BIO NANONET

NEWSLETTER

02/2016

June 2016

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Editorial -
Contemporary issues from the network

Dear Readers,

2016 is a special year for BioNanoNet. On the one hand, we can look back on ten years of successful work and the milestones we could reach within this time period. This will be done in a short wrap-up “10 successful years of BioNanoNet” during our annual event in September. On the other hand, we can summarise our work by citing Konfuzius (551-479 b.C.) who said: “It does not matter how slowly you go, as long as you do not stop.” and taking this as maxim for our future work. Most of you are already collaborating with us and in the frame of BioNanoNet since its start in 2006. Along this way, some of the great ideas created from you could be converted in success stories, others are still under development. However, one of the big strengths of our network is that we continue to move, accepting “barriers” as new challenges and work even harder to achieve the set goals.

Hence, the process of defining goals, objectives or strategic activities is the most important part to be done each year. We try to improve this process steadily, therefore, we will do our strategy workshop on September 15th in Laßnitzhöhe (please register via this link) in a new format: the morning session will include a short presentation about the news and planned activities in the three focus areas, followed by YOUR presentations of expertise. After digesting this information during lunch, we will have an interactive afternoon-session during which all participants will be able to identify collaboration potentials with each other, discuss on setting up new focus areas, etc. We will assist in this process by adding knowledge about upcoming calls, trends in European research funding, strategies of technology platforms and of course, how YOU can benefit from all this. (Please find our final programme on page 6 in this newsletter.)

We are very much looking forward to seeing you and talking to you personally on September 15th in Laßnitzhöhe.

Sincerely,

BioNanoNet-team

BioNanoNet *news*

BioNanoNet welcomes its new members

Silver members:

- Research Center for Non-Destructive Testing GmbH (RECENDT)

- FH JOANNEUM – University of Applied Sciences (Graz)

Standard members:

- Department for Health Sciences and Biomedicine, Faculty of Health and Medicine, Danube University Krems

Save the date:

BioNanoNet Strategy Workshop
BioNanoNet General Board Meeting
10 years Anniversary

The BioNanoNet Strategy Workshop, the Meeting of the Advisory Board and our 10th BioNanoNet anniversary will take place on Thursday, 15th of September 2016 in Hotel Liebmann, Laßnitzhöhe (www.hotel-liebmann.at).

This year's event is focused on the "multidisciplinary cooperation in research" and provides the opportunity to substantially exchange ideas in the focus groups sensor technology, nanotoxicology and health, safety and nano-(medicine). A stakeholder meeting of the national technology platforms „NanoMedicine-Austria“ and „SusChem Austria“ will also take place during this event. Meeting language is German.

The BioNanoNet team is grateful to announce that this event is **supported by the Federal Ministry of Health**. We are looking forward to your participation!

Board and lodging will be provided by the host. Due to limited capacity, we ask for early and binding registration!

Please register for the strategy meeting, general meeting and 10 years anniversary via our Registration tool!

Please take a look at our final programme on the next page:


BIO NANONET
Strategieworkshop 2016
„Multidisziplinäre Kooperation in der Forschung:
Nanotoxikologie, Sensortechnologie, Gesundheit-Sicherheit-Medizin“
15. September 2016
Hotel Liebmann, Laßnitzhöhe
(www.hotel-liebmann.at)
AGENDA
9:30 – 10:00 Eintreffen der Teilnehmer/innen und Registrierung
10:00 – 10:30
Aktivitäten und Ziele in den Fokusgruppen
Fokusgruppe Sensortechnologie
Fokusgruppe Nanotoxikologie
Fokusgruppe Gesundheit–Sicherheit-Medizin
10:30 – 12:00
Innovative Forschungsthemen- und expertisen
Stakeholdermeeting nationaler Technologieplattformen, die von BioNanoNet koordiniert werden: NanoMedicine-Austria und SusChem Austria
12:00 – 13:30 Mittagessen
13:30 – 16:00
Networking
16:00 – 16:15
Zusammenfassung des Tages und Ausblick
16:30 – 17:30
Mitgliederversammlung Verein BioNanoNet
17:45 – 19:30
Rückblick auf 10 erfolgreiche Jahre und Abenddiskussion
mit kulinarischem Ausklang
supported by

BioNanoNet offers Nano@School Workshops

We are pleased to inform you that the BioNanoNet offers workshops about nanotechnology for schools.

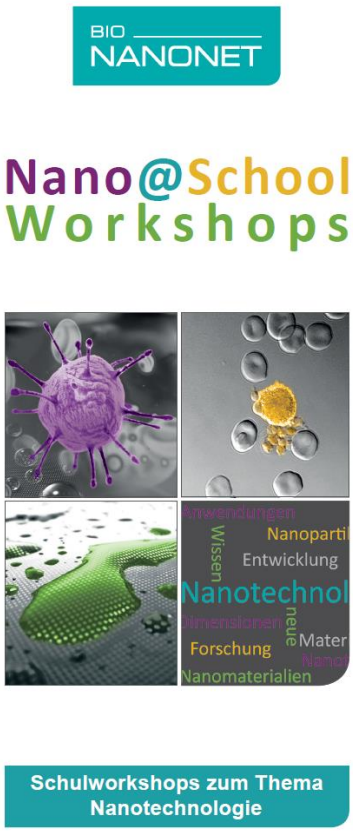
The so called Nano@School Workshop has the aim to familiarize children as well as teachers about “nano” in general and to provide them with information about nanotechnology related issues.

The Nano@School Workshop folder shall give you an overview about the different activities on nanotechnology for kids and teachers.

If you would like to get more information about Nano@School Workshops please do not hesitate to contact us.

We would appreciate if you could distribute our folder to interested parties.

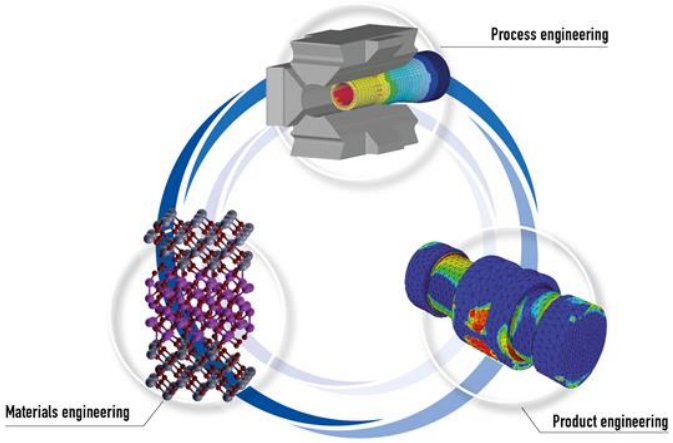
Click on the picture to download the flyer:



BioNanoNet *member presentation*

MATERIALS CENTER LEOBEN GMBH

…the Center for Materials Engineering, Process Engineering & Product Engineering



CORPORATE PROFILE

Materials Center Leoben Forschung GmbH (MCL) is an international research company working in the field of materials research and technology. We are specialised partners for industry, providing the foundations for the innovations which will secure the future of individual companies in the global marketplace. MCL specialises in materials, their manufacture and processing, as well as innovative material applications.

MCL research focuses on the following areas:

- **STEEL – Extending diversity**

Developing, processing, innovating and optimizing the design, weight and safe use of steel and other metallic materials

- **TOOLS – Processing beyond limits**

Developing tool materials, and researching tool design and service life

- **MICROELECTRONICS – Opening up new dimensions**

Researching materials and composites to increase the reliability of electronic components, as well as new sensor materials and systems

- **SERVICES – Comprehensive solutions to urgent problems**
  Materials analysis at all length scales, as well as material mechanics and simulations of manufacturing processes, design and reliability

As the operating company of the COMET K2 Competence Center “MPPE – Integrated Research in Materials, Processing and Product Engineering”, MCL is the ideal partner when it comes to demanding and complex, interdisciplinary research and development tasks. Within the framework of cooperative research and development projects, more than 140 highly qualified employees work together with over 140 industrial and scientific partners on fundamental and innovative developments along the entire value chain, from materials synthesis and processing through to in-service behaviour.

