

BIO \_\_\_\_\_  
NANONET

# NEWSLETTER

04/2016

December 2016

The BioNanoNet team wishes you  
a Merry Christmas,  
relaxing holidays and a healthy,  
joyful and prosperous  
New Year!



*The BioNanoNet office will be closed from  
23<sup>rd</sup> of December, 2016 until 8<sup>th</sup> of January, 2017!*

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### Conference calendar

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## Editorial - *Contemporary issues from the network*

Dear Ladies and Gentlemen,

the final days of each year are likely to be used for recap and outlook. 2016 was the year of BioNanoNet's tenth business anniversary and we are very happy that significant milestones could be reached. As one of the most important development of BioNanoNet for the future, we like to highlight the following:

- SusChem-AT: After the foundation of Austrian National Technology Platform on Sustainable Chemistry in 2015, this year, the strategic board was installed and first strategic activities started e.g. preparation of strategic topics for future European calls. The efforts dedicated to SusChem-AT-activities will support Austrian research and development to be involved in the following up on important topics in the main areas of sustainable chemistry (e.g. sustainable bio-economy, ICT for processes, water, catalysis and processes, and materials for energy). By opening our doors towards process oriented research and development, SusChem-AT aims to become a well-positioned NTP in Europe to strongly contribute to shaping the European strategies in the aforementioned thematic areas.

On the scientific-technical side, our team could successfully support more than 10 proposals which have been submitted end of October. Furthermore, our team supported the preparation of ideas for the forthcoming national call "Production of the future". It can be mentioned that the Austrian research community benefits from the community-efforts initiated and continuously maintained by our network team. Based on the independent non-profit position, our organisation grows step by step towards a multi-technology network, bringing together the different key enabling technologies (KETs) in one community to develop and enable scientific solutions addressing societal needs. The future vision is to step forward becoming a network using cross-KETs-synergies to increase the strength and visibility of research in Austria and beyond. We are open for your ideas on collaboration and will highly welcome to create synergies with you by connecting technology oriented research communities.

Sincerely,

BioNanoNet-team

## BioNanoNet *news*

### New BioNanoNet members

It is a pleasure to welcome our new BioNanoNet members:

#### Silver member:

- [PAYER Medical GmbH](#)

#### Standard members:

- [Department of Environmental Geosciences, Faculty of Earth Sciences, Geography and Astronomy, University of Vienna](#)
- [GENSPEED Biotech GmbH](#)

#### Extraordinary member:

- [Laboratory for Biological Characterisation of Advanced Materials \(LBCAM\), Institute of Molecular Medicine, Trinity College Dublin](#)

# Invitation to the Nano World Cancer Day 2017



**Nano World Cancer Day**  
Researchers? Entrepreneurs? Clinicians?  
Join us to educate & raise attention to Nanomedicine!



**February 2nd, 2017**

**Simultaneous press conferences in Europe**

For the 4th year, the main European actors of Nanomedicine will present the latest innovations in Nanomedicine for oncology

NWCD2017 is an Austrian Event taking place in Graz.  
For further information see [www.nwcd.eu](http://www.nwcd.eu)



**#NWCD2017**



**February 2<sup>nd</sup>, 2017, 10:00 – 12:00 in Graz,  
on the premises of Medical University of Graz**

Download [NWCD2017 invitation](#)

The Nano World Cancer Day is a worldwide event organized in the framework of the World Cancer Day (February 4th). Its main objective is to raise the public awareness about Nanomedicine and its ability to introduce new opportunities and game changers in the fight against cancer. Simultaneous press conferences will be organized in several countries all around the World. The event addresses public and targeted media, but also more specific audience including clinicians, scientist, students, etc.

Nanomedicine has the power to create a paradigm shift by changing the way diseases are treated. Indeed, oncology is the area benefitting from the most advanced developments, including earlier diagnosis, more efficient drug delivery in tumor, more efficient radiotherapy

treatments with active nanoparticles, nano-surgery, etc. But it remains an area of significant unmet medical needs – resources dedicated to fund this development are needed to create benefit for the patients and society.

The conferences of the NWCD are a unique opportunity to enlighten the public about the benefits of Nanomedicine for cancer patients. They will also provide information about the European Technology Platform of Nanomedicine, NanoMedicine-Austria and its activities in structuring and federating the Nanomedicine community, helping concretely very innovative projects to reach markets and thus patients.



## BioNanoNet *member presentation*

# Department for Health Sciences and Biomedicine, Donau University Krems



In their everyday work health professionals have to deal with a number of considerable challenges arising from the developments in modern health systems. With research as well as teaching the Faculty of Health and Medicine at the Danube University Krems provides expert support in facing these challenges. A sustainable contribution to this task comes from the Department of Health Sciences and Biomedicine, the largest department of the faculty in view of its range of courses as well as research activities. At present the department's issues are carried out in nine highly specialized centers:

- Center for Biomedical Technology
- Center for Regenerative Medicine and Orthopedics
- Center for Integrated Sensor Systems
- Center for PhD Studies
- Center for Geriatric Medicine and Geriatric Care
- Center for Management in Healthcare
- Center for Traditional Chinese Medicine and Complementary Medicine
- Center for Medical Specialisations
- Center for Interdisciplinary Dentistry

Currently there are 114 people working at the department, including the professorships for:

- Applied Biochemistry: Univ.-Prof. DI Dr. Viktoria Weber
- Management in Healthcare: Univ.-Prof. Dr. Gottfried Haber
- Organ and Tissue Replacement: Univ.-Prof. Dr. Michael Fischer
- Tissue Engineering: Univ.-Prof. Dr. Stefan Nehrer
- Translation of Biomedical Innovations: Univ.-Prof. Dr. Emanuele Gatti
- Traumatology: Univ.-Prof. Dr. Thomas Klestil

### **Innovation, quality and societal impact**

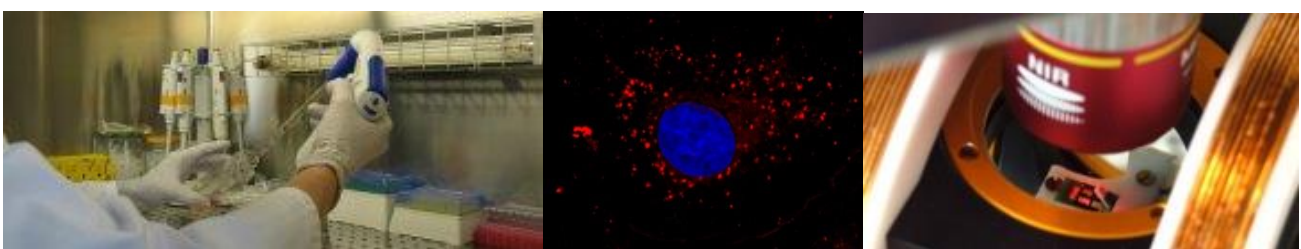
With both research and teaching the Department of Health Sciences and Biomedicine strives to ensure the three guiding principles of the Danube University Krems: innovation, quality and societal impact. Therefore the post graduate study programs offered by the department consider not only the practical needs of health professionals but also up to date

specialized knowledge. Needless to say that the department’s curriculum is permanently adapted to current developments. At present its emphasis is on regenerative medicine and orthopedics, management and technology in healthcare, medical specialisations such as physiotherapy, ergotherapy and logopaedics, geriatric medicine and geriatric care, traditional Chinese medicine, complementary medicine and interdisciplinary dentistry. A novelty in the range is the PhD-program in regenerative medicine, which started with this year’s summer semester.

**Research for human health**

Practical relevance and applicability is also of central concern for the research team at the Department of Health Sciences and Biomedicine. Therefore most of the research work is carried out in collaboration not only with academic but also industrial partners. Thanks to close cooperations with hospitals the results of research can be directly transferred into clinical use. The research and development activities of the department are internationally highly acknowledged and concentrate on regenerative medicine, biomedical technology and sensor systems as well as technology. Many of the projects are funded by the EU (Horizon 2020), the Christian Doppler Research Association (CDG), the Austrian Science Fund (FWF), the Austrian Research Promotion Agency (FFG) or the Government of Lower Austria.

**Main topics of current research**



**Regenerative medicine for the musculoskeletal system:**

- Tissue engineering
- Allografts
- Stem cells

Contact: **Univ.-Prof. Dr. Stefan Nehrer**

**Extracorporeal blood purification and apheresis:**

- Adsorbent-based technologies
- Blood compatible materials
- Anticoagulation

Contact: **Univ.-Prof. DI Dr. Viktoria Weber**



**Sensor systems for the health, environmental and industrial sector:**

- Micro and nano sensors
- Modeling and simulation
- Distributed systems and sensor networks
- Water and environmental sensors

Contact: **Priv.-Doz. Dr. Hubert Brückl**

**Inflammation and sepsis:**

- Cell culture models
- Microvesicles
- Point-of-care diagnostics
- Personalized therapy

Contact: **Univ.-Prof. DI Dr. Viktoria Weber, Univ.-Prof. Dr. Michael Fischer**

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**Univ.-Prof. Dr. Stefan Nehrer**, Head of the Department of Health Sciences and Biomedicine, Head of the Faculty for Health and Medicine: [stefan.nehrer@donau-uni.ac.at](mailto:stefan.nehrer@donau-uni.ac.at)

## *Member contributions*

### ***BioNanoNet Member Contribution of Graz University of Technology***



## **Surface Modification of Titanium Alloys for Biomedical Application**

Human life expectancy has been continuously increasing in the last decades in the whole world. Bones become more fragile due to a loss of mass and density over time, increasing the probability of fracture.

Furthermore, the fixation of complex fractures drives the need to continue to improve orthopaedic devices. Metallic materials such as austenitic steel, cobalt chromium alloy and titanium and titanium alloys are the big players in such application. Titanium and titanium alloys for orthopaedic devices have higher corrosion resistance, excellent mechanical properties and biocompatibility and lower elastic modulus than the other metals used. But two major challenges need to be overcome. On one hand fast osseointegration – molecular connection between implant and human tissue – the key role is the interface between the implant material and the tissue. On the other hand, a reduction of the elastic modulus to prevent bone regression – also called “stress shielding”.

