre for upscaling

This case study will deal with a complex situation where:

1. The company has a range of different types of nanofibers and would like to select one for upscaling. The different types of nanofibers are closely related though key phys-chem parameters provide them with different phys-chem charateristics which drive different toxicological and even explosive potential.
2. The company needs to design the upscaling reactor taking into account key parameters required for a safer process.

What the Safe by Design Implementation Platform does for you in this case study:

1. Structure the project in an easy-to-follow path based on:
    a. Project family (carbon nanofibres).
    b. Individual projects (carbon nanofibre1, carbon nanofibre2, carbon nanofibre3).
    c. Individual project Phases (carbon nanofibre1/loading process, carbon nanofibre1/growing process, carbon nanofibre1/collection process).
2. Store locally the data from all the different projects and phases in one platform.
3. Give an exhaustive parameter based list as required per different applicable regulation (in this case Occupational, REACH and others).
4. If information on the different regulatory based parameters is available the Platform is able to compare project-based results to those requested from regulation so the customer knows where they stand to the applicable regulation.
    a. Examples include baseline for genotoxicity, cytotoxicity, etc.
5. Assist in the identification of hotspots at production sites regarding safety.
6. Provide masks to four main qualitative risk assessment tools (in this particular case we will use the Swiss Precautionary Matrix and LICARA) since consumers, environment and workers should be addressed.
7. Comparison on risk assessment outputs for guidance purposes.
8. Give an exhaustive list of relevant information per parameter including Standard Operating Procedures, methodologies, etc.
9. Produce tailored-made output graphs and dossiers to be shared with different interest groups.

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Contribution of ZFE Graz, Austria

RISE, Raman Imaging and Scanning Electron Microscopy plus EDXS: A new system @ FELMI-ZFE Graz

The Institute of Electron Microscopy and Nanoanalysis of Graz University of Technology and the Graz Center for Electron Microscopy, abbreviated FELMI-ZFE, have a broad experience concerning different microscopic and analytic methods. The FELMI-ZFE is pioneering in different fields in order to be a modern partner for science and industry. As a new method, the system RISE (Raman Imaging and Scanning Electron microscopy) was recently established.

This system offers the possibility of high resolution imaging by the scanning electron microscope Zeiss Sigma 300 VP and chemical analysis with the attached Raman microscope from WITec. Together with a modern detector for energy dispersive x ray spectroscopy (EDXS), this setup is unique in the world delivering high resolution imaging together with precise elemental and chemical analysis.

The newest scanning electron microscope (SEM) at the FELMI-ZFE is the Zeiss Sigma 300 VP (Oberkochen, Germany). It offers high resolution for both secondary electrons (SE) to image surface topography and backscattered electrons (BSE) to present compositional information (material contrast) in the high vacuum mode. Additionally, it facilitates a variable pressure (VP) mode for imaging electrically nonconductive specimens without additional coating by using nitrogen as imaging gas at pressures between 10 and 133 Pa. This is a requirement for further investigations with the Raman microscope from WITec (Ulm, Germany).

The Raman investigation is achieved by consecutive measurements with the specimen stage moving (semi automatically) between the SEM and the Raman measurement position in the specimen chamber. Thus, chemical mapping (Raman) can be combined with high resolution SEM images. Since Raman spectroscopy can identify different organic materials

[1] and can provide information about chemical bonds (especially H-bonds), it is an excellent complementary technique to the traditional combination of SEM and EDXS. Fig.1 shows the electron microscope with the attached Raman microscope (left) and the EDXS detector (right).

The modern silicon drift detector from Oxford (UK) is a fast EDXS detector which enables spectra and mappings in a shorter time. As a special mode the controlling software Aztec enables Large Area Mapping (LAM), where large regions of interest can be imaged (SEM) and analysed (EDXS) by an automatic routine. Furthermore, via Aztec automated particle analysis for faster investigations with enhanced statistics is possible.

The setup of the electron microscope and the Raman microscope was enabled by the project “HRSM-Projekt ELMINet Graz” (cooperation of KFU, MedUni und TUG), which was financed by the Austrian Federal Ministry of Education, Science and Research. The combination with the EDXS detector could be realised by the project “Innovative Materialcharakterisierung” (SP2016-002-006), which is part of “ACR Strategisches Projektprogramm 2016” of the Austrian Cooperative Research (ACR) [2], where a support by the ministry Austrian Federal Ministry for Digital and Economic Affairs is to be mentioned. A vital signal of Austrian cooperative research.