MCL’s core service offerings include characterising materials and components with respect to their structure and microstructure, determining the mechanical and physical properties of materials, developing material models for simulations as well as advanced simulation models, damage analysis, and advice on the choice of materials. MCL’s key advantage lies in its combination of experimental laboratory analysis with calculations and simulations, state-of-the-art technical facilities, and wide-ranging specialist knowledge of the most diverse range of materials. MCL has the expertise and experience required to provide scientifically sound results and targeted support in practical material and product development. Current research topics on experimental characterisation and numerical simulations of materials range from the nano-scale up to the scale of large products such as railway tracks and gas pipelines.

EXPERTISE AND KNOW-HOW IN THE SERVICE OF RESEARCH AND DEVELOPMENT

The technical facilities, together with our theoretical and practical expertise, make MCL a flexible professional partner for research and development in the fields of materials engineering, process technology, quality assurance and component design. MCL offers a variety of laboratory analyses and complex services such as damage analysis or materials advice, product engineering, in addition to materials, components and process simulations.

Product engineering of sensors for the consumer-market

Development of miniaturised sensor-systems

Nano technology based sensors that are integrated on CMOS based electronics devices offer new possibilities in gas sensing for consumer applications. To this end metal oxide nanowires are functionalized in order to become more sensitive to various gases.

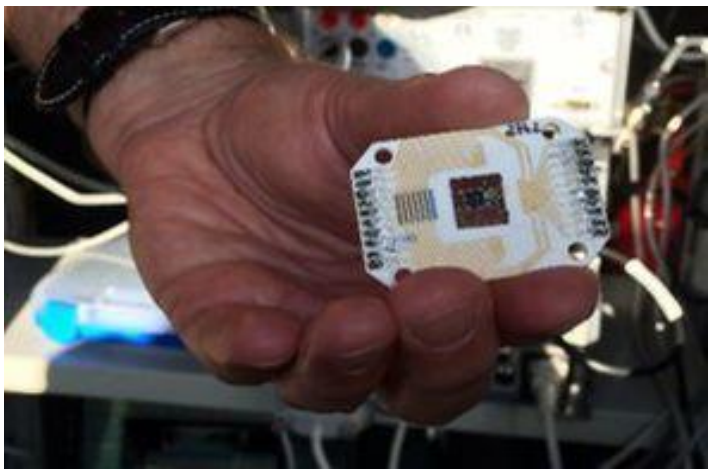
Together with company partners an innovative process chain is developed to apply nanowires and nanoparticles on CMOS-wafers to transpose the distinguished properties of nano-components in gas-sensor-technology, concerning both technical and economic aspects.

High-sensitive sensors by use of nanowires

Within the scope of international projects MCL is working with its partners to develop new sensor systems and production technologies, which should enable a flexible „Plug-and-play“ 3D-integration of nanosensors and nanotechnological components on CMOS-chips, to produce high-sensitive sensors, which are equally capable for bulk production.

Environmental monitoring

Sensors for environmental monitoring, in order to alert people from the existence of hazardous gases such as ozone, carbon monoxide or from high fine dust contents in the air will be widely used in future.



MCL test sensors in use for environmental sensing © MCL

Physical-chemical analysis

The physical / chemical laboratory of the Materials Center Leoben offers both standard methods – such as determination of retained austenite and residual stress measurement – and highly specialized methods for innovative solutions in materials research and process development.

XR CT- Image of an USB-Stick © MCL

The physical / chemical laboratory specialises in the characterisation of materials in terms of the following properties:

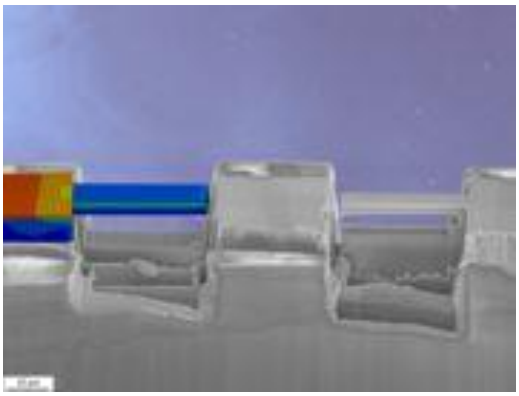
- Crystallographic structure
- Phase composition
- Residual stress
- Surface topography
- Chemical composition

Technical equipment of the Physical/Chemical Laboratory:

- Various X-ray diffractometers (laboratory and mobile goniometers)
- High-resolution glow discharge spectrometer
- Differential scanning calorimeter including mass spectrometer
- Quenching dilatometer including low-temperature unit
- High-resolution CT scanner
- Acoustic microscope

Electron microscopy

The range of services extends from fast standard analyses to sophisticated high-resolution examinations using the latest technologies available in the field of cross-beam scanning electron microscopy.



Fabricated by FIB bending beam for determination of residual stresses in layers. In addition, the calculated stress field is represented by FE. © MCL

The electron microscopy laboratory specialises in:

- SEM characterisation of surfaces, fracture surfaces and metallographic specimens
- Materials analysis including 3D microstructure tomography using SEM-FIB technology
- Target preparation of TEM thin films or atom probe specimens for subsequent high-resolution analysis
- Damage characterisation

Technical equipment of the Electron Microscopy Laboratory:

- High-resolution dual-beam scanning electron microscope (SEM-FIB)
- Scanning electron microscope with large specimen chamber for component analysis
- Scanning probe microscope (SPM), which can also be integrated into the SEM-FIB for in-situ-analysis

Mechanical tests

The mechanical testing laboratory specialises in the static and cyclic testing of various metallic materials, metal / ceramic composites, cemented carbides etc. with special focus on:

- Determination of mechanical material parameters (e.g.hardness, yield stress, strength, ductility)
- Determination of cyclic material parameters (e.g. S-N curve, fatigue strength)
- Determination of material data for FE simulation (e.g. constitutive laws)

The range of services extends from tests in accordance with international standards to tests on high-strength brittle materials. If required, new testing methods are developed, which are offered as a service or within the framework of research projects.

Technical equipment of the Mechanical Testing Laboratory:

- Universal testing machines with extensive accessories
- Servohydraulic testing machines with various heating and cooling units, including a vacuum chamber
- Electrodynamic (resonant) testing machines
- Various strain measurement sensors and crack measurement devices (potential probes)

Metallography

The metallography laboratory specialises in the analysis of various metallic materials, metal / ceramic composites, cemented carbides and special materials with focus on:

- Metallographic preparation and characterisation of components
- Classical and instrumented hardness testing including hardness mapping
- Analysis of surface structures and topographies
- Fracture surface analysis
- Damage analysis

The services offered by the metallography laboratory include fast preparation and characterisation of different materials and components including presentation and interpretation of the results.