### **Interface implant material and human tissue**

A stable and fast bone anchorage is not only desired to ensure a fast mobility of the patient after surgery, it also prevents postoperative inflammation, which is one of the most common complications. However, despite the benefits in the tissue compatibility of modern biomaterials, surface quality of implant materials still needs to be improved. Recent research requires multi scale topographies to act at different biological levels to permit faster osseointegration. To fulfil these requirements, the electron beam process seems to be a promising technique. Due to the interaction of the high-energy focused electron beam (EB) with the surface of the implant material, the material becomes locally molten. The molten mate-

rial can easily be moved along the surface due to the deflection of the electron beam according to coordinate points. The electron beam surface structures can be produced without fill material at micro and macro meter scale. The electron beam surface structuring not only changes the topography of the surface, it also changes the mechanical properties in correlation to the material, the design and the process parameters. The results represent different surface topographies and surface roughness which act at different biological levels and suggest an increase of interlocking capacity between implant and bony bed.

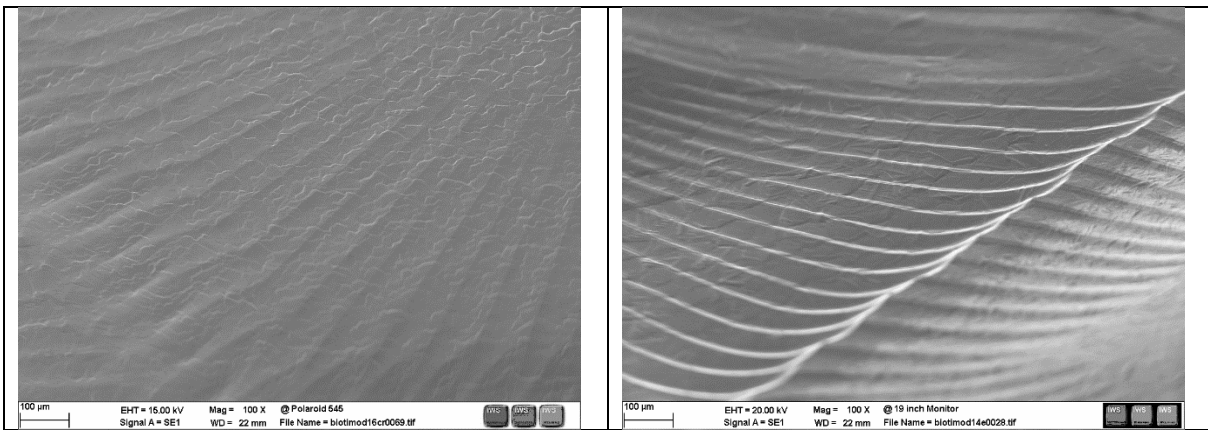


Figure 1: © IWS; TU Graz; Electron-beam structuring on titanium alloy (left: Ti6Al4V; right: TiGr2).

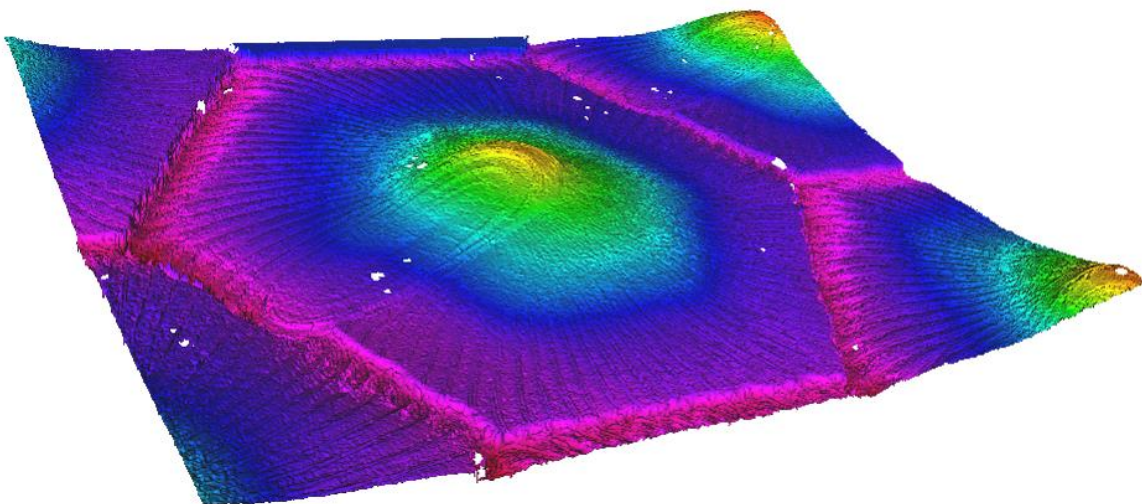


Figure 2: © IWS; TU Graz; Analysis of the topography on an electron-beam structured titanium specimen (Alicona measurement).

## Material

Three different titanium alloys (commercial pure TiGr2,  $\alpha+\beta$  alloy Ti6Al4V and metastable  $\beta$  alloy Ti15Mo) were successfully investigated using the electron beam structuring process. TiGr2 and Ti6Al4V are already used for orthopaedic devices. The wear resistance of the Ti6Al4V alloy in particular is critical due to the fact that ion release in the body can lead to health problems. For this, the combination of electron beam process and rapid cooling increased the hardness of such alloys in the surface area, thus suggesting an improvement in wear resistance. The new and promising metastable  $\beta$  alloy (Ti15Mo) highlights the advantage of lower elastic modulus similar to human bone compared to commercial pure TiGr2, Ti6Al4V and a chemical composition with nontoxic elements. The mechanical properties of these alloys are related to their microstructure and they can be altered by thermo-mechanical processes.

## Cell experiments

In vitro investigations with bone-like cells were performed between 6 to 72h of cultivation time. The cells were uniformly spread on different types of surface structures and showed polygonal morphology (*Figure 3*). Furthermore, a higher cell spreading area on the electron-beam structured surface was detected.

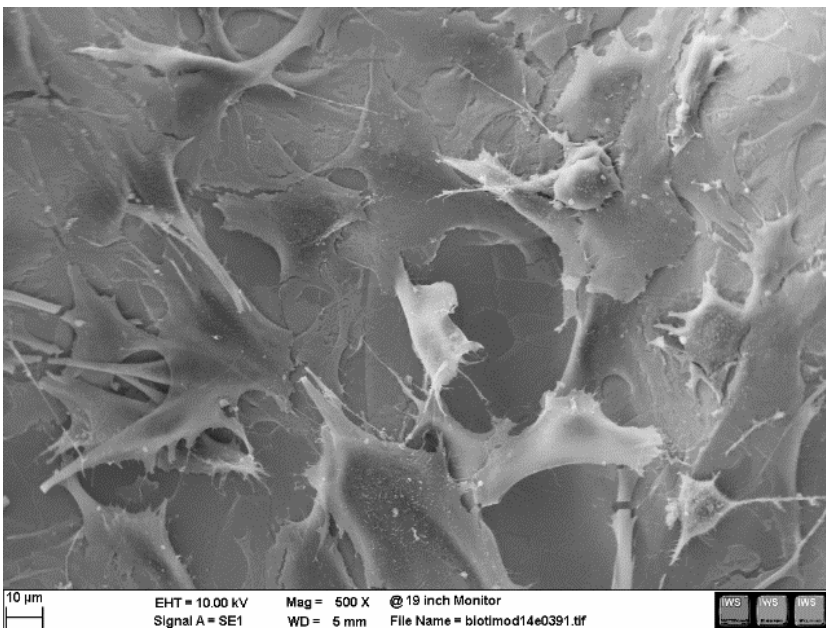


Figure 3: © IWS; TU Graz; Bone-like cells on the surface of a structured titanium alloy after 24hs cultivation.

## **Project**

Due to the Bio TiMod project, which was carried out in the framework of “HTI:Tech\_for\_Med” in cooperation with the Department of Orthopaedic Surgery at the Medical University of Graz, not only a well-founded knowledge of the electron-beam structuring process could be developed, but also the influence of surface structuring on cell growth on biomaterials in vitro was able to be investigated.

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***BioNanoNet Member Contribution of  
Graz University of Technology***



## **Smart artificial skin: ERC grant for researcher at Graz University of Technology**

**Anna Maria Coclite is the first woman to be awarded an ERC Starting Grant at TU Graz. Her research project deals with developing a hybrid material to produce an artificial skin with multi-responsive sensors.**

Skin is one of the main human sensory organs. Through our skin we feel humidity, temperature and pressure – sensory impressions which are passed on to our brains as signals. The technological imitation of a system such as human skin and its information processing presents an enormous challenge to the technology of intelligent materials. This challenge is being met by chemist Anna Maria Coclite from the Institute of Solid State Physics at TU Graz, who is receiving a grant from the European Research Council to the amount of 1.5m euros for her research project to develop smart artificial skin.

### **More sensitive than fingertips**

The aim of Anna Maria Coclite's ERC-sponsored project "Smart Core" is to develop a hybrid material which can perceive temperature, humidity and pressure simultaneously and react accordingly. State-of-the-art materials currently include three different sensors for the perception and transmission of individual stimuli. The three-in-one hybrid material which Coclite and her team will work on simplifies the sensors of artificial skin and can increase sensory resolution 20-fold in comparison to human skin. This hugely increased sensory resolution of the novel hybrid material is achieved using a variety of nanorods on a surface. The "smart core" of these nanorods, hence the name of the project, consists of a polymer which responds to temperature and humidity by expanding. The change in thickness of the polymer exerts pressure on its shell, i.e. the nanorods, and these react sensitively to the pressure and in turn trigger stimuli. The hybrid material will achieve some 2,000 sensors

per square millimetre, and thus spatial resolutions far below one millimetre, which corresponds to that of the human fingertip.