Up to now FELMI-ZFE was applying the new method in the field of materials science [3]. Fig. 1 shows a large area imaging (SEM mode) of a paper specimen and EDXS maps of the elements calcium, carbon and oxygen which can also be applied over a large area. Figure 2 shows an SEM image of a polymer system with an integrated Raman mapping: PET (red), PMMA (blue), PS (green), resin (turquoise)

Besides materials science FELMI-ZFE is definitely interested in cooperation with institutions of life sciences.

Fig. 1: The scanning electron microsope Zeiss Sigma 300 VP, with the Raman microscope from WITec (left) and the EDXS detector from Oxford (right).

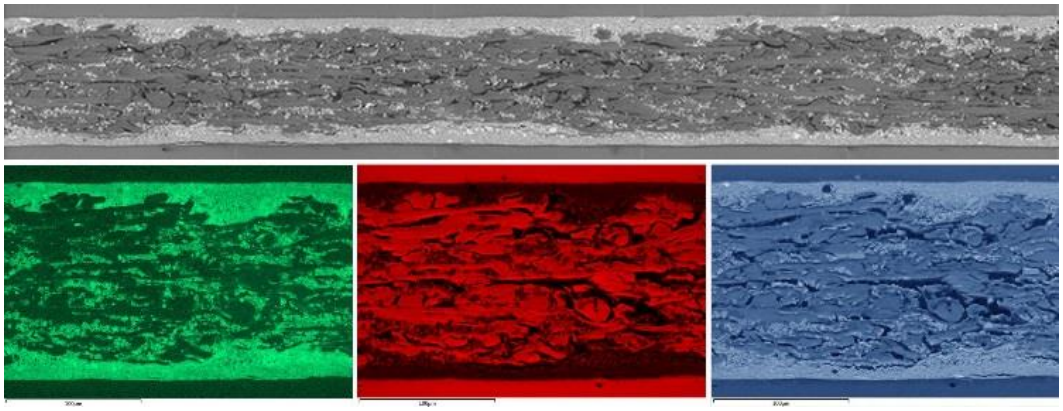

Fig. 2: Large Area Mapping (LAM): SEM image of a large region of interest on a paper specimen (length 1.2 mm, automatic stitching of five different images). EDXS mappings concerning the elements calcium (green), carbon (red) and oxygen (blue).

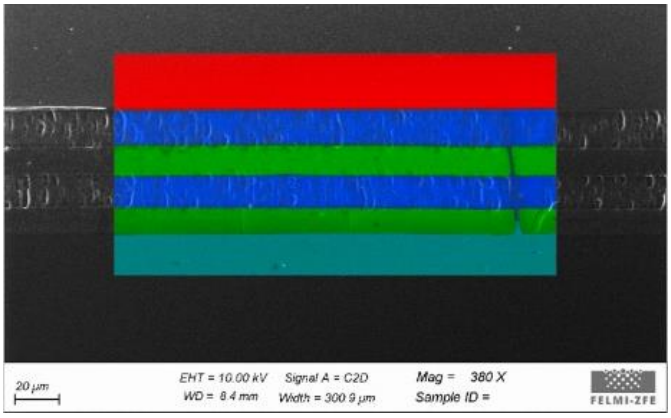

Fig. 2: SEM image of a polymer system with Raman mapping: PET (red), PMMA (blue), PS (green), resin (turquoise).

Further reading and Links:

[1] Thomas Dieing, T., Olaf Hollricher, O., Toporski, J., (2011) Confocal Raman Microscopy, Springer Series in Optical Sciences, volume 158.

[2] ACR: https://www.acr.ac.at/

[3] Fitzek, H., Mayrhofer, C., Nachtnebel, M., Schmidt, R., Zankel, A.: Recent developments in correlative SEM-Raman confocal microscopy, examples of application and perspective, invited talk at HSM 2018 - Annual Meeting of the Hungarian Society for Microscopy, Siofok, Lake Blaton – Hungary (2018)

Did you already know?
On the homepage of FELMI-ZFE (www.felmi-zfe.at) find a link to a film about the new electron microscope.

Please find more information:
https://www.youtube.com/watch?v=a7QPXjmmeJw

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BioNanoNet *retrospect*

11th European and Global Summit for Clinical Nanomedicine, Targeted Delivery and Precision Medicine – The Building Blocks to Personalized Medicine

2 – 5 September 2018, Basel, Switzerland

CLINAM
European Foundation for Clinical Nanomedicine
BASEL, SWITZERLAND

II/2018
September 2–5

SMART4FABRY

BIO RIMA
BIOmaterial RIsk MAnagement

Every year, the CLINAM summit brings together all stakeholders in nanomedicine, targeted medicine and precision medicine. It builds on the principle that fundamental scientists, developers and professionals in clinical application can mutually learn from each other to find better solutions for medical approaches of the future.