Technical equipment of the Metallography Laboratory:

- Equipment for metallographic preparation of metallic materials and composites
- Optical and stereo microscopes including a quantitative image analysis system
- Confocal microscope for profilometry measurements
- Micro, small load and macro hardness testers (partially instrumented)
- Nano-indenter with integrated heating unit up to 500°C

Modelling and Simulation

The simulation team at MCL combines comprehensive expertise in high-quality modelling and simulation with longstanding experience in material behaviour and damage analysis. Special expertise exists in:

- Simulation services for development and design
- Damage tolerant design
- Thermomechanical loading
- Process chain simulation
- Modelling of complex material behaviour

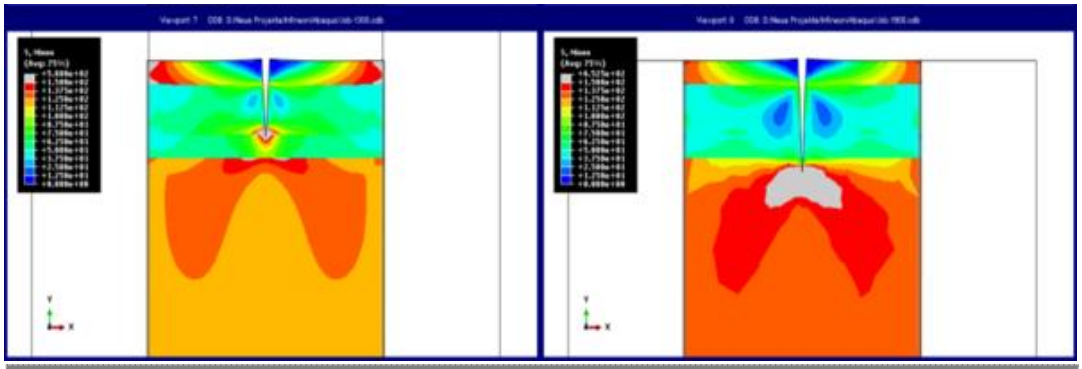
The simulation services offered range from simple linear problems to thermomechanical analyses to strongly non-linear models (elasto-viscoplastic material behaviour, phase transformation behaviour during heat treatment, contact, etc.).

The Modelling and Simulation team offers the following fields of expertise:

- Simulation services for development and design
- Damage tolerant design
- Thermomechanical loading
- Process chain simulation
- Modelling of complex material behaviour

Technical equipment of the Modelling and Simulation team:

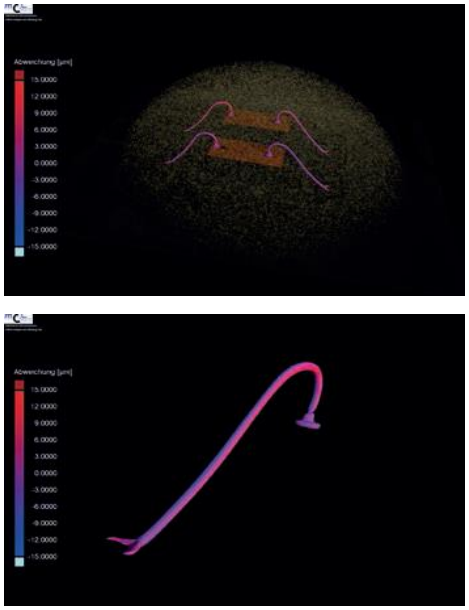
- Various high-performance workstations and access to high-performance computer clusters
- Wide range of software tools for finite element, CFD, ab-initio, thermodynamic and kinetic simulations



Finite element – based Simulation of crack growth in a three layered coating © MCL

Microelectronics

The division „Materials for Microelectronics“ is focused on material based solutions for the microelectronics industry and has a wide-range of expertise in material characterisation as well as numerical simulation of materials, processes and components at all length scales at its disposal.



CT-pictures from a LEDmodule: The colours indicate the displacement of the wire with increasing temperature © MCL

The division of „Materials for Microelectronics“ is focused on:

- 3D Integration and Packaging
- Materials for sensor technology, compatible with CMOS
- Simulation-based „Design for Reliability“ and „Co-Design“
- Services for material characterisation and reliability analysis

Technical equipment of the Laboratory of microelectronics:

- High-resolution Computed Tomography (Nanotom M from GE) with equipment for heating, cooling and mechanical loading
- Ultrasonic microscope (SAM 400 PVATEPLA) with equipment for mechanical loading
- Dynamic-mechanical-analysis (RSA G2 from TA) with a tempering unit (-70 to 500°C)
- Scanning Probe Microscope (BRR from DME) to be used in connection with the REM/FIB workstation
- Thermal-Impedance measuring system (T3Ster from Mentor Graphics) including TeraLED modules and Flowtherm
- Point probe station, DC and AC supply and parameter analysis
- Differential-scanning-calorimetry (DSC8000 from Perkin Elmer)
- UV-VIS spectrometer (Lamda 650 form Perkin Elmer)
- Infrared spectrometer (Avatar 320 from Nicolett)
- Spray-pyrolysis-facilities
- Gas sensors test station
- Target preparation (TXP from Leica) and light microscopy

In Cooperation:

- Lithography (e-Beam and Licht), etch procedures, coating facilities
- Nanoindenter (Agilent Nanoindenter G200 from Keysight Technologies)

Certifications:

ISO 9001:2008 CERTIFICATION FOR INTERNAL AND EXTERNAL SERVICES

In addition to its research activities, MCL provides businesses and scientific partners with services in the fields of materials and component characterisation, materials selection and damage analysis. To be able to offer these services at a high quality level, MCL has obtained certification to ISO 9001:2008, which includes the following points:


ZERTIFIKAT

TÜV AUSTRIA

für das Managementsystem nach
EN ISO 9001:2008

Materials Center Leoben Forschung GmbH
Roseggerstrasse 12
A-8700 Leoben
inkl. Standorte:
Roseggerstraße 15, 17 und Kerpelystraße 2 in 8700 Leoben

Services im Bereich
- Werkstoff- und Bauteilanalyse
- Werkstoffauswahl
- Charakterisierung mikroelektronischer Komponenten
- Berechnung und Simulation
- Schadensanalytik

Rapid order processing
Reproducible and reliable results
Customer satisfaction and on-going company development

MCL CERTIFIED AS “AUSTRIAN LEADING COMPANY”

MCL received the ‘Leitbetriebe Austria’ certificate, which is awarded to leading companies which demonstrate outstanding performance in terms of corporate innovation, sustainability and social responsibility.

LEITBETRIEBE AUSTRIA

Employees and partners © Pressberger / MCL

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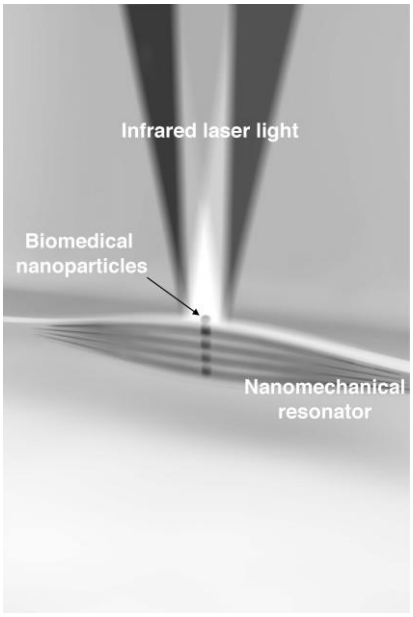
We Innovate Materials

Member contributions

Contribution of Technische Universität Wien

TECHNISCHE UNIVERSITÄT WIEN

Faster chemical analysis of biomedical nanomaterial



The growing use of engineered nanomaterials (ENMs), e.g. in nanomedicine, calls for novel analytical devices that enables a fast chemical analysis of the typically minute sample amounts available. Prof. Silvan Schmid from TU Wien in collaboration with researchers from the Technical University of Denmark have presented a novel technique called nanomechanical infrared spectroscopy (NAM-IR), which allows for the fast chemical analysis of picograms of ENMs. NAM-IR requires one billion time less sample material than standard IR analysis techniques. The minute required sample amount reduces the time needed for sample preparation from typically 2 days to only a few minutes. With a reduced total analysis time from days to minutes, NAM-IR can speed up the development of novel ENMs for a future use in nanomedicine.