### **Towards a novel hybrid material**

Delighted with the award of the ERC grant, Coclite explains: “This grant will allow us to use a new method to develop a completely novel material, which reacts simultaneously to multiple stimuli and which can be used as an artificial skin for a wide range of applications. The success of ‘Smart Core’ will significantly influence disciplines such as biotechnology, biological sensors and tissue engineering.” To develop this hybrid material Coclite uses the initiated chemical vapor deposition method (iCVD), which was developed at the Massachusetts Institute of Technology. Coclite combines this with the atomic layer deposition method (ALD). The development of the iCVD method, which Coclite brought from the USA to TU Graz and which is in use only in four universities in Europe, enables the necessary material manipulations to be carried out on the nanoscale. Further research results from the “Smart Core” project will also include knowledge of the production of nanocomposite materials for a wide variety of applications, such as sensitive materials, formulation of drugs, membranes and sensors as well as alternative ways of controlling the chemical properties and molecular arrangement of polymers using the chemical vapor deposition method.

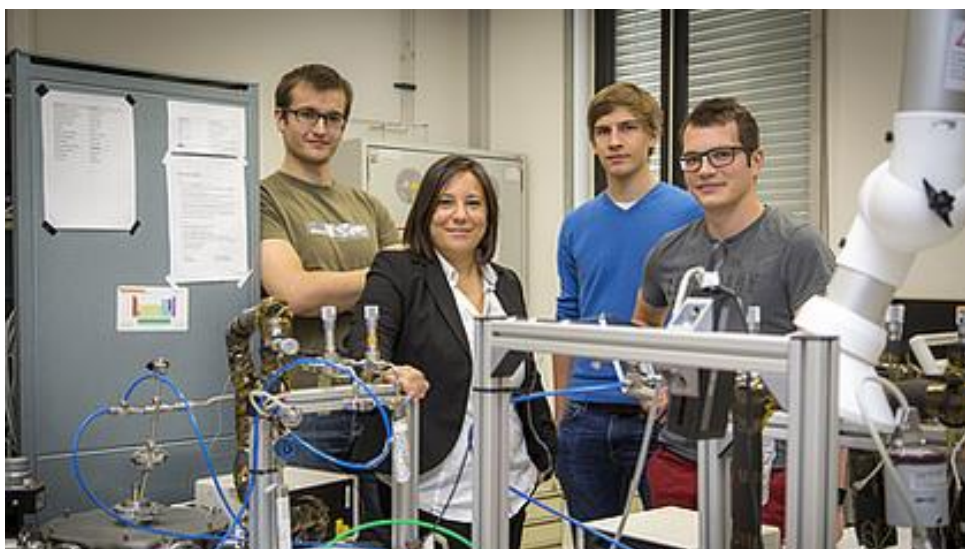
### **Ass.Prof. Dr. Anna Maria Coclite**

Anna Maria Coclite is an assistant professor at TU Graz’s Institute of Solid State Physics and heads the CVD (Chemical Vapor Deposition) lab of the Institute. Coclite studied chemistry at the University of Bari, her home city. After obtaining her doctorate in 2010, she worked as a post-doc at the Massachusetts Institute of Technology (MIT) in Boston before coming to TU Graz in 2013. Anna Maria Coclite received a Marie Curie Fellowship for the *Three-S* project in 2014 and in the same year she was awarded a research grant for the *Pro-CVD* project by the Austrian Science Fund. On top of this, she has also received seed funding from TU Graz for various submitted projects. Anna Maria Coclite’s research area is in materials science and especially in the CVD method (Chemical Vapor Deposition) for treating materials at the nanolevel, which she brought back to Europe from MIT and which she is continuing to develop at TU Graz. Anna Maria Coclite is not only the first researcher

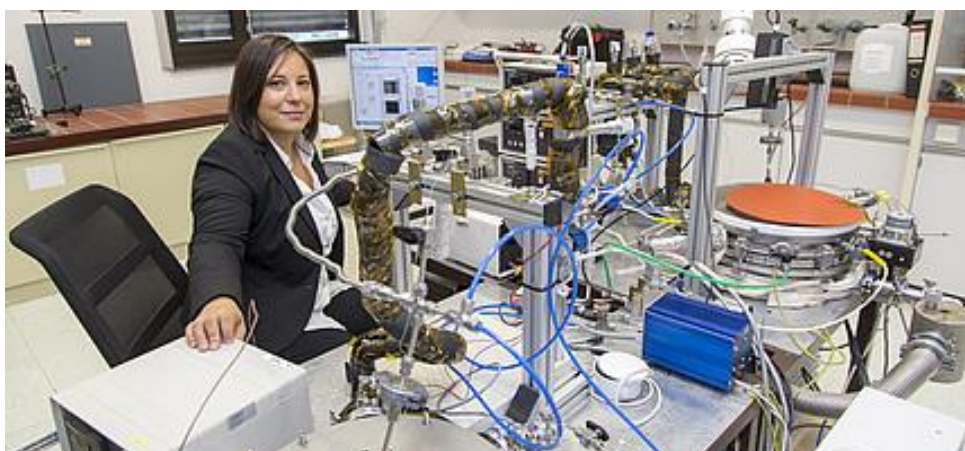
to receive an ERC Starting Grant at the Faculty of Mathematics, Physics and Geodesy, but she is the first woman at all to receive an ERC Starting Grant at TU Graz.

## CONTACT

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Anna Maria Coclite with members of her research team, from left to right: Martin Tazreiter, Anna Maria Coclite, Paul Christian and Stephan Tumphart at the CVD lab at TU Graz. © Lunghammer – TU Graz



Anna Maria Coclite in her lab at the Institute of Solid State Physics at TU Graz where the novel three-in-one hybrid material will be developed. © Lunghammer – TU Graz



## Smart Sensing - MEMS sensor platform for measuring physical properties of liquids

### Project description

There is an ongoing trend in engineering that reflects the innate human desire to continuously increase the size and power of human creations, be it bigger and safer buildings or more powerful and more efficient engines. This development is accompanied and supported by the opposite trend of miniaturisation. Sensor networks consisting of small micro electromechanical systems (MEMS) on areas of only a few square millimetres each are integrated into large scale structures and provide sensor information about the structural health of buildings or the operation conditions inside an engine, and thus enable to further push the envelope of the possible.

At TU Wien, a unique **micro sensor platform** has been developed to accurately measure the physical properties density and viscosity of liquids (see figure 1 and figure 2). The sensor consists of a mechanical one side clamped beam structure and is mechanically excited into **resonance** with a **piezoelectric aluminium nitride** (AlN) transducer stack on top. When immersed in a liquid, the dissipation of the kinetic energy and thus the damping behaviour of the resonating beam changes. This change in the damping is the sensor signal from which the liquid properties density and viscosity can be derived. A **sophisticated electrical** actuation method further allows the excitation of specifically shaped resonance modes, which feature good measurement signals even in highly viscous liquids (e.g. engine lubricants).

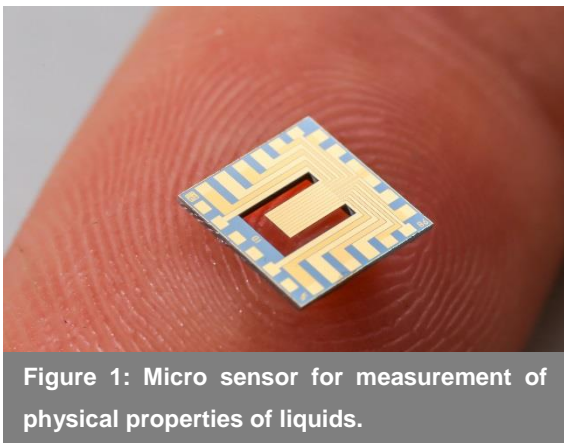


Figure 1: Micro sensor for measurement of physical properties of liquids.

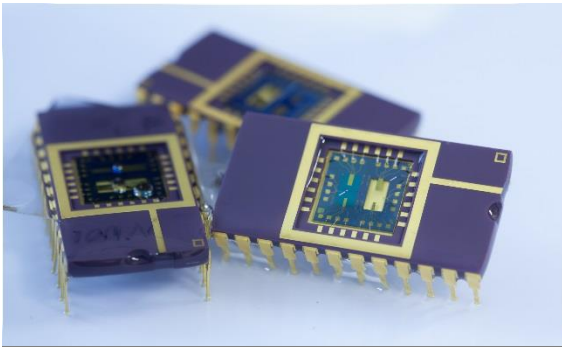


Figure 2: Micro sensor in package.

### Fabrication

The fabrication of these micro sensors was done entirely **in-house** in the cleanroom facilities at the Institute of Sensor and Actuator Systems (ISAS) at TU Wien. Modern processing technologies including reactive sputter deposition of the piezoelectric AlN thin films and deep reactive ion etching (DRIE) for micro structuring of the silicon substrate have been employed to achieve the targeted device performance. The inclusion of aluminium nitride as the piezoelectric material of choice in combination with standard metals like chromium and gold for the electrodes assures **compatibility with standard CMOS** fabrication technologies. This will allow the transfer of this technology platform to industrial or small scale fabrication lines with relative ease, which will enable future cost-efficient production of significant quantities of those sensors. The manufacturing layers as well as a processed wafer are depicted in figure 3 and figure 4.

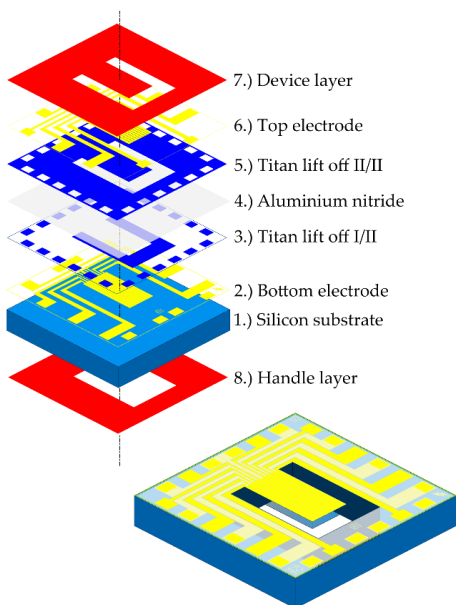


Figure 3: Manufacturing layers of a single die.