The 11th CLINAM conference took place from 2 – 5 September 2018 in Basel, Switzerland, and welcomed participants from the community of nanomedicine, including worldwide opinion leaders, not only to learn and discuss, but also to develop new ideas, create new collaborative projects and shape the future of medicine.

The summit and the exhibition were aimed at physicians as well as all interested people with a background in pharmacology, biology, physics, chemistry, biophysics, medicine, materials science and engineering. The conference was also of interest for members of the regulatory authorities as well as policymakers, experts from industry in the field of life sciences, developers of new tools and materials for nanomedicine, and all investigators of emerging technologies in the field of healthcare. High-level presentations given by international renowned scientists, including Nobel Laureates, highlighted latest research results and future trends in nanomedical applications.

BioNanoNet participated and supported the conference in presenting the BioNanoNet Association's expertise at the Austrian University Village Table, giving a small speech on "Considering nanosafety in nanomedical applications – potential shortcomings and bene-

fits", and contributing a scientific poster presentation addressing "Nanomedical Technologies and Applications – Showcases in Imaging/Diagnostics, Therapeutics and Regenerative Medicine".

More information including the whole programme can be found on https://www.clinam.org.

Impressions of CLINAM Conference 2018 (© BioNanoNet).

The projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760928 and No 720942.

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Horizon2020 funded e-infrastructure project – NanoCommons – participated in the 4th International Conference on Research Infrastructure

12 – 14 September 2018, Vienna, Austria

As part of the Austrian EU Presidency, the 4th International Conference on Research Infrastructure (ICRI 2018) was held in Vienna, bringing together coordinators of EU-funded research infrastructure projects and their international counterparts from more than 50 countries to provide a forum for strategic discussion on international cooperation for research infrastructures at the global level, including highlighting the essential role of research infrastructures (RIs) in addressing global challenges and contributing to Sustainable Development Goals and discussing existing and emerging challenges faced by RI stakeholders and investigating policy options and possible steps forward.

Left: ICRI2018 took place at HOFBURG Vienna, the historical complex of the former imperial residence. Right: the NanoCommons roll-up as part of the exhibition of research infrastructures in Europe and worldwide.

Participation in ICRI2018 was invitation only, Prof. Iseult Lynch coordinator of NanoCommons (The European Nanotechnology Community Informatics Platform: Bridging data and disciplinary gaps for industry and regulators) attended the event on behalf of the project. The goal of NanoCommons is to develop community guidance and best practice to support EU nanosafety projects and to ensure that nanosafety data, old and new, is accessible to scientists for development of computational hazard and risk assessment models, for industry to support product development and safe-by-design approaches, and for regulators (via the European Observatory for Nanomaterials) for science-based decision making. From early 2019, funded access to the NanoCommons nanoinformatics services will be available via 6-monthly calls for Transnational Access.

Key issues considered at the IRCI2018 conference and during the parallel breakout sessions were enhancing societal value, overcoming inequality and enhancing diversity, human resources and data. As an e-infrastructure, NanoCommons was especially interested in the data topic, and as such participated mainly in this breakout session. *Provenance and persistence* of data was a recurring theme. Here issues such as implementation of persistent IDs (PIDs) for people, papers, instruments, materials and datasets as well as for papers as is currently in place. Another recurring theme was *culture and credit* – how to change the culture around data management and address the needs of different stakeholders and how to credit individual efforts. The latter is also a priority topic for NanoCommons which is investigating approaches such as development of a certification as a nanosafetey data curator for your researchers, as well as awards or prizes for nanosafety projects / partners making their data Open and FAIR (Findable, Accessible, Interoperable and Reusable). Finally, effective evaluation of what has been achieved was discussed and the potential for data-driven research funding, however, if algorithm-based evaluation there is the risk of gaming the system, so this was not recommended. Overall, it was a very productive 3 days, with lots of new contacts made, lots of ideas born and confirmation that we are on the right track within NanoCommons in terms of addressing important societal and researcher needs.

The project coordinator is Prof. Iseult Lynch from the University of Birmingham (United Kingdom). Further information about the NanoCommons project, updates on developments, and the role of BioNanoNet can be found here.

For more information about the NanoCommons project please take a look at the official project webpage www.nanocommons.eu.

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731032.