In NAM-IR, ENM is nebulized directly from dispersion and collected on a nanomechanical string resonator, which is “filtering” the airborne ENM out of the generated aerosol. Picograms of sample that is collected on the resonator surface can convert absorbed IR light into a measurable mechanical frequency shift via the photothermal heating of the resonator. Hence, the IR absorption spectrum of the ENM is readily obtained by monitoring the resonator frequency as a function of the IR wavelength.

Link to article: http://dx.doi.org/10.1016/j.snb.2016.04.002

Contact:
Prof. Silvan Schmid, Head of Micro and Nanosensors Group
Institute of Sensor and Actuator Systems, Vienna, Wien, Austria
http://mns.isas.tuwien.ac.at

Contribution of Technische Universität Wien

TECHNISCHE UNIVERSITÄT WIEN

There is more to the picture than meets the eye

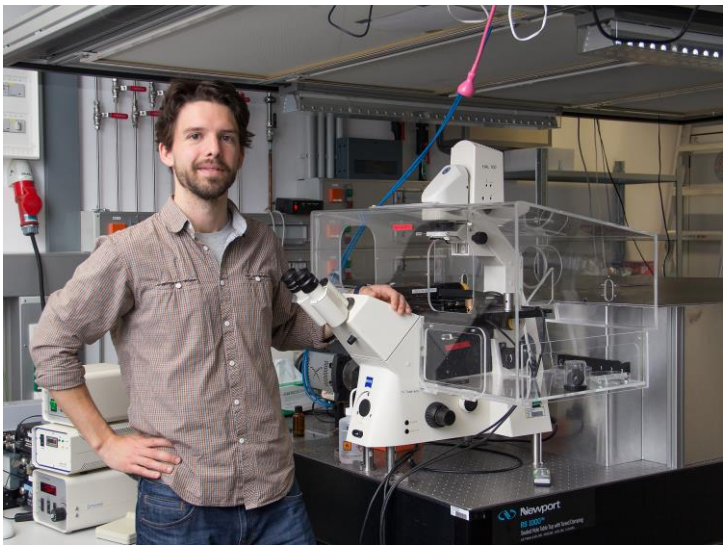
Over the last few years, the team around Prof Gerhard Schütz has established biophysics as an integral part of the basic research portfolio at TU Wien. In order to get a fundamental understanding of the workings of the cell plasma membrane of mammalian cells, the group uses advanced microcopy techniques to directly look at the nanoscopic architecture of cells. Among other approaches, they use single molecule localization-based superresolution microcopy, which can produce nano-scale maps of cellular structures like the cell plasma membrane. In a recent publication in Nature Methods, they presented a new experimental strategy that is insensitive to common artifacts of this technique. The results challenge current paradigms of how proteins are organized on the cell plasma membrane.

Initially, Florian Baumgart, a postdoc in Gerhard Schütz's lab, decided to follow up recent reports about nanoscopic clusters of signaling proteins at the plasma membrane of T-cells, a cell type that is central to the adaptive immune system. His idea was to implement single molecule imaging techniques to get an understanding of the biological significance of molecular clustering in the T cell plasma membrane. This was based on the hypothesis that nanoclusters of signaling proteins in immune cells were an essential structural feature that was crucial for immune signaling. Understanding nanoclustering of T-lymphocyte signaling proteins therefore seemed a promising goal to pursue.

Soon, however, things turned out to be a little less clear. One of the inherent features of single molecule localization-based superresolution microscopy techniques is that those approaches exploit stochastic blinking of fluorophores to determine the exact positions of target molecules. Experimentally, cellular proteins are specifically labeled with fluorescent dyes. In this setting, the fluorescent signals of molecules in close proximity overlap and cannot not be resolved. Under certain chemical conditions the fluorescent dyes can be induced to switch stochastically between a fluorescent on-state and a dark off-state. When only a sparse subset of molecules is in the on-state at any given time, it is possible to determine their exact positions. After recording many individual images in this way, it is possi-

ble to reconstruct a high resolution localization map from the acquired positions. Unfortunately, the induced blinking can lead to difficulties when numbers of localizations need to be correlated with underlying numbers of molecules. Exactly that, however, is necessary to make statements about molecular clustering.

After detailed analysis of the data, Florian Baumgart and Gerhard Schütz suspected that what had been reported as protein nano-clusters of one of the important signaling proteins in T-cells, could actually be imaging artifacts due to multiple observations of the very same fluorescent molecules. Together with Andreas Arnold, a PhD student in the lab, they tried to find a strategy that would circumvent overcounting artifacts. They developed a sample-based approach, where deliberate variations of the labeling density during the sample preparation yield characteristic differences in the statistics of superresolution localization maps in case of clustered versus random protein distributions. The new method turned out to work very robustly both in synthetic settings and on cell samples. It also confirmed the initial suspicion that the reported nano-clustering of at least some T-lymphocyte signaling proteins was actually a measurement artifact.



Florian Baumgart in the laboratory
© Technische Universität Wien

Contact:
Univ.-Prof. Dr. Gerhard J. Schütz and Florian Baumgart, PhD
Biophysics Group, Institute of Applied Physics
Vienna University of Technology, Vienna, Austria
http://biophysics.iap.tuwien.ac.at/home/

Contribution of Medical University of Graz

From knowledge to implementation: Knowledge Transfer Centre South - Wissenstransferzentrum (WTZ) Süd

Since summer 2014 six Universities from the South of Austria work together at the regional Knowledge Transfer Centre South - Wissenstransferzentrum (WTZ) Süd on cooperative projects in order to create a lasting utilisation culture and awareness at the universities for the market potential of university ideas. The three regional Knowledge Transfer Centres in Austria (East, West and South) were founded and supported by the Federal Ministry of Science, Research and Economy (bmwfw) and the aws in order to intensify the cooperation between science and industry as well as to promote systematic knowledge transfer in the fields of humanities, social and cultural sciences.

The know-how of the participating universities (University of Graz, Graz University of Technology, University Klagenfurt, University of Music and Performing Arts Graz, Montanuniversität Leoben and Medical University of Graz) is pooled by the WTZ Süd in order to cooperatively use the available resources between the universities. The goal is to transfer university knowledge and results of regional research fast and demand-oriented to companies, institutions and society.

The WTZ Süd

- offers support in search for university inventions and innovations
- transfers university research expertise and performance to the industry
- creates awareness among students, scientists and university-affiliated stakeholders for the topic of intellectual property and entrepreneurship
- transfers knowledge from the humanities, social sciences and arts to the society

A particular challenge is the transfer of results from the fundamental research into products and services. By making clustered university technologies visible the WTZ Süd facilitates the search for new technologies for companies.

The cooperation and the exchange between scientists and industry is supported by the WTZ Süd for example in events, such as the R&D Round Tables or the Partnering Day, whereby scientists have the possibility of presenting their ideas as well as their know-how to interested companies.

A goal of the WTZ Süd is to offer a complete infrastructure and competence register of university expertise and infrastructure and to provide to the industry a one-stop-shop in order to increase the competitiveness of research in Austria, too. The contact points at the WTZ Süd and at each of the six universities act as competent and uncomplicated intermediaries if in search of know-how.

ErfinderInnenehrung *© Lunghammer/TU Graz*

Contact:

Knowledge Centre South coordination:

Dr. Moritz Theisen, Graz University of Technology
www.wtz-sued.at
office@wtz-sued.at

Contribution of Siemens AG Österreich

SIEMENS

Test lab for small-scale bio-production techniques

Research group **Process Analytics and Sensing of Siemens Corporate Technology** develops intelligent measurement and automation technology to optimize bioprocesses in pharmaceutical and food industry.