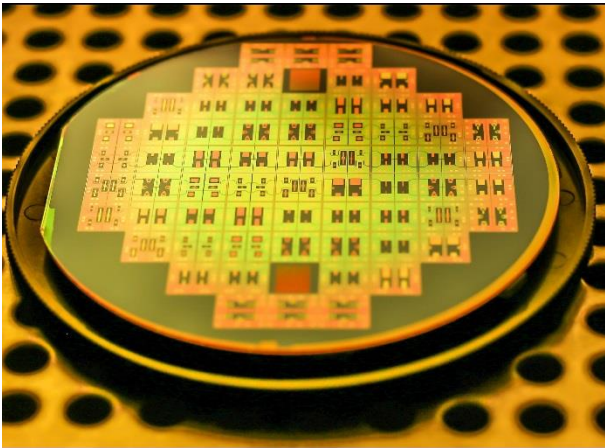


Figure 4: Finished wafer.

### Monitoring of wine fermentation process

One possible use case of this sensor is the online monitoring of the fermentation process in grape must for the fabrication of wine. During this process, yeast converts the sugar in the grapes into ethanol. This is a delicate chemical reaction, which under the wrong conditions can result in a stuck fermentation, in which the sugar is not converted correctly into ethanol, resulting in a much lower final ethanol concentration. This renders the end product unusable and incentivises a measurement procedure to detect this stuck fermentation in its early stages. The sensor developed at ISAS has been shown to be capable of **measuring the change in density** during the fermentation process caused by the changing chemical composition and to discern between stuck and ordinary fermentation at very early stages. These results have been presented at the conference “*Miniaturized Systems for Chemistry and Life Sciences 2016*” in Dublin, Ireland. The sensor is shown in figure 5.

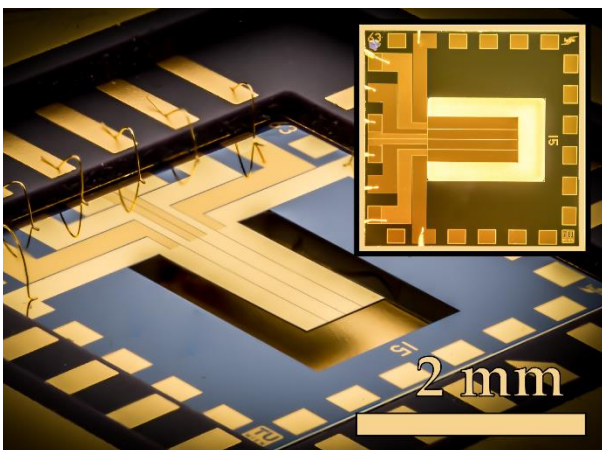


Figure 4: MEMS Sensor for monitoring of the wine fermentation process.

## Condition monitoring of engine oils

Large amounts of waste oils are disposed of on a yearly basis due to periodical oil changes in cars. By moving from schedule based oil changes to an on-demand approach, the amount of waste oil could be substantially decreased. This requires a condition monitoring of the oil quality, which can be achieved by an “on-board” monitoring solution. This is the most promising approach to avoid expensive measurement procedures like viscometers or sedimentation analysis.

The sensor developed at ISAS is capable of monitoring the physical properties density and viscosity of highly viscous oils **up to a temperature of 100°C**. The journal contribution featuring this sensor was awarded one of the “*Highlights of the year 2015*” by the renowned *Journal of Micromechanics and Microengineering*. The sensor is shown in figure 6.

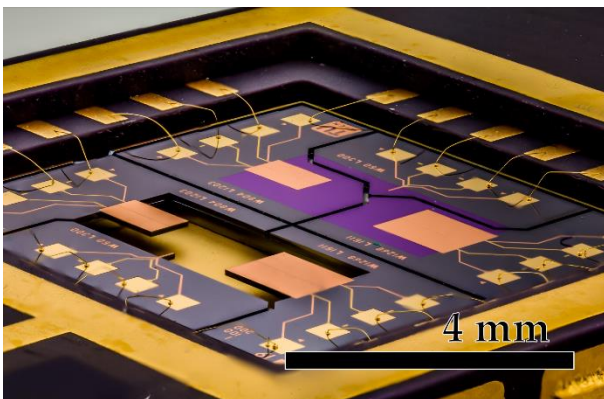


Figure 5: MEMS Sensor for condition monitoring of highly viscous oils.

## CONTACT

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**BioNanoNet Member Contribution of  
Technische Universität Wien**



## Multiphoton Lithography: Techniques, Materials, and Applications

Jürgen Stampfl, Robert Liska, Aleksandr Ovsianikov (Eds.)

John Wiley & Sons, Inc. (2016)

ISBN: 978-3-527-33717-0

Since its first demonstration almost two decades ago, multiphoton lithography has come a long way. The progress in this field is evidenced by a tremendous number of publications by research groups all around the globe. Featuring the preface by one of the pioneers in the field Prof. Kawata, the book “Multiphoton Lithography: Techniques, Materials, and Applications” is written with both beginners and professionals in mind. It provides a comprehensive overview of the state of the art in the field and also gives indications where the journey is heading towards. A team of leading international experts from Asia, Europe and the Americas, reviews the latest research results on such materials as new photoinitiators, hybrid photopolymers, and metallic carbon nanotube composites. They also cover promising applications and prospective trends, including photonic crystals, microfluidic devices, biological scaffolds, metamaterials, waveguides, and functionalized hydrogels.

By bringing together the essentials for both industrial and academic researchers, this is an invaluable companion for materials scientists, polymer chemists, surface chemists, surface physicists, biophysicists, and medical scientists working with 3D micro- and nanostructures.

Link to the book “Multiphoton Lithography: Techniques, Materials, and Applications”:

<http://eu.wiley.com/WileyCDA/WileyTitle/productCd-3527337172.html>

### ORGANISATION

TU Wien (Technische Universität Wien)

Additive Manufacturing Technologies (AMT) Group: <http://amt.tuwien.ac.at/>

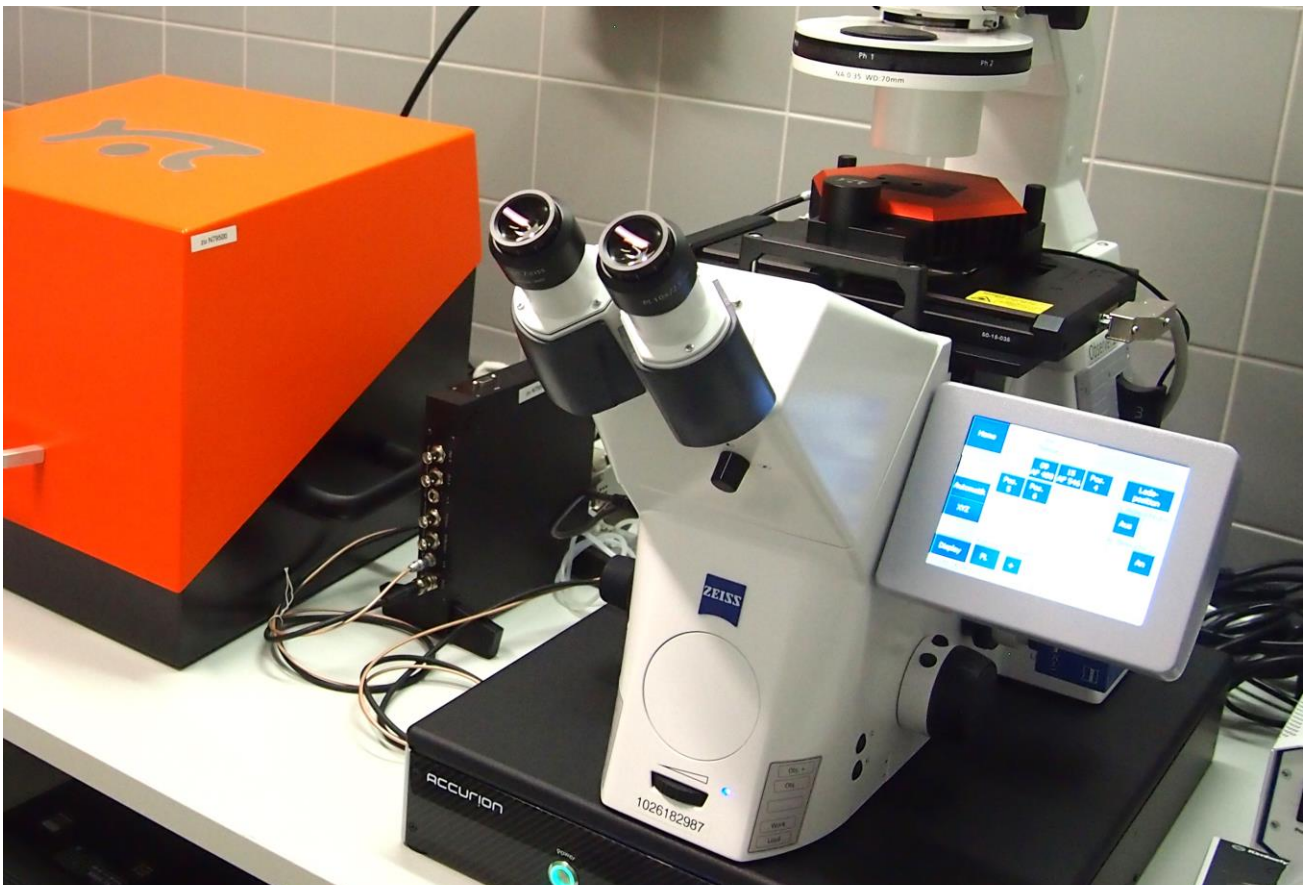
## **BioNanoNet Member Contribution of Medical University of Graz**



Medizinische Universität Graz

### **Atomic Force Microscope: Resolution in the nanometer range – New research device for BioTechMed-Graz**

As of now, the Center for Medical Research (ZMF) at the Medical University of Graz is equipped with the new and powerful atomic force microscope (AFM). This microscope, of course, is available to all BioTechMed-Graz researchers. AFM offers resolution in the nanometer range and manipulation of single cells. In line with a symposium that took place on November 23<sup>rd</sup>, this innovative feature was presented to the public.