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BioNanoNet Focus on Nanomedicine and Nanosafety – "Bio-Nano-Interactions: Medical Breakthrough & Safety Aspects"

12 September 2018, JOANNEUM RESEARCH HEALTH, Graz, Austria

On 12 September 2018, BioNanoNet organised a scientific event in the course of the H2020 MSCA-RISE project NANOGENTOOLS, bridging the key topics nanomedicine and nanosafety: "Bio-Nano-Interaction: Medical Breakthrough and Safety Aspects". The event was hosted by JOANNEUM RESEARCH – HEALTH and provided scientific sessions with key note lectures from Austrian and international experts. Five highly interesting presentations showcased latest results, achievements and future trends in nanomedicine, nanotoxicology and nanosafety research:

- *"In Vitro Toxicity Testing of Nanoparticles in Physiologically Relevant Conditions"* Eleonore Fröhlich (Medical University of Graz, AT)
- *"Biotransformation Patterns of Nanoparticles In Vivo"*
  Ivana Vinković Vrček (Institute for Medical Research and Occupational Health, HR)
- *"NANOGENTOOLS: Nanosafety Assessment at the Molecular Level"*
  Juan Antonio Tamayo Ramos (University of Burgos – ICCRAM, ES)
- *"An Integrative Biology Approach to Nanomaterial Effect Assessment in the Environment: A Case Study in Marine Molluscs"*
  Francesco Dondero (Università del Piemonte Orientale, IT)
- *"Nanoparticles Crossing Barriers – And How to Monitor Them"*
  Thomas Birngruber (JOANNEUM RESEARCH – HEALTH, AT)

After the presentations, lab visits of JOANNEUM RESEARCH – HEALTH and the Center for Medical Research at the Medical University of Graz were provided.
This event built a great chance to further share and exchange knowledge, expertise and experiences among the 20 participants.

Impressions of the event at JOANNEUM RESEARCH – HEALTH (© BioNanoNet).

The projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 760928, No 720942 and No 691095.

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BioNanoNet Strategy Workshop and Networking

13 September 2018, Graz, Austria

On September 13th, 2018 the BioNanoNet Strategy Workshop and Networking Event took place at the University of Graz, attracting more than 40 international participants from BioNanoNet community as well as from NANOGENTOOLS project. During the morning session in the strategy development Workshop, the roadmap for the next 12 months was discussed, structured along the three focus groups (i) Nanotoxicology, (ii) Sensortechnologies, and (iii) Health-Safety-Medicine.

After a short introduction about the University of Graz by **vicerector Dr. Peter Riedler**, the afternoon session was scientifically started with three keynote lectures from the host organizations scientific experts: **Assoc. Prof. Dr. Eva Roblegg** (*Impact of biological barriers on the fate of nanoparticles: Translation into drug delivery strategies*), **Ao. Univ.-Prof. Dr. Joachim R. Krenn** (*Nano-Optics @ University of Graz*) and **Univ.-Prof. Dr. Adrian Daniel Boese** (*Theoretical and Computational Chemistry*) highlighted the strength in science and research. The lectures were followed by 14 presentations of BioNanoNet members and NANOGENTOOLS consortium members, initiating the workshop and networking interaction to discuss collaboration potential, innovative research ideas, and multidisciplinary expertise along the entire value chain.

Supported by the presented competences, the networking part of the event enabled establishing new contacts for future cooperation and discussing the involvement in the national technology platforms NanoMedicine Austria and SusChem-AT. The activities of the Austrian Microfluidics Initiative (save the date: 28 February 2019 – 1st Austrian Microfluidics Initiative scientific conference, Vienna) and furthermore, kick-starting the writing process for the new initiative “Nutrition & Health” can also be highlighted. The continuous growth of the network enables expanding the thematic horizon of BioNanoNet to the benefit of our members and thus supporting research and development activities in different branches.

From the left: Assoc. Ao. Univ.-Prof. Dr. Joachim R. Krenn (University of Graz), Mag.ª Gabriele Katz (BioNanoNet), vicerector Dr. Peter Riedler (University of Graz), Prof. Dr. Eva Roblegg (University of Graz), Dr. Erwin Kubista (JOANNEUM RESEARCH), Univ.-Prof. Dr. Adrian Daniel Boese (University of Graz) and Andreas Falk, MSc. (BioNanoNet) (© BioNanoNet).

Participants of the BioNanoNet Strategy Workshop and Networking Event (© BioNanoNet).

These projects hae received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691095 and No 731032.

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BioNanoNet Focus on Sensortechnology

14 September 2018, Graz, Austria

With the kind support of **Human.technology Styria GmbH, BioNanoNet** and **Graz Technical University** organised the focus group event "**BioNanoNet Focus on Sensortechnology**" on 14th of September 2018 at the Institute of Analytical Chemistry and Food Chemistry, Graz University of Technology. The scientific session with key note lectures demonstrated the strength of the Austrian Sensortechnology community to the international guests from the H2020 Marie Sklodowska Curie project **NANOGENTOOLS** and several Styrian companies. After the session, an overall of 30 participants had the chance of visiting the sensor lab at the institute as well as of networking with the sensor experts.