Bio lab Siemens Corporate Technology © *Siemens / Peppo Schuster*

The bioprocess lab of Siemens Corporate Technology in Vienna is fitted with a demonstrator which tests and monitors small-scale bio-production techniques. Interested users can thus experience the interaction of Siemens SIMATIC PCS 7 products, COMOS and SIPAT by means of the fully functional lab facility. The demonstrator system is continuously being enhanced towards a holistic system, which forms the underlying idea of "Industry 4.0".

Statistical and deterministic models, soft sensors and online optimization measures should help to make processes in the pharmaceutical and bio industry more efficient and more error-free. For this purpose, it is important to define which parameters are significant for the product quality, and when and how they should be controlled. During the fermentation of yeast cells, active substance properties, which significantly influence the quality of a bioprocess, are recorded by means of sensors and analysis devices. Included are, for example, the pH-value, the oxygen and the glucose contents. Depending on the task at hand and including spectrometer data, between 100 and 2000 measured values are collected and analyzed. Based on this data, statistical models are developed which predict how the parameters will change when subjected to different process conditions. These predictive tools form the basis for managing manufacturing processes in order to ensure that the product quality can be maintained at any given time.

The entire fermentation process is controlled by the Siemens SIMATIC PCS7 control. It manages the pumps, regulates the temperature and the pH-value and collects the meas-

urement data. The data platform SIMATIC SIPAT subsequently analyzes the collated data of the different analysis devices. Quality requirements and critical process parameters are monitored in real-time during production. If a deviation is encountered, the process can be readjusted without interruption. The obvious advantage: Quality control does not only take place later in the final product, but has instead already been assessed multiple times during the course of the process. Errors can therefore be identified or avoided in a timely manner and batches can be approved faster.

Statistical models support the automation of industrial processes.
© Siemens/ Georg Lembergh

The entire range of process parameters and analysis data is recorded and processed with SIMATIC PCS7 and SIPAT.
© Siemens/ Peppo Schuster

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Success stories

INSPIRED – A project to print the future

In January 2015, 13 partners from 7 European countries met in Brussels to kick off the project INSPIRED, acronym for “INdustrial Scale Production of Innovative nanomateRials for printEd Devices”, which is funded within the HORIZON 2020 EU research and innovation programme.

The focus of the INSPIRED project is to fundamentally improve the current understanding of Printed Electronics (PE). PE is set to revolutionise the electronics industry over the next decade and can offer Europe the opportunity to regain lost market share. It allows for the direct printing of a range of functional (conducting, semi-conducting and dielectric) nanomaterials formulations to enable a simpler, more cost-effective, high performance and high volume processing in comparison to traditional printed circuit board and semiconductor manufacturing techniques. The global growth consulting firm Frost and Sullivan[1] has reported that the market for PE will increase in revenues from $0.53Bn in 2010 to $5.04Bn in 2016 at a compound annual growth rate of 32.5%. However, the migration towards low-cost, liquid-based, high resolution deposition and patterning using high throughput techniques, such as inkjet printing, requires that suitable functional nanomaterials formulations (e.g. inks) are available for end users in industrially relevant quantities. Presently, there are issues with industrial supply of nanomaterials which are low cost, high performance, environmentally friendly and tailored for high throughput systems. Therefore, better collaboration is warranted between supply chain partners to ensure that nanomaterial production and nanomaterial formulations are tailored for end use applications to meet this need.

The INSPIRED project will address these fundamental issues within the printed electronics industry by ensuring that suitable functional nanomaterials formulations (inks) are available for end users in industrial scale quantities. Production of these nanomaterial formulations on an industrial scale and then depositing them using cost-effective, high throughput printing technologies enables rapid production of printed electronic components, on a wide vari-

ety of substrates, therefore enabling new electronics applications whilst overcoming the problems associated with traditional manufacturing.

In detail, the INSPIRED project will develop and demonstrate cost-effective, innovative, high throughput synthesis and functionalization of nanomaterials (e.g. nano-copper, silver nanowires, graphene nanoplatelets) already validated in the laboratory (e.g. currently at Technology Readiness Level (TRL) 4) for printed electronic systems (e.g. copper indium gallium selenide photovoltaics (CIGS PV), capacitive touch screens (CTS) and liquid crystal displays (LCD)) using high volume printing techniques which surpass currently available printing technologies. The global objective of the INSPIRED project is to demonstrate the synthesis and functionalisation of nanomaterials for printing applications with high process throughput. This will be achieved through development of high performance, cost-effective nanomaterial formulations in a range of commercial applications in relevant industrial environments (TRL 6) against the relevant industrial standards and end user applications.

The partners in the project, which has a duration of four years, come from academia, industries and organisations in 7 European countries and are experts in their fields, covering nanomaterial synthesis and scale-up, ink formulation, high throughput printing, equipment manufacture and process engineering, nanosafety assessment, process and post-process characterisation of nanomaterial inks and components as well as CIGS PV cell, touchscreen display and LCD design and manufacture. The project coordinator is DI Dr. Andreas Klug, MBA from NanoTecCenter Weiz Forschungsgesellschaft mbH (Austria), who is supported by Dr. Paul Reip from Intrinsiq Materials Ltd (UK). Further partners are NanoGap Sub-nm-Powder S.A. (Spain), M-Solv Ltd (UK), Thomas Swan & Co Ltd (UK), BioNanoNet Forschungsgesellschaft mbH (Austria), Touchnetix Ltd (UK), Nexcis (France), EuroLCDs (Latvia), Nanotechnology Industries Association (Belgium), University of Bologna (Italy), Fundacion Tecnalia Research & Innovation (Spain) and University of Santiago de Compostela (Spain).

Information on the INSPIRED project and updates on developments will be presented at the dedicated website www.nano-inspired.eu which will be launched in spring 2015. For more information do not hesitate to contact the project coordinator Andreas Klug (andreas.klug@ntc-weiz.at).

[1] *Frost & Sullivan, World Printed Electronics Market, N6C8-25.*

Picture of the INSPIRED project kick-off meeting in Brussels, Belgium © *INSPIRED*

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 646155. www.nano-inspired.eu

BioNanoNet *retrospect*

NanoMedicine Austria Day 2016

5th April, 2016, Danube University Krems

Bio- and nanomedicine opens up fascinating new chances for medical applications by offering novel methods for drug delivery systems, imaging techniques, diagnostic tools, etc. The diversity of these topics encourages interdisciplinary expertise and connects a variety of scientific fields. The use of smallest particles in the nanometer range enables new methods for improved treatment of numerous diseases. Through Austria`s excellent scientific expertise in these fields, it has also high economic potential. In 2015, BioNanoNet founded the Austrian platform "NanoMedicine-Austria" to ensure Austria a leading position in this promising and economically highly interesting field. The aim of this platform is to bring together Austrian bio- and nanomedical experts into one platform in order to create appropriate structures to promote science and research and to strengthen the scientific and business location Austria sustainably.

Bundling of bio- and nanomedical expertise

At the first Austrian NanoMedicine Day on 5th April 2016 at the Danube University Krems, 22 experts from all over Austria discussed and defined the topics to be dealt with in the coming years and the necessary framework conditions in research, education and technology transfer.

© BioNanoNet

The discussion about nanotechnologies applied to medicine to address medical needs focused on the topics (i) diagnosics and imaging, (ii) therapeutics and (iii) regenerative medicine. Interesting ideas were exchanged and views on possible future applications for the coming years were given. The results and central ideas will be further developed in upcoming activities.

We kindly invite you to become part of NanoMedicine-Austria contributing your relevant expertise in the platform; if you are interested, please contact office@bionanonet.at .