New and powerful atomic force microscope (AFM)

© Medical University Graz

## **AFM: A novelty in the research landscape of Graz**

AFM enables the resolution of cellular surfaces in the nanometer range. In doing so, the microscope scans the surface line by line and forms images. For the first time, researchers of BioTechMed-Graz also have access to this device. “In the examination of sample surfaces the AFM-technique has been used for quite some time. But now it can also be used for surface imaging, force measurement, and cell manipulation”, says Prof. Dr. Eleonore Fröhlich, Core Facility Imaging, Center for Medical Research, Medical University of Graz.

This unique equipment is a novelty in Graz and offers versatile applications. Especially in the field of cell examination, AFM is an invaluable enrichment to the research landscape of Graz because both sampling and injection into cells directly under the microscope are possible.

Furthermore, AFM enables the combination of different imaging processes like fluorescent-microscopic images and surface mapping. “Now we are able to determine precise cell characteristics such as the texture which was only possible to a limited extent with other techniques. In addition, the cell content (and also cytophysiology) can be precisely determined, characterized and manipulated, as substances will be injected into cells or samples will be taken from the cells”, outlines Eleonore Fröhlich the vast field of application of AFM. Also important is the fact that now it is possible to determine the adhesion of cells to substrates or the binding of molecules and particles to cell surfaces.

The atomic force microscope has been purchased for EUR 390,000 and is available to all BioTechMed-Graz members for their scientific work. And it is not surprising at all that the AFM will be used in the broad field of cancer research. One possible application could be the diagnosis of biopsies to distinguish tumor cells from healthy ones. Actually, there are various BioTechMed-Graz research projects under way and the AFM is supposed to contribute significantly to the success of these projects.

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## **BioNanoNet Member Contribution of Materials Center Leoben**



# **Smart Multi Sensor Systems – the key to highly innovative solutions meeting societal needs with great impact for Safety, Health, and Environment**

EU FP7-Project “MSP - Multi Sensor System for Smart Building Management” coordinated by MCL



The Materials Center Leoben (MCL), an Austrian COMET K2 Competence Centre, is coordinating since September 2013 the EU FP7 Project “MSP - Multi Sensor Platform for Smart Building Management” (FP7-ICT-2013-10, Project # 611887). The € 18.5 million project has the objective of strengthening the leadership of European industries in the highly competitive area of smart sensing systems in building management and mobile applications.

### **MSP contributes to solving a worldwide problem**

Air pollution is a major environmental risk to health affecting everyone in developed and developing countries alike. Key facts are that urban outdoor air pollution is estimated to cause 1.3 million deaths worldwide per year. Indoor air pollution is estimated to cause approximately 2 million premature deaths mostly in developing countries and is supposed to pose a risk to the health of over half of the world’s population. However, exposure to air pollutants is definitely beyond the control of individuals. Up to now there is no system on the market for personal monitoring of the air and screening potential environmental health hazards.

The goal of the MSP-project is the development of a novel 3D-integrated multi-sensor system which contributes in solving this enormous societal problem. The MSP-multi sensor system features a worldwide unique combination of environmental sensors capable of de-



tecting harmful and toxic gases, to sense particulate matter and ultrafine particles, to detect infrared, visible, and ultraviolet light, and to measure temperature and humidity. With respect to sensor networks capable for IoT applications a wireless system is being developed to achieve best-in-class performance at world's lowest power consumption.

### Nanotechnology sensors meet conventional electronics

The aim of the MSP project is to develop highly competitive production technologies enabling flexible integration of nanotechnology based sensors with conventional electronic chips. This is a ground-breaking approach, because nanosensors will be the game changers in environmental monitoring and will open entirely new applications for smart building management and lifestyle products such as smartphones. The multi-sensor system approach will pave the way for worldwide deployment of wireless sensor networks with a great impact on health and well-being, environmental monitoring, safety and security.

The MSP project comprises 17 partners from 6 different countries who constitute a consortium capable for developing the first 3D-integrated multi-sensor system featuring a worldwide unique combination of highly sophisticated sensor devices.

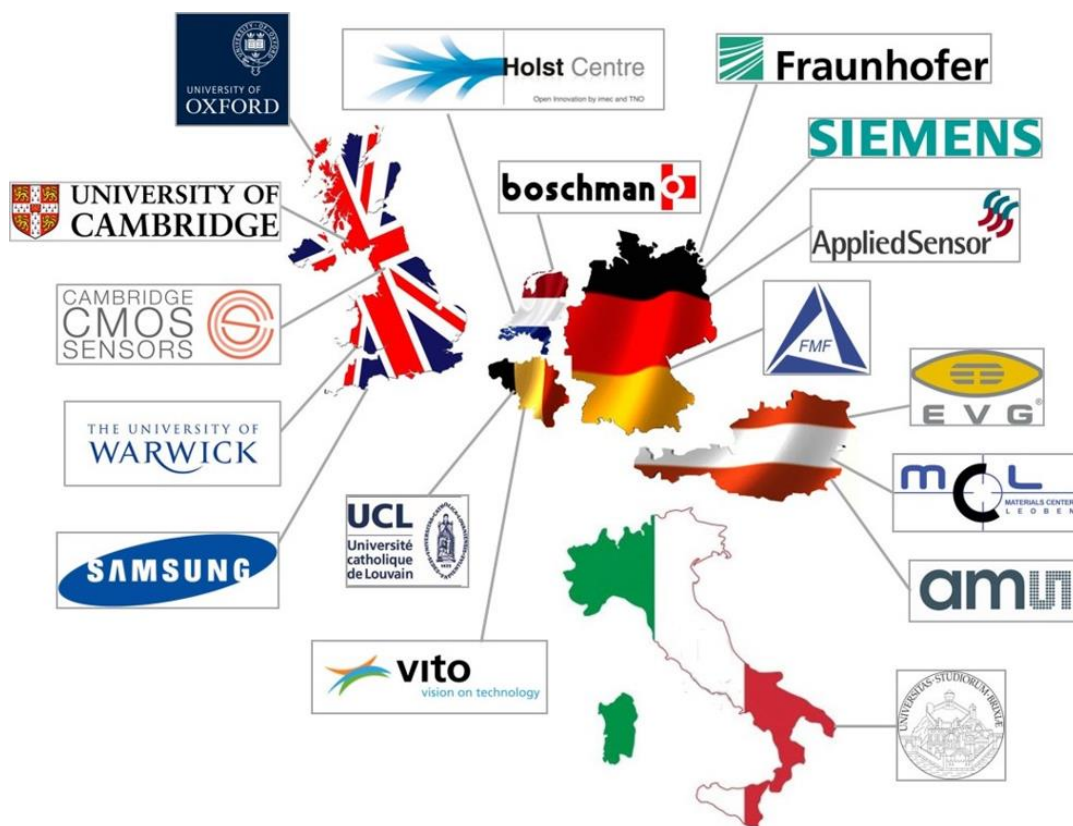


Figure 1: Partner network of the MSP project

## New environmental sensing and warning applications in smartphones

One major goal is to implement multi-sensor systems directly into smartphones for making people aware of harmful environmental situations which may negatively affect personal health. A gas sensor for carbon monoxide can provide warning of a defective heating system and an increased or even deadly CO concentration - a potential source of danger in millions of households worldwide! Nitrogen dioxide, ozone or particle sensors can be used to monitor air quality and warn people of adverse conditions, support athletes in planning outdoor training or assist cyclists in choosing the healthiest routes.

### The MSP-Project at the European Nanoelectronics Forum 2016 in Rome

This year the MSP project was exhibited among more than 60 projects from FP7/H2020, ECSEL, and EUREKA Clusters in the Project Village (Exhibition area) of the European Nanoelectronics Forum (ENF), 23<sup>rd</sup> – 24<sup>th</sup> November 2016, in Rome. With a history that dates back to 2001, the annual ENF event is important for micro- and nanoelectronics stakeholders, from industry and research institutes to academics and policy makers. Each year, the Forum attracts around 300 participants to learn about the latest innovations and industry trends, as well as to get updates on policy developments, European strategies and collaborative funding programmes. The 2016 edition was co-organised by AENEAS, CATRENE, ECSEL, the European Commission and PENTA with the theme of Innovation along the Value Chain.

The 2016 ENF project village was a perfect opportunity to present the major results achieved within the MSP project. Three posters were presented at the booth (Fig.2) to provide an overview of the project goals and achievements.



Figure 2: The MSP booth in the ENF Project Village.

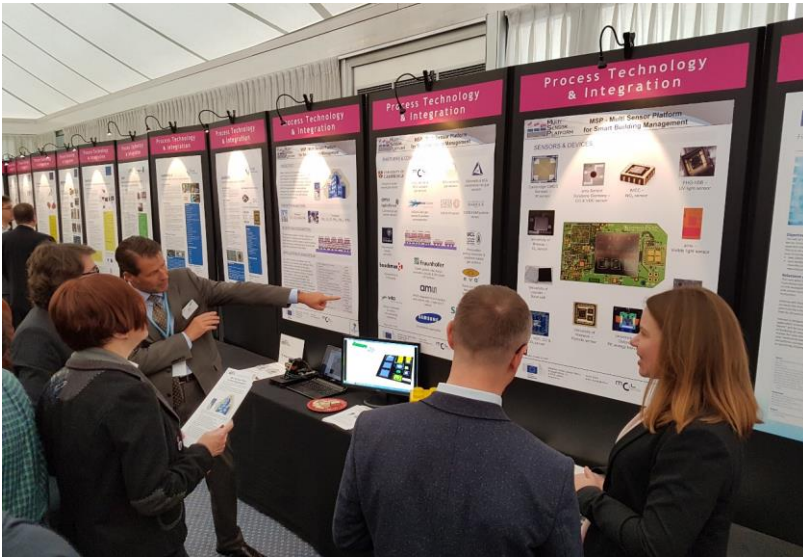


Figure 3: Rob van Schaik (IMEC) and Anton Köck (MCL) explaining the MSP-project.