The event was officially opened by **Dr. Torsten Mayr** (Graz University of Technology), **Andreas Falk, MSc** (CEO BioNanoNet) and Nikolaus Ladenhauf, MA (BioNanoNet).

Dr. Jan Hesse from JOANNEUM RESEARCH, Institute for Surface Technologies and Photonics started the scientific session with his key note lecture on "*Roll-to-Roll Technology for the Production of Microfluidic Systems*".

Dr. Peter Ertl from the Technische Universität Wien presented "*Implanted Biosensors*", "*Smart Implants*" and "*Self-Powered Sensing Solutions*" as examples of his wide field of research towards *Embedded Electrical Microsensors*.

Dr. Anton Köck from the Materials Center of Leoben introduced *Multifunctional Nanoparticles* as the *Key for Optimizing Chemical Nanosensors*.

Dr. Martin Hajnsek from JOANNEUM RESEARCH, Institute for Biomedicine and Health Sciences pictured the future of sensors "*Moving towards Health Home Monitoring and Patient Empowerment*".

Dipl.-Ing. Robert Holzer presented the approach of RECENDT – Research Center for Non-Destructive Testing regarding "*Sensor Technology Beyond Mainstream – from Nano to Meters*".

Dr. Vedran Sabol from the Research Center for Data-Driven Business & Big Data Analytics (Know Center) held his key note focusing on "*Visualization and Interactive Analysis of Sensor Data*". To conclude the series of talks, **Dr. Torsten Mayr** from Graz University of Technology gave insights in the world of "*Optical Chemical Sensors – Useful Tools for Manifold Applications*". Thank you especially to **Dr. Torsten Mayr** from Graz University of Technology for being a great host!

Impressions from the event:

From left to right: Vedran Sabol, Anton Köck, Torsten Mayr, Jan Hesse, Martin Hajnsek, Robert Holzer, Peter Ertl (© BioNanoNet).

Dipl.-Ing. Robert Holzer from RECENDT – Research Center for Non-Destructive Testing talking to the audience (© BioNanoNet).

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691095.

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Conference Calendar

BioNanoNet events

Save the date for the following events:

Austrian Microfluidics Initiative 1st Scientific Meeting

When? 28 February 2019

Where? Vienna, Austria

BioNanoNet Annual Forum 2019

When? 10 September 2019

Where? Salzburg, Austria

BioNanoNet on site events

SpotLight on Automatisierungstechnik + Kick Off CFG "Advanced Manufacturing" in Kooperation mit der AT Styria Plattform Automatisierungstechnik

When? 3 October 2018, 13:00 – 17:00

Where? Graz, Austria

For more information please visit the event website.

OpenTox Euro 2018

When? 9 – 11 October, 2018

Where? Athens, Greece

For more information please visit the event website.

Open Campus: Intel - How we think "Artificial Intelligence"

When? 16 October, 2018, 11:00 – 12:00

Where? Graz, Austria

For more information please visit the event website.

4th International Congress on Occupational & Environmental Toxicology (ICOETOX)

When? 24 – 26 October, 2018

Where? Matosinhos - Porto, Portugal

For more information please visit the event website.

2nd EU-Asia Dialogue on Nanosafety

When? 29 October, 2018

Where? Vienna, Austria

For more information please visit the event website.

Industrial Technologies Conference 2018

When? 30 – 31 October, 2018

Where? Vienna, Austria

For more information please visit the event website.

NanoSafe

When? 5 – 9 November, 2018

Where? Grenoble, France

For more information please visit the event website.

Workshop on SAFETY ASPECTS IN PILOT LINES an EPPN-NSC i2L joint session

When? 7 November, 2018

Where? Grenoble, France

For more information please visit the event website.

For all events visit our BioNanonet website!

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Finally

We hope you enjoyed our BioNanoNet newsletter!

Please do not hesitate to contact us if you would like to give us any suggestions or feedback!

Our next BioNanoNet newsletter will be published in December 2018.
BioNanoNet partners are welcome to send their contributions until 7th of December 2018!

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Your BioNanoNet team

from the left …

Christa Schimpel (scientist), Beatriz Alfaro Serrano (scientist), Susanne Resch (scientist), Andreas Falk (CEO), Gabriele Katz (CEO), Christine Halbedel (office), Angelika Halbedl-Herrich (office), Simone Jagersbacher (public relations & marketing) and Nikolaus Ladenhauf (project manager)

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