BioNanoMed 2016

7th International Congress Nanotechnology in Medicine & Biology

6th – 8th April, 2016, Krems, Austria

From 6th April to 8th April 2016, the 7th International Congress of Nanotechnology in Medicine & Biology took place at the Danube University in Krems, Austria. The event provided a forum for researchers, engineers, students and practitioners from Natural Sciences, Medical Sciences and Engineering as well as from educational, governmental and non-governmental institutions to discuss current, emerging and future trends of the converging fields of nanotechnology, biotechnology and medicine. Exciting lectures and invited talks given by leading international scientists as well as poster presentations offered delegates an excellent opportunity to discuss pioneering developments and to initiate cooperation projects.

A great variety of different presentations were performed by international experts, addressing the key topic **„Nanotechnology enables Personalized Medicine“**.

The programme covered the following panel sessions:

- Nanomaterials for Biomedical Applications
- Regenerative Nanomedicine - Nanotechnology and Stem Cells
- Nanotechnology for Detection, Diagnosis, Imaging & Sensing
- Nano Oncology: Drug Delivery & Therapeutics
- Nano Pharmaceuticals & Drug Design

In addition, thematic sessions on (i) 3D-Technologies for Nanomedicine and (ii) Nanomaterials Toxicology & NanoSafety Aspects (co-organized by EURO-NanoTox) were performed. Invited experts presented their recent findings and gave insight into their ongoing work. BioNanoNet participated the conference and contributed a poster presentation on the topic “A Prospective Approach for Assessing the Potential Impacts of Nanomaterials to Human and Environmental Health”.

Susanne Resch at BioNanoMed 2016
© *BioNanoNet*

Opening up Research and Innovation to Society
The NanoDiode Experience - Working Conference

nano diode
w nanodiode.eu

Developing Innovative Outreach and Dialogue on responsible nanotechnologies in EU civil society (NanoDiode)

31st May, 2016, Centre for Fine Arts Brussels, Belgium

The NanoDiode Working Conference, held on 31st May 2016 at the Centre for Fine Arts in Brussels, enabled participants to debate on stakeholder engagement in European research and innovation. Policy makers, researchers, representatives from industry and civil society organisations explored how to engage societal stakeholders and open up research and innovation to broader societal considerations.

This day-long working conference was an opportunity to discuss the achievements, findings and recommendations of the project and to put the issue of stakeholder engagement in research and innovation for discussion.

In several sessions, invited speakers debated on the reasons for stakeholder engagement, the means of putting it into action and the potential future of this matter. A number of breakout sessions, taking the form of ‘knowledge fairs’, were then held for smaller groups to discuss the details of this process.

Participants at NanoDiode working conference © *BioNanoNet*

Session 1 – Why engage societal stakeholders in research and innovation?

The following panellists shared their views on this question:

- Philippe Keraudren, Deputy Head of Unit, EC RTD, B6 – Open and Inclusive Societies
- David Azoulay**, CIEL**
- **Hilary Sutcliffe, Matter**
- **Valerie Flynn, freelance journalist**

Session 2 – Knowledge fair: The what and how of stakeholder engagement

NanoDiode partners discussed with conference participants how to organise stakeholder engagement in their own work, building on the results of the NanoDiode project.

Session 3 – Embedding stakeholder engagement **in research and innovation practice**

The second session was dedicated to embedding stakeholder engagement in research and innovation practice. Four panellists came on stage to debate on this question:

- Helene Chraye, Head of Unit, EC RTD D.3 – Advanced Materials and Nanotechnologies
- Catherine Durand, CEA
- Anne Goldberg, Solvay
- Massimo Perucca, Project s.a.s.

Session 4 – The future of stakeholder engagement

In the closing panel, five debaters discussed the future of stakeholder engagement:

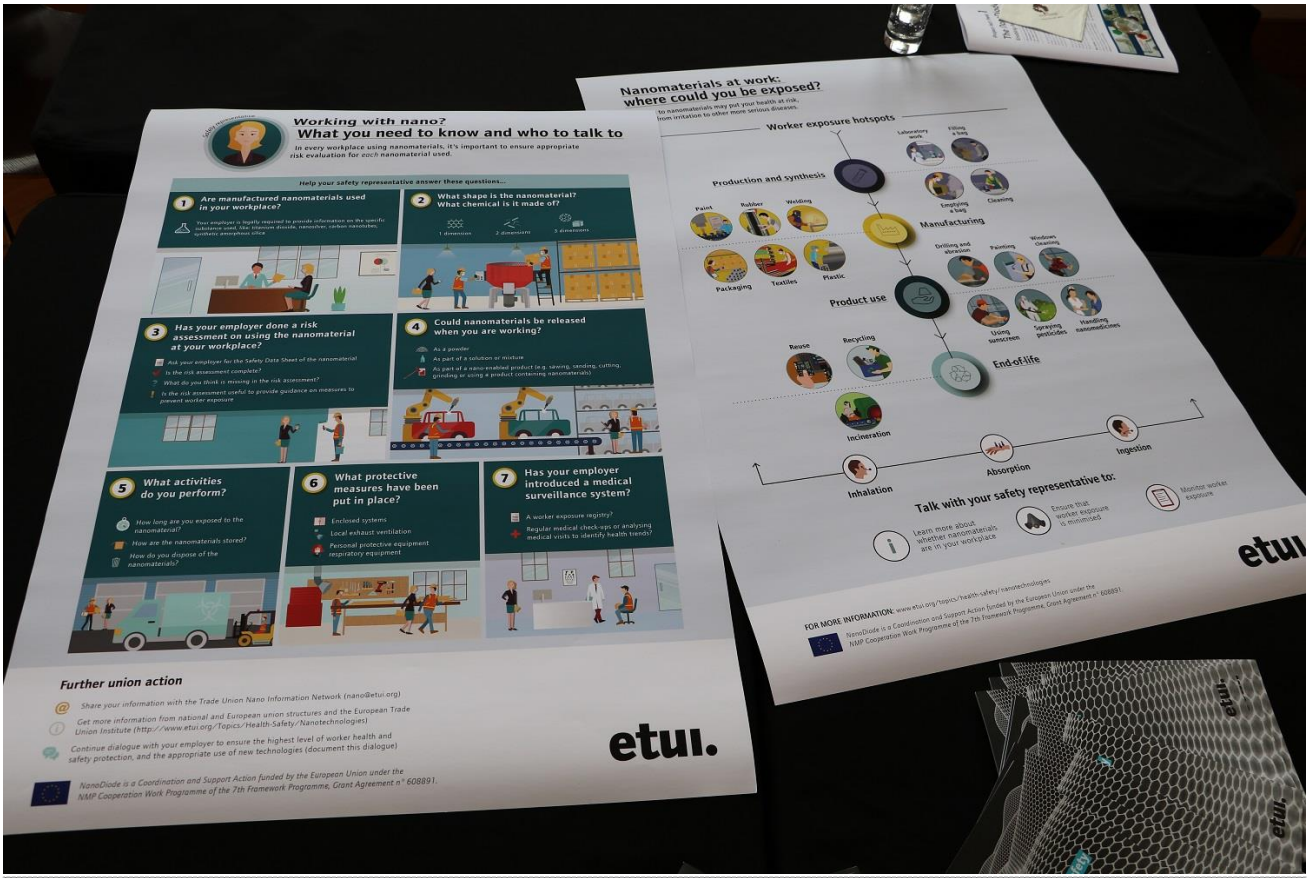
- Rene von Schomberg, EC DG RTD A.6 – Data, Open Access and Foresight
- Axel Singhofen, Advisor to the European Parliament
- Carolin Kranz, BASF
- Arie Rip, University of Twente
- Doreen Fedrigo-Fazio, ETUI

<u>Compilation of some statements during the panel sessions:</u>

'Stakeholder engagement is not about informing, it is about learning'
'Some European research is too technical for stakeholder engagement to make sense'
'Our main stakeholder are our customers'
'Some technologies that can address societal issues are available but are unable to reach the market because of the huge segmentation in regulation'

'Innovation needs to respond more to consumer needs'
'European Commission should boost dedicated dialogue platforms on key enabling technologies'
'The extension of traditional stakeholder engagement towards the inclusion of new stakeholders will reduce representative-democratic governance'
'It has all been about avoiding regulatory action, but there needs to be developments and commitments'
'Nanotechnologies have positive aspects, but the longest we wait, the technology loses its attractiveness'
'We have talked about stakeholder engagement, but action needs to be taken'
'The EC does not want to govern nanomaterials, regulation is seen as a 'killer of innovation' rather than a way to deal with societal engagements'
'Responsible Research & Innovation shifts the focus from the exploitation of particular technological potentials towards societal objectives'

The NanoDiode Working Conference was a lively and vibrant format, mixing interesting brief plenaries with interactive sessions.