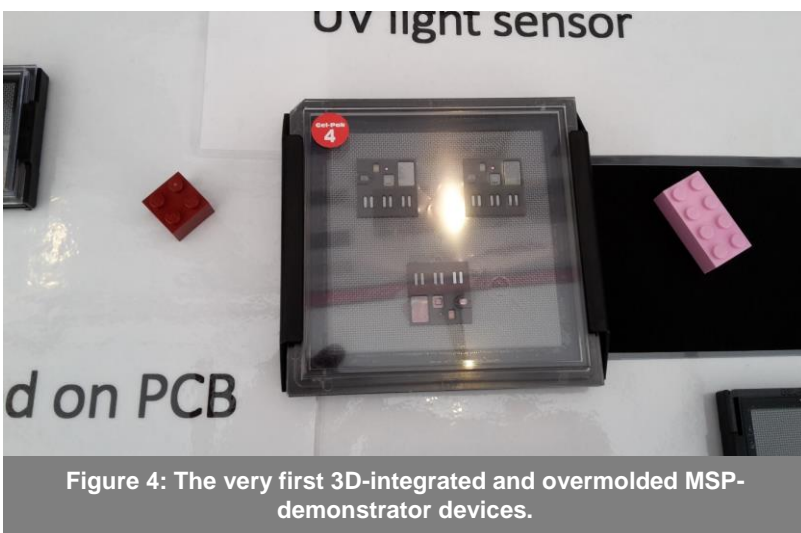


Figure 4: The very first 3D-integrated and overmolded MSP-demonstrator devices.

A video demonstration supported the exhibition by presenting the “Lego-like” plug-and-play tool-box enabling flexible 3D-integration of sophisticated sensor devices to customer specific smart systems that can address industrial and consumer electronic applications.

The booth of the MSP consortium showed the full variety of sensor devices being 3D-integrated on a platform chip (2 x 2cm<sup>2</sup>) to the multi-sensor system:

- Gas sensors based on ultrathin films, nanowires and nanoparticles for detection of CO, CO<sub>2</sub>, O<sub>3</sub> and VOCs
- A unique AlGaIn/GaN sensor for NO<sub>2</sub>
- A worldwide unique CMOS micro-hotplate array for 16 gas sensors on a single chip
- Humidity sensor based on graphene oxide

- A sensor for detection of particle and ultrafine dust
- A sensor for visible light and a calibrated temperature sensor
- A thermopile-based sensor for infrared light
- A SiC-sensor for ultraviolet light (UV-A/B)
- A photovoltaic energy harvester with interdigitated back contact structure
- A piezoelectric energy harvester based on PVDF-films
- The CMOS platform chip containing the required circuitry
- A very first 3D-integrated and overmolded MSP-demonstrator device.

As particular highlight the newly designed wristband device from IMEC being the wearable demonstrator of the MSP project has been presented. In addition a piezoelectric energy harvester demonstrator has been setup at the MSP-booth.



Figure 5: The the newly designed wristband device from IMEC for the wearable demonstrator.

## CONTACT

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<http://www.multisensorplatform.eu/>

## **About Materials Center Leoben (MCL)**

The Materials Center Leoben Forschung GmbH (MCL) is one of the leading Austrian institutions in the field of applied Materials Science with around 150 employees. In particular, it is the coordinator of the COMET K2 Center on “Integrated research in Materials, Processing and Product Engineering (MPPE)” which focuses on the application of advanced materials science to technological aspects along the whole value chain including materials development, materials processing, fabrication of components, and the behavior of components in service.

To discover more, please visit [www.mcl.at](http://www.mcl.at).

## BioNanoNet *success stories*

### Cost Action TD1204 MODENA



Over its lifespan MODENA has achieved a great number of successes; from a small group of around 50 scientists at its inception, we ultimately completed our work with an impressive collective of 291 high calibre scientists and early stage researchers from multi-disciplinary backgrounds who worked together to make real advances in the area of nanotoxicity modelling.

As a very short summary, in the last 4 years MODENA and its scientists have:

- Held 17 meetings;
- Run 6 training schools engaging over 100 young scientists;
- Funded 35 short term scientific missions between labs across all member countries;
- Organised a conference for Young Scientists active in modelling (Syracusa 2014), and an international conference (CompNanoTox Malaga 2015);
- Published 23 peer-reviewed papers, and a book on 'modelling toxicity of nanoparticles' (due early 2017);
- Collaborated with numerous other FP7 projects, including the 5 key projects active in the area of modelling for nanomaterials; and
- Formed consortia to bid for work to develop further what MODENA started...at the current time we have over 10 proposals at various stages of application, securing future collaborations between MODENA scientists and the wider scientific community.

#### CONTACT

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## BioNanoNet *retrospect*

### Scientific Kick-Off Meeting COST Action MultiComp

***MultiComp Cost Action CA15107 - Multi-Functional Nano-Carbon Composite Materials Network***

October 19<sup>th</sup> – 20<sup>th</sup>, 2016, Heraklion, Crete

The logo for MultiComp, featuring the word "MultiComp" in a bold, sans-serif font. The letter "o" in "Comp" is replaced by a green hexagonal shape with a white dot in the center, resembling a stylized atom or a molecular structure.

The COST Action connects groups with knowledge of theory, synthesis and characterization of Nanoscale Reinforcing Component Materials (NRCMs) with groups that have experience of fabrication of composites (such as polymers and ceramics). This will make a considerable contribution to the coordination of interdisciplinary research efforts across Europe which is required in order to facilitate the fast exchange of information between different areas of expertise and application. Moreover, this Action provides an ideal platform, especially via STSM (short time scientific mission) exchanges, for permanent established researchers, post-doctoral workers and Early Career Investigators (ECIs) to enhance their research-related skills as well as their innovation and enterprise skills in this international network involving both academic and business enterprises.

**MultiComp** is built upon an integrated experimental and theoretical approach aimed at the understanding of the chemical and physical properties of nanocarbon-composites. This will open up new exciting opportunities of growth for SMEs and "spin-offs". The complexity of this effort requires a multi-technique effort: development of novel and integrated approaches for synthesis, manipulation, characterisation and engineering of nanocarbon-multifunctional composites that will promote and implement new perspectives for science and technology.

BioNanoNet is part of WG 3 – “Characterization, Health, Safety and Environment (HSE)” to bring in the experiences gained within and create synergies with nanosafety-related pilot line projects (e.g., INSPIRED). This COST Action is also a chance to initiate/create fruitful discussions (regarding toxicological and environmental studies of nanocarbon materials and composites with respect to possible health hazards) and/or valuable collaborations between MultiComp and INSPIRED-project.



Poster Session - Scientific Kick-off Meeting

COST Action MultiComp in Heraklion

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## Nano-EHS workshop

NanoEHS

### **Enabling a Sustainable Harmonised Knowledge Infrastructure supporting Nano Environmental and Health Safety Assessment.**

**October 24<sup>th</sup>, 2016, Rheinfelden, Baden-Württemberg, GERMANY**

The objective of the workshop was to facilitate networking, knowledge sharing and idea development on the requirements and implementation of a sustainable knowledge infrastructure for Nano Environmental and Health Safety Assessment and Communications. The infrastructure supported the needs required by different stakeholders including scientific researchers, industry, regulators, workers and consumers. BioNanoNet attended this workshop to bring in knowledge from EURO-NanoTox and practical needs identified within our ongoing pilot projects.

Three European Initiatives funded by H2020 and FP7 gathered their resources to jointly organize this workshop.

**BILAT USA 4.0** and its predecessor project (BILAT USA 2.0) have been supporting US-EU Dialogue in NanoEHS field since 2014 as enhancing the cooperation between scientists and other innovation actors in priority areas identified by the EC in Road Map for International Cooperation is one of the main objectives of the Projects. Nanotechnologies, Advanced Materials and Production are among these priority topics. The workshop supported European and U.S. actors in this field to further develop synergies in order to identify joint solutions to common problems in data management and ontologies.

**eNanoMapper (ENM)** proposes a computational infrastructure for toxicological data management of engineered nanomaterials (ENMs) based on open standards, ontologies and an interoperable design to enable a more effective, integrated approach to European research in nanotechnology.

**OpenTox** is the leading global open platform for predictive toxicology supported by open standards. OpenTox is a community-led effort sharing common values in the development of interoperability, transparency and extensibility in the OpenTox framework and its applica-

tions. The goal of OpenTox is to develop an interoperable predictive toxicology framework which may be used as an enabling platform for the creation of predictive toxicology applications.

The workshop also identified funding opportunities and financial models within and beyond current international and national programs. Specifically, the workshop facilitated active discussions but also identified potential partners for future EU-US cooperation on the development of knowledge infrastructure in the NanoEHS field. Advances in the Nano Safety harmonisation process, including developing an ongoing working consensus on data management and ontology, were discussed, specifically:

- Information needs of stakeholders and applications
- Data collection and management in the area of NanoEHS
- Developments in ontologies supporting NanoEHS goals
- Harmonisation efforts between EU and US programs
- Identify practice and infrastructure gaps and possible solutions
- Identify needs and solutions for different stakeholders
- Propose an overarching sustainable solution for the market and society

The presentations held by EU and US key researchers in the field of nanosafety focused on the current efforts and concrete achievements within EU and US initiatives and their potential elaboration and extension.

The workshop was organized by eNanoMapper and BILAT USA 4.0 projects and was held in conjunction with Nano Modelling workshop and the OpenTox Euro 2016 conference.