NanoDiode working conference © *BioNanoNet*

Conference Calendar

7th World Nano Conference

When? 20 – 21 June 2016

Where? Cape Town, South Africa

For more information please visit the event website.

3rd International Conference on Occupational & Environmental Toxicology (ICOETox 2016)

When? 21 – 23 June 2016

Where? Porto, Portugal

For more information please visit the event website.

NanoTech Poland

When? 22 – 25 June 2016

Where? Poznan, Poland

For more information please visit the event website.

Industrial Technologies Conference

When? 22 – 24 June 2016

Where? Amsterdam, Netherlands

For more information please visit the event website.

12th International Conference on Diffusion in Solids and Liquids - DSL2016

When? 26 – 30 June 2016

Where? Split, Croatia

For more information please visit the event website.

CLINAM 2016

When? 26 – 29 June 2016

Where? Basel, Switzerland

For more information please visit the event website.

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4. Zukunftstag der Steirischen Wirtschaft

When? 27 June 2016

Where? Graz, Austria

For more information please visit the event website.

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nanoFIS 2016

When? 27 – 29 June 2016

Where? Graz, Austria

For more information please visit the event website.

9th Nano Congress for Future Generation

When? 27 – 29 June 2016

Where? Valencia, Spain

For more information please visit the event website.

7th International Nanomedicine Conference

When? 27 – 29 June 2016

Where? Sydney, Australia

For more information please visit the event website.

5th European Biosimilars Congress

When? 27 – 29 June 2016

Where? Valencia, Spain

For more information please visit the event website.

Open Research Data in Horizon 2020

When? 28 June 2016

Where? Vienna, Austria

For more information please visit the event website.

9th World Drug Delivery Summit

When? 30 June – 2 July 2016

Where? New Orleans, United States

For more information please visit the event website.

ISSON 2016 - 10th International Summer Schools on Nanosciences & Nanotechnologies, Organic Electronics & Nanomedicine

When? 2 – 9 July 2016

Where? Thessaloniki, Greece

For more information please visit the event website.

10th International Conference on Advanced Computational Engineering and Experimenting - ACE-X 2016

When? 3 – 6 July 2016

Where? Split, Croatia

For more information please visit the event website.

Nanotechnology in Medicine: From Molecules to Humans

When? 3 – 7 July 2016

Where? Herrnstein, Austria

For more information please visit the event website.

Faraday Discussion: Nanoparticles with Morphological and Functional Anisotropy

When? 4 – 6 July 2016

Where? Glasgow, Scotland

For more information please visit the event website.

JEUPISTE academic workshop in nanotechnology during NANOTEXNOLOGY

When? 4 – 8 July 2016

Where? Thessaloniki, Greece

For more information please visit the event website.

NN 16 - 13th International Conference on Nanoscience and Nanotechnologies

When? 5 – 8 July 2016

Where? Thessaloniki, Greece

For more information please visit the event website.

Kurs Qualitätsmanagement für Medizinprodukte nach ISO 13485

When? 6 July 2016

Where? Nürnberg, Germany

For more information please visit the event website.

Horizon 2020 Health Partnering Day 2016

When? 7 July 2016

Where? Brussels, Belgium

For more information please visit the event website.

Open Info Day Health 2017 der Europäischen Kommission

When? 8 July 2016

Where? Brussels, Belgium

For more information please visit the event website.

5th International Symposium on Graphene Device -ISGD-5

When? 11 – 14 July 2016

Where? Brisbane, Australia

For more information please visit the event website.

2nd International Conference on Nanoenergy and Nanosystems 2016 (NENS2016)

When? 13 – 15 July 2016

Where? Beijing, China

For more information please visit the event website.

NANO KOREA 2016

When? 13 – 15 July 2016

Where? Kintex, Korea

For more information please visit the event website.

Mechanisms and Barriers in Nanomedicine

When? 14 – 16 July 2016

Where? Breckenridge, Colorado

For more information please visit the event website.

"Application driven advances in additive manufacturing technologies" at ICQNM 2016

When? 24 – 28 July 2016

Where? Nice, France

For more information please visit the event website.

ANM2016

When? 25 July 2016

Where? Aveiro, Portugal

For more information please visit the event website.

NANO ENERGY 2016

When? 27 – 29 July 2016

Where? Liverpool, United Kingdom

For more information please visit the event website.

9th Nano Congress for Next Generation

When? 1 – 2 August 2016

Where? Manchester, United Kingdom

For more information please visit the event website.

ICANM 2016: International Conference & Exhibition on Advanced & Nano Materials

When? 1 – 3 August 2016

Where? Montreal, Canada

For more information please visit the event website.

Summer School on nanoScience@Surfaces

When? 1 – 4 August 2016

Where? Cambridge, United Kingdom

For more information please visit the event website.

2nd World Congress on Biopolymers

When? 4 – 5 August 2016

Where? Manchester, United Kingdom

For more information please visit the event website.

Int. Conference on Environmental Effects of Nanoparticles and Nanomaterials

When? 14 – 18 August 2016

Where? Golden, Colorado

For more information please visit the event website.

252nd American Chemical Society Meeting

When? 21 – 25 August 2016

Where? Philadelphia, United States

For more information please visit the event website.

IEEE Nano - 16th International Conference on Nanotechnology

When? 22 – 25 August 2016

Where? Sendai City, Japan

For more information please visit the event website.

9th conference Interfaces Against Pollution (IAP2016)

When? 4 – 7 September 2016

Where? Lleida, Spain

For more information please visit the event website.

21st European Symposium on Quantitative Structure-Activity Relationship

When? 4 – 8 September 2016

Where? Verona, Italy

For more information please visit the event website.

Eurosensors 2016

When? 4 – 9 September 2016

Where? Budapest, Hungary

For more information please visit the event website.

21st EuroQSAR

When? 4 - 8 September 2016

Where? Verona, Italy

For more information please visit the event website.

TNT2016 - 17th edition of Trends in Nanotechnology

When? 25 – 28 September 2016

Where? Fribourg, Switzerland

For more information please visit the event website.

11th NANOSMAT 2016

When? 6 – 9 September 2016

Where? Aveiro, Portugal

For more information please visit the event website.

AEM 2016 - 8th Internationl Conference on Advanced Nanomaterials

When? 12 – 14 September 2016

Where? Guildford, United Kingdom

For more information please visit the event website.

3rd International Conference on Structural Nano Composites - Nanostruc 2016

When? 12 – 15 September 2016

Where? Aberdeen, United Kingdom

For more information please visit the event website.

2nd Nanosafety Forum for Young Scientists

When? 15 – 16 September 2016

Where? Visby, Sweden

For more information please visit the event website.

BIO NANONET on site

BioNanoNet Strategy Meeting & 10th Anniversary *(for members only)*

When? 15 September 2016

Where? Laßnitzhöhe, Austria

For more information please visit the event website.

BIO NANONET on site

BioNanoNet General Board Meeting *(for members only)*

When? 15 September 2016

Where? Laßnitzhöhe, Austria

For more information please visit the event website.