## 5<sup>th</sup> NANOSAFE International Conference – Health and Safety Issues related to Nanomaterials

November 7<sup>th</sup> – 10<sup>th</sup>, 2016, Grenoble, France



After the success of the last four conferences, the 5<sup>th</sup> edition was once again held in MINATEC Grenoble, France, from November 7<sup>th</sup> to 10<sup>th</sup>. The conference gathered about 400 attendees with the interest of discussing and sharing the major progresses/future trends in the field of health and safety issues related to nano objects.

In 2016, the Organising Committee extended the topics to urban and incidental nano objects and nanoparticles for medicine applications in addition to the usual issues addressed on previous Nanosafe conferences such as measurement and characterization of nano objects, exposure, Safer by design nanomaterials and process, release from nanoobjects and nano-enabled products, risk management, nanoproducts to waste, nano responsible development, regulation and standardisation and environmental interactions.

Being part in several nanosafety-related H2020 pilot line projects, BioNanoNet was invited to present the project INSPIRED and its corresponding nanosafety activities to the interested audience. Furthermore, within the NanoSafety Cluster meeting, BioNanoNet organized and chaired the session of “industrial innovation liaison i2L-group”, and co-chaired the session 1 “Upgrading of NSC activities”. More information about i2L-activities can be found here: [link to i2L-group](#).



Impressions from the NANOSAFE 2016 Conference in Grenoble

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## Joint Scientific Conference of ProSafe & OECD and Final Conference of NANoREG

November 28<sup>th</sup> – December 1<sup>st</sup>, 2016, Paris, France



From the 29<sup>th</sup> of November to the 1<sup>st</sup> of December, a group of 180 international experts has debated the regulatory relevance and applicability of science-based results generated over the past 10 years, regarding the Environmental, Health and Safety (EHS) aspects of nano-materials. The conference was hosted by the OECD and funded by the EU H2020 project ProSafe coordinated by the Dutch Ministry of Infrastructure and the Environment. It also was the final conference of the European Union flagship project NANoREG.

Main focus of the conference were Breakout group discussions related to regulatory relevance of new and state-of-the art research and initiatives and results in the field of nanosafety (including EU FP7 as well as Horizon 2020 research projects, but also non-EU research and activities related to OECD and ECHA) as well as considerations linked to outstanding and future regulatory challenges. In order to support successful discussions in the Breakout Groups, conference attendees were encouraged to respond to key regulatory questions related to their area of expertise (i.e., physicochemical identification and characterisation, exposure, fate and kinetics, ecological and health effects as well as testing and assessment strategies). Feedback from the key questions were used by the chairs of the corresponding Breakout Groups to promote fruitful discussions. Together with the NANoREG Regulatory Framework & Toolbox valuable key outputs will serve as a building block for the development of the will feed into a White Paper with short and long term recommendations for policy makers to be released before the summer of 2017.



Final NANoREG Conference in Paris



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## Conference Calendar

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### **spICP-MS: data analysis training Workshop**

**When?** 10 – 12 January 2017

**Where?** Wageningen, Netherlands

For more information please visit the [event website](#).

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### **Shaping the future Quantum Technology Flagship**

**When?** 18 January 2017

**Where?** Vienna, Austria

For more information please visit the [event website](#).

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### **Horizon 2020: European Health Brokerage Event in Zagreb**

**When?** 19 January 2017

**Where?** Zagreb, Croatia

For more information please visit the [event website](#).

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### **NATIONAL INFO DAY: Interreg Europe**

**When?** 19 January 2017

**Where?** Vienna, Austria

For more information please visit the [event website](#).

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### **RNA Nanotechnology and Extracellular RNA**

**When?** 21 – 22 January 2017

**Where?** Ventura, California

For more information please visit the [event website](#).

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### **Webinar: Marie Skłodowska-Curie Förderungen für Unternehmen und den nichtakademischen Sektor**

**When?** 24 January 2017, 10:00 – 11:00 a.m.

For more information please visit the [event website](#).

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### **Complex Active & Adaptive Material Systems**

**When?** 29 January – 3 February 2017

**Where?** Ventura, California

For more information please visit the [event website](#).

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### **Industry/market oriented R&D partnering event**

**When?** 31 January 2017

**Where?** Aachen, Germany

For more information please visit the [event website](#).

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### **nanoPT 2017**

**When?** 1 – 3 February 2017

**Where?** Porto, Portugal

For more information please visit the [event website](#).

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### **Nano World Cancer Day 2017**

**When?** 2 February 2017

**Where?** Graz, Austria

For more information please visit the [event website](#).

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### **Biotech and Money**

**When?** 7 – 8 February 2017

**Where?** London, Great Britain

For more information please visit the [event website](#).

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### **Final conference of the COST Action ES1205: Engineered nanomaterials from wastewater treatment & stormwater to rivers**

**When?** 7 – 8 February 2017

**Where?** Aveiro, Portugal

For more information please visit the [event website](#).

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### **2017 Malaga**

**When?** 7 – 9 February 2017

**Where?** Malaga, Spain

For more information please visit the [event website](#).

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### **2<sup>nd</sup> Biomarker Conference**

**When?** 13 – 14 February 2017

**Where?** Graz, Austria

For more information please visit the [event website](#).

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### **Nano tech 2017**

**When?** 15 – 17 February 2017

**Where?** Tokyo, Japan

For more information please visit the [event website](#).

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### **ATTD - 10<sup>th</sup> Int. Conference on Advanced Technologies & Treatments for Diabetes**

**When?** 15 – 18 February 2017

**Where?** Paris, France

For more information please visit the [event website](#).

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### **Conference on "Advances in Biological Systems & Materials Science in NanoWorld"**

**When?** 19 – 22 February 2017

**Where?** Varanasi, India

For more information please visit the [event website](#).

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### **7<sup>th</sup> Annual Congress on Materials Research and Technology**

**When?** 20 – 22 February 2017

**Where?** Berlin, Germany

For more information please visit the [event website](#).

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### **Crash-Kurs Klinisches Risikomanagement und dessen Rahmenbedingungen**

**When?** 21 February 2017

**Where?** Nürnberg, Germany

For more information please visit the [event website](#).

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### **Printed & Flexible Electronics Congress 2017**

**When?** 21 – 22 February 2017

**Where?** London, United Kingdom

For more information please visit the [event website](#).

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### **Non-Invasive Delivery of Macromolecules Conference 2017**

**When?** 21 – 24 February 2017

**Where?** San Diego, United States

For more information please visit the [event website](#).

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### **Biomarkers for Cancer Immunotherapy Symposium**

**When?** 23 – 24 February 2017

**Where?** San Francisco, United States

For more information please visit the [event website](#).

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## Nanomaterials for Applications in Energy Technology

**When?** 26 February – 3 March 2017

**Where?** Ventura, California

For more information please visit the [event website](#).

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## Society for Risk Analysis Policy Forum: Risk Governance for Key Enabling Technologies

**When?** 1 – 3 March 2017

**Where?** Venice, Italy

For more information please visit the [event website](#).

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## 10<sup>th</sup> NanoNET Meeting

**When?** 3 March 2017

**Where?** tba

For more information please visit the [event website](#).

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## 5<sup>th</sup> International Conference on Multifunctional, Hybrid and Nanomaterials

**When?** 6 - 10 March 2017

**Where?** Lisbon, Portugal

For more information please visit the [event website](#).

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## NanoSpain 2017

**When?** 7 – 10 March 2017

**Where?** San Sebastian,

For more information please visit the [event website](#).

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## NANOTEK 2017

**When?** 11 – 13 March 2017

**Where?** Hamburg, Germany

For more information please visit the [event website](#).

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## NanoImpact

**When?** 12 – 17 March 2017

**Where?** Monte Verita, Switzerland

For more information please visit the [event website](#).

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## 10<sup>th</sup> International Conference and Exhibition on Pharmaceutics & Novel Drug Delivery Systems

**When?** 13 – 15 March 2017

**Where?** London, Great Britain

For more information please visit the [event website](#).

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## IKT Delegation trip to China

**When?** 13 – 17 March 2017

**Where?** China (Shenzhen, Guangzhou, Shanghai, Peking)

For more information please visit the [event website](#).

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## International Conference on Medical and Biological Engineering

**When?** 16 – 18 March 2017

**Where?** Sarajevo, Bosnia

For more information please visit the [event website](#).

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## 3<sup>rd</sup> Annual World Congress of Smart Materials-2017

**When?** 16 – 18 March 2017

**Where?** Bangkok, Thailand

For more information please visit the [event website](#).

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## 3<sup>rd</sup> International Conference on Smart Materials & Structures

**When?** 20 –22 March 2017

**Where?** Orlando, FL, USA

For more information please visit the [event website](#).

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## 8<sup>th</sup> International BioNanoMed 2017 Congress

**When?** 20 –22 March 2017

**Where?** Krems, Austria

*Speaker's deadline extended >> 12 January 2017! You are invited to submit an abstract to be reviewed for oral and poster presentation at BioNanoMed 2017 >>*

For more information please visit the [event website](#).

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## LABOR-IMPULS-FORUM 2017

**When?** 21 –22 March 2017

**Where?** Aachen, Germany

For more information please visit the [event website](#).

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### **INTERREG ALPENRAUM: Meet & Match Forum**

**When?** 21 –22 March 2017

**Where?** Milano, Italy

For more information please visit the [event website](#).

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### **INTERREG EUROPE: „Europe, let's cooperate“**

**When?** 22 –23 March 2017

**Where?** Malta

For more information please visit the [event website](#).

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### **World Congress and Expo on Nanotechnology and Nanoengineering**

**When?** 27 –29 March 2017

**Where?** Dubai, United Arab Emirates

For more information please visit the [event website](#).

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### **Trends in Nanoscience 2017**

**When?** 27 – 30 March 2017

**Where?** Irsee, Germany

For more information please visit the [event website](#).

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### **World Congress and Expo on Nanotechnology and Nanoengineering**

**When?** 27 – 29 March 2017

**Where?** Dubai, United Arab Emirates

For more information please visit the [event website](#).