International Conference on High Performance and Optimum Design of Structures and Materials

When? 19 - 21 September 2016

Where? Siena, Italy

For more information please visit the event website.

MNE 2016 - 42nd Micro & Nano Engineering

When? 19 – 23 September 2016

Where? Vienna, Austria

For more information please visit the event website.

NANOINNOVATION 2016

When? 20 – 23 September 2016

Where? Rome, Italy

For more information please visit the event website.

2nd International Congress on Clinical Trials for Medical Devices (CTMD2016)

When? 21 – 22 September 2016

Where? Berlin, Germany

For more information please visit the event website.

FTI-Bundesländerdialog/Plenumstreffen 2016 der Nationalen Clusterplattform

When? 21 September 2016

Where? Vienna, Austria

For more information please visit the event website.

4th Conference on Innovation in Drug Delivery: Site-Specific Drug Delivery

When? 25 – 28 September 2016

Where? Antibes-Juan-les-Pins, France

For more information please visit the event website.

Seminar sicheres Arbeiten mit Nanomaterialien

When? 26 – 28 September 2016

Where? Dresden, Germany

For more information please visit the event website.

11th International Particle Toxicology Conference – IPTC

When? 26 – 30 September 2016

Where? Singapore, China

For more information please visit the event website.

MICRONORA 2016

When? 27 – 30 September 2016

Where? Besancon, France

For more information please visit the event website.

IMI Stakeholder Forum

When? 28 – 29 September 2016

Where? Brussels, Belgium

For more information please visit the event website.

Micro Nano MEMS 2016

When? 28 – 29 September 2016

Where? Birmingham, United Kingdom

For more information please visit the event website.

ICONAN 2016 - International Conference On Nanomedicine And Nanobiotechnology

When? 28 – 30 September 2016

Where? Paris, France

For more information please visit the event website.

24th International Conference on Materials & Technology (24 ICM&T)

When? 28 – 30 September 2016

Where? Portoroz, Slovenija

For more information please visit the event website.

Add+it 2016

When? 29 – 30 September 2016

Where? Steyr, Austria

For more information please visit the event website.

4th International Conference on Competitive Materials and Technology Processes (ic-cmtp4)

When? 3 – 7 October 2016

Where? Miskolc-Lillafured,Hungary

For more information please visit the event website.

CPhI worldwide

When? 4 – 6 October 2016

Where? Barcelona, Spain

For more information please visit the event website.

FFG Akademie Training: AntragstellerInnen KMU Instrument

When? 5 October 2016

Where? Vienna, Austria

For more information please visit the event website.

Workshop Nanotechnologie im Rahmen der SALTEX 2016

When? 6 October 2016

Where? Dornbirn, Germany

For more information please visit the event website.

Zukunftsreise Composit- und Nanomaterialien

When? 10 – 12 October 2016

Where? Moscow, Russio

For more information please visit the event website.

PROFACTOR Fachexkursion

When? 11 October 2016

Where? Steyr, Austria

For more information please visit the event website.

Nanoforum 2016

When? 11 – 13 October 2016

Where? Milano, Italy

For more information please visit the event website.

Herald's International Conference and Exhibition on Nanomedicine and Nanotechnology (Nano-2016)

When? 12 – 14 October 2016

Where? Baltimore, United States

For more information please visit the event website.

7th Szeged International Workshop on Advances in Nanoscience (SIWAN7)

When? 12 – 15 October 2016

Where? Szeged, Hungary

For more information please visit the event website.

LISAvienna Business Treff in Kooperation mit Fit for Health 2.0: SMEs in Horizon 2020

When? 12 October 2016

Where? Vienna, Austria

For more information please visit the event website.

Medtech meets IT - smart technologies for medicine

When? 13 October 2016

Where? tba

For more information please visit the event website.

Partnering Day „Solutions for a better life"

When? 17 October 2016

Where? Linz, Austria

For more information please visit the event website.

NANOCON 2016

When? 19 – 21 October 2016

Where? Brno, Czech Republic

For more information please visit the event website.

11th International Conference and Expo on Nanoscience and Molecular Nanotechnology

When? 20 – 22 October 2016

Where? Rome, Italy

For more information please visit the event website.

Nano 2016 - 4th International Conference "Nanotechnologies"

When? 24 – 27 October 2016

Where? Tbilisi, Georgia

For more information please visit the event website.

Conference Re-Industrialisation of the European Union 2016

When? 26 – 28 October 2016

Where? Bratislava, Slovakia

For more information please visit the event website.

BIT`s 6th Annual World Congress of NanoScience & Technology

When? 26 – 28 October 2016

Where? Singapore, China

For more information please visit the event website.

5th International Conference NANOSAFE 2016

When? 7 – 10 November 2016

Where? Grenoble, France

For more information please visit the event website.

Applied Nanotechnology and Nanoscience International Conference – ANNIC 2016

When? 10 – 12 November 2016

Where? Beijing, China

For more information please visit the event website.

ISACS21: Challenges in Nanoscience

When? 10 – 12 November 2016

Where? Beijing, China

For more information please visit the event website.

BIO NANONET on site

9th Nanotrust Tagung

When? 17 November 2016

Where? Vienna, Austria

For more information please visit the event website.

BIO NANONET on site

NANoREG final conference

When? 29 November – 1 December 2016

Where? OECD/Paris, France

Save the date! We will keep you informed as soon as further details are available.

BIO NANONET on site

World Congress on Clinical Trials in Diabetes (WCTD2016)

When? 30 November – 1 December 2016

Where? Berlin, Germany

For more information please visit the event website.

ICI Meeting 2016

When? 4 – 6 December 2016

Where? Tel Aviv, Israel

For more information please visit the event website.

ICNSNT-2016 - 3rd Annual International Conference on Nanoscience and Nanotechnology

When? 7 – 8 December 2016

Where? Bangalore, India

For more information please visit the event website.

7th NRW Nano-Konferenz

When? 7 – 8 December 2016

Where? Münster, Germany

For more information please visit the event website.

3rd Annual International Conference on Nanoscience and Nanotechnology - ICNSNT2016

When? 7 – 8 December 2016

Where? Bangalore, India

For more information please visit the event website.

ICNSNT-2016 - 3rd Annual International Conference on Nanoscience and Nanotechnology

When? 15 – 16 December 2016

Where? Colombo, Sri Lanka

For more information please visit the event website.

ATTD 2017 - 10th International Conference on Advanced Technologies & Treatments for Diabetes

When? 15 – 18 February 2017

Where? Paris, France

For more information please visit the event website.

5th International Conference on Multifunctional, Hybrid and Nanomaterials

When? 6 - 10 March 2017

Where? Lisbon, Portugal

For more information please visit the event website.

10th Advanced Study Course on Optical Chemical Sensors (ASCOS)

When? 20 – 28 July 2017

Where? Trest, Czech Republic

For more information please visit the event website.

Finally

We would like to thank the following persons for their contributions for this BioNanoNet newsletter:

Dr. Carolin Auer, Medical University Graz

Florian Baumgart, PhD, Institute of Applied Physics, Vienna University of Technology

Dr. Martin Joksch, Siemens AG Austria

DI Dr. Andreas Klug, NTC Weiz

Dr.in Elke Kraker, Materials Center Leoben GmbH

Prof. Silvan Schmid, Technische Universität Wien, Institute of Sensor and Actuator Systems

Prof. Dr. Gerhard J. Schütz, Institute of Applied Physics, Vienna University of Technology

Dr. Moritz Theisen, Graz University of Technology & Wissenstransferzentrum Süd (WTZ-Süd)

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

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Our next BioNanoNet newsletter will be published in September 2016.

BioNanoNet partners are welcome to send their contributions until 12th of September 2016!