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### **Graphene 2017**

**When?** 28 – 31 March 2017

**Where?** Barcelona, Spain

For more information please visit the [event website](#).

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### **International Conference on Surfaces, coatings and interfaces - SurfCoat Korea 2017**

**When?** 29 – 31 March 2017

**Where?** Incheon, Korea

For more information please visit the [event website](#).

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### **14<sup>th</sup> Global Experts Meeting on Nanomaterials and Nanotechnology**

**When?** 30 – 31 March 2017

**Where?** Madrid, Spain

For more information please visit the [event website](#).

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### 253<sup>rd</sup> American Chemical Society National Meeting & Exposition

**When?** 2 – 6 April 2017

**Where?** San Francisco, United States

For more information please visit the [event website](#).

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### 2<sup>nd</sup> EUROPEAN CONFERENCE on Pharmaceuticals

**When?** 3 – 4 April 2017

**Where?** Krakow, Poland

For more information please visit the [event website](#).

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### European Nanomedicine Meeting

**When?** 3 – 4 April 2017

**Where?** London, Great Britain

For more information please visit the [event website](#).

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### COST Training School on Upconverting nanoparticles in bioaffinity assays

**When?** 3 – 5 April 2017

**Where?** Turku, Finland

For more information please visit the [event website](#).

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### Training school on "Upconverting nanoparticles in bioaffinity assays - from bioconjugation to luminescence readout"

**When?** 3 – 5 April 2017

**Where?** Turku, Finland

For more information please visit the [event website](#).

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### 2<sup>nd</sup> International Conference on Nanotechnology Modeling and Simulation (IC-NMS'17)

- [2<sup>nd</sup> International Conference on Nanobiotechnology \(ICNB'17\)](#)
- [2<sup>nd</sup> International Conference on Nanomedicine, Drug Delivery, and Tissue Engineering \(NDDTE'17\)](#)
- [2<sup>nd</sup> International Conference on Nanotechnology and Environmental Issues \(ICNEI'17\)](#)
- [2<sup>nd</sup> International Conference on Nanomaterials, Nanodevices, Fabrication and Characterization \(IC-NNFC'17\)](#)

**When?** 4 – 6 April 2017

**Where?** Barcelona, Spain

For more information please visit the [event website](#).

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### **Industrial Workshop on Safe-by-Design**

**When?** 24 – 26 April 2017

**Where?** Bilbao, Spain

For more information please visit the [event website](#).

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### **International Conference and Exhibition on Pharmaceutical Development and Technology**

**When?** 24 – 26 April 2017

**Where?** Dubai, United Arab Emirates

For more information please visit the [event website](#).

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### **Plant Based Summit - The Biobased Solutions international conference and exhibition**

**When?** 25 – 26 April 2017

**Where?** Lille, France

For more information please visit the [event website](#).

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### **Panel on Nanomedicine & Nanobiotechnology**

**When?** 1 – 4 May 2017

**Where?** Athens, Greece

For more information please visit the [event website](#).

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### **14<sup>th</sup> Global Experts Meeting on Nanomaterials and Nanotechnology**

**When?** 4 – 6 May 2017

**Where?** Dubai, United Arab Emirates

For more information please visit the [event website](#).

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### **5<sup>th</sup> International Conference on Bio-Sensing Technology**

**When?** 7– 10 May 2017

**Where?** Riva del Garda, Italy

For more information please visit the [event website](#).

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### **CLINAM 2017**

**When?** 7 – 10 May 2017

**Where?** Basel, Switzerland

For more information please visit the [event website](#).

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### **SETAC Europe 27<sup>th</sup> Annual Meeting**

**When?** 7 – 11 May 2017

**Where?** Brussels, Belgium

For more information please visit the [event website](#).

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### **Nanotech 2017 Conference & Expo**

**When?** 14 – 17 May 2017

**Where?** Washington DC, United States

For more information please visit the [event website](#).

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### **2<sup>nd</sup> World Congress on Polymer Science and Engineering**

**When?** 15 – 17 May 2017

**Where?** Valencia, Spain

For more information please visit the [event website](#).

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### **2<sup>nd</sup> World Congress on Polymer Science and Engineering**

**When?** 15 – 17 May 2017

**Where?** Valencia, Spain

For more information please visit the [event website](#).

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### **15<sup>th</sup> World Medical Nanotechnology Congress & Expo**

**When?** 22 – 23 May 2017

**Where?** Osaka, Japan

For more information please visit the [event website](#).

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### **International Conference and Exhibition on Nanomedicine and Drug Delivery**

**When?** 29 – 31 May 2017

**Where?** Osaka, Japan

For more information please visit the [event website](#).

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### **8<sup>th</sup> International Symposium on Nanotechnology, Occupational and Environmental Health**

**When?** 29 May – 1 June 2017

**Where?** Elsinore, Denmark

For more information please visit the [event website](#).

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### **Maastricht Conclave 2017**

**When?** 31 May – 1 June 2017

**Where?** Maastricht, Netherlands

For more information please visit the [event website](#).

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### **16<sup>th</sup> World Nano Conference**

**When?** 5 – 6 June 2017

**Where?** Milano, Italy

For more information please visit the [event website](#).

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### **8<sup>th</sup> International Conference on Nanotechnology: Fundamentals and Applications (ICNFA'17)**

**When?** 6 – 8 June 2017

**Where?** Rome, Italy

For more information please visit the [event website](#).

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### **International Workshop on Computational Nanotechnology**

**When?** 6 – 9 June 2017

**Where?** Windermere, United Kingdom

For more information please visit the [event website](#).

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### **ADA 77<sup>th</sup> Scientific Sessions**

**When?** 9 – 13 June 2017

**Where?** San Diego, United States

For more information please visit the [event website](#).

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### **9<sup>th</sup> World Congress on Materials Science & Engineering**

**When?** 12 – 14 June 2017

**Where?** Rome, Italy

For more information please visit the [event website](#).

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### **2<sup>nd</sup> Conference on Computational Nanotoxicology**

**When?** 12 – 16 June 2017

**Where?** Gdansk, Poland

For more information please visit the [event website](#).

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## 6<sup>th</sup> Annual World Congress of Advanced Materials 2017

**When?** 14 – 16 June 2017

**Where?** Xi'an, China

For more information please visit the [event website](#).

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## Euro Nano Forum 2017

**When?** 21 – 23 June 2017

**Where?** Valetta, Malta

For more information please visit the [event website](#).

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## 13<sup>th</sup> International Conference on Diffusion in Solids and Liquids - DSL2017

**When?** 26 – 30 June 2017

**Where?** Vienna, Austria

For more information please visit the [event website](#)

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## Nanotech France 2017

**When?** 28 – 30 June 2017

**Where?** Paris, France

For more information please visit the [event website](#)

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## NANOTECHNOLOGY 2017 - ISSON 2017

- [11<sup>th</sup> International Summer School on Nanosciences & Nanotechnologies, Organic Electronics & Nanomedicine](#)
- [14<sup>th</sup> International Conference on Nanosciences & Nanotechnologies \(NN17\)NN 17 \(4 – 7 July 2017\)](#)

**When?** 1 – 8 July 2017

**Where?** Thessaloniki, Greece

For more information please visit the [event website](#)

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## 7<sup>th</sup> IC-EPSMSO - International Conference on “Experiments / Process / System Modeling / Simulation / Optimization”

**When?** 5 – 8 July 2017

**Where?** Athens, Greece

For more information please visit the [event website](#)

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### **International Conference on Nanobiotechnology**

**When?** 10 – 11 July 2017

**Where?** Chicago, United States

For more information please visit the [event website](#)

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### **10<sup>th</sup> Advanced Study Course on Optical Chemical Sensors (ASCOS)**

**When?** 20 – 28 July 2017

**Where?** Trieste, Italy

For more information please visit the [event website](#)

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### **10<sup>th</sup> International Conference on Emerging Materials and Nanotechnology**

**When?** 27 – 29 July 2017

**Where?** Vancouver, Canada

For more information please visit the [event website](#)

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### **ICANM 2017: International Conference & Exhibition on Advanced & Nano Materials**

**When?** 7 – 8 August 2017

**Where?** Toronto, Canada

For more information please visit the [event website](#)

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### **Biosimilars Congress 2017**

**When?** 10 – 12 August 2017

**Where?** Vancouver, Canada

For more information please visit the [event website](#)

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### **ICCE2016: 5<sup>th</sup> International Conference & Exhibition on Clean Energy**

**When?** 21 – 23 August 2017

**Where?** Montreal, Canada

For more information please visit the [event website](#)

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### **International Conference of Theoretical and Applied Nanoscience and Nanotechnology (TANN'17)**

**When?** 24 – 25 August 2017

**Where?** Toronto Canada

For more information please visit the [event website](#)

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## ESB 2017 - 28th European Conference on Biomaterials

**When?** 4 – 8 September 2017

**Where?** Athens, Greece

For more information please visit the [event website](#)

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## BioNanoNet Strategy Workshop & Networking Event *(for BioNanoNet members only!)*



**When?** 14 September 2017 – save the date!

**Where?** tba

For more information please visit the [event website](#)

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## EUROMAT 2017

**When?** 17– 22 September 2017

**Where?** Thessaloniki, Greece

For more information please visit the [event website](#)

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## 13<sup>th</sup> International Conference and Exhibition on Materials Science and Engineering

**When?** 13 – 15 November 2017

**Where?** Las Vegas, United States

For more information please visit the [event website](#)

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## 22<sup>nd</sup> International Conference and Expo on Nanoscience and Molecular Nanotechnology

**When?** 13 – 14 November 2017

**Where?** Vienna, Austria

For more information please visit the [event website](#)

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## SHIFT 2017 - Spectral sHapIng For biomedical and energy applicaTions

**When?** 13 – 17 November 2017

**Where?** Costa Adeje, Tenerife, Spain

For more information please visit the [event 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 March 2017.

BioNanoNet partners are welcome to send their contributions until 14<sup>th</sup> of March 2017!

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