

TWINFUSYON NEWSLETTER I

Summer 2016

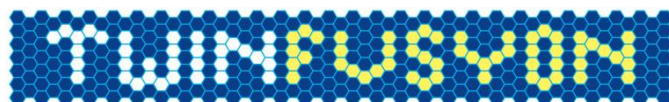
Dear TWINFUSYON friends,

We are glad to inform you that we have successfully launched the TWINFUSYON project starting with the project Kick-off meeting on 21st January. The Project Twinning for Improving Capacity of Research in Multifunctional Nanosystems for Optoelectronic Biosensing (TWINFUSYON) is a 3-year H2020 TWINNING project initiated on 1st January 2016. The project mission is seeking opportunities in the development of nanotechnologies, new materials and structures with intelligent surfaces and exceptional mechanical, electrical, magnetic, optical and biological properties to develop novel design of an optoelectronic biosensor. The nearly 1 million euro grant received from the European Commission for this project will be spent on various networking and training activities, including, lectures and short

courses of invited experts, exchange of scientists within consortium, secondments in industry, as well as workshops, summer schools and other events for scientists, industry and general public.

This is the first TWINFUSYON Newsletter where we would like to introduce the project and its activities, as well as inform you about upcoming events in the project.

Prof. Josef Humlíček
Project coordinator



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This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 692034.

INTRODUCING TWINSUFYON PROJECT

Meeting New Needs

The word "optronics" is a combination of optical and electronics. It involves detection, image processing and stabilization functions. Electronics, optics and communications continue to make tremendous progress through the use of nanoscale devices and techniques.

In numerous fields, the development of innovative technologies requires a refinement and miniaturization of existing systems resulting in an increasing requirement for process friendly quality and dimension control for industry. Optronic bio-systems are seen to bring innovation in high performance and affordable solutions, merging advances in knowledge and technologies in diode laser optical systems, imaging, and time and spatially resolved spectroscopies.

In the field of optronics, research is active to reduce the size and number of components used in complex optical structures. Nanotechnology is being applied in the form of ultrathin films and layers, e.g. graphene, with remarkable electric, optical and absorbing properties to produce planar electro-optic highly responsive sensor technology for homeland security and environmental monitoring applications.

Noteworthy, consulting Isi Web of Science by the keyword "optronics", it comes out that the top-10 cited papers in optronics are related to nanobiotechnology and detection of various enzymes, growth factors for human and animal cells, DNA, and imaging of cells.

TWINFUSYON supports innovative, transformative, and insightful investigations of fundamental

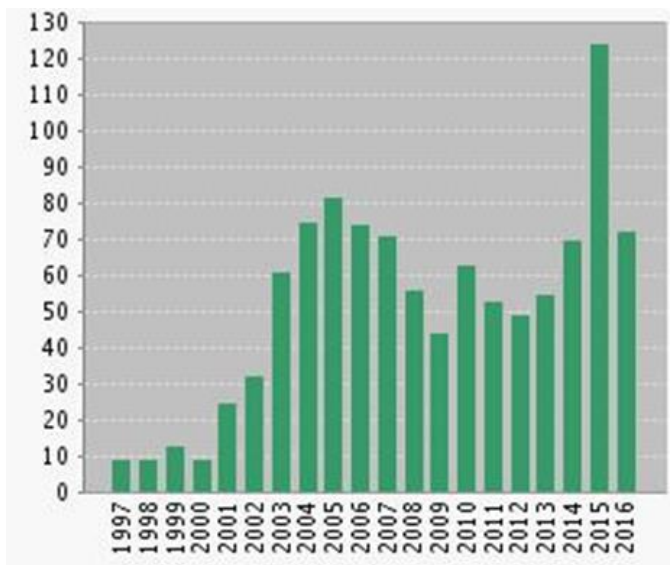


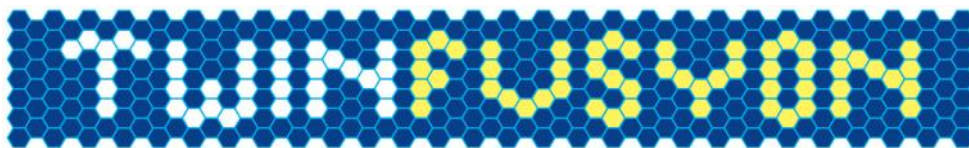
Figure: Citations every year for "optronics" [Source: Isi Web of Science]

problems with broad long term impact and applications that require novel use of bio-inspired engineering principles and sophisticated devices to meet the engineering and technology needs..

We specialize in providing solutions for advanced optical spectroscopic applications to sensing solutions. We provide scientific and technical support to assisting you resolve your most challenging application needs in novel materials and approaches for biosensors.

Optronic active companies list are rapidly expanding covering a broad field of applications.

This represents an invitation to connect and network with us to address cooperatively scientific questions and find new solutions and opportunities.



INTRODUCING TWINSUFYON PROJECT

Project aims in a nutshell

SCIENCE & TECHNOLOGY

Reinforcing knowledge in novel materials;
Identifying best-practices and developing new processes/products;
Improving technology capacity in optronic biosensing.

EDUCATION

Providing a platform for students and young researchers to undergo a well-rounded PhD education;
Strengthening the scientific competence of technical staff.

INTEGRATION

Fostering the dissemination and transfer of knowledge
Networking to jointly identify bottlenecks and possible breakthroughs in optronic biosensing.

SOCIETY

Reinforcing a dialogue with end-users, policy makers, investors and society;
Contributing to exploitation of materials, approaches and implemented technologies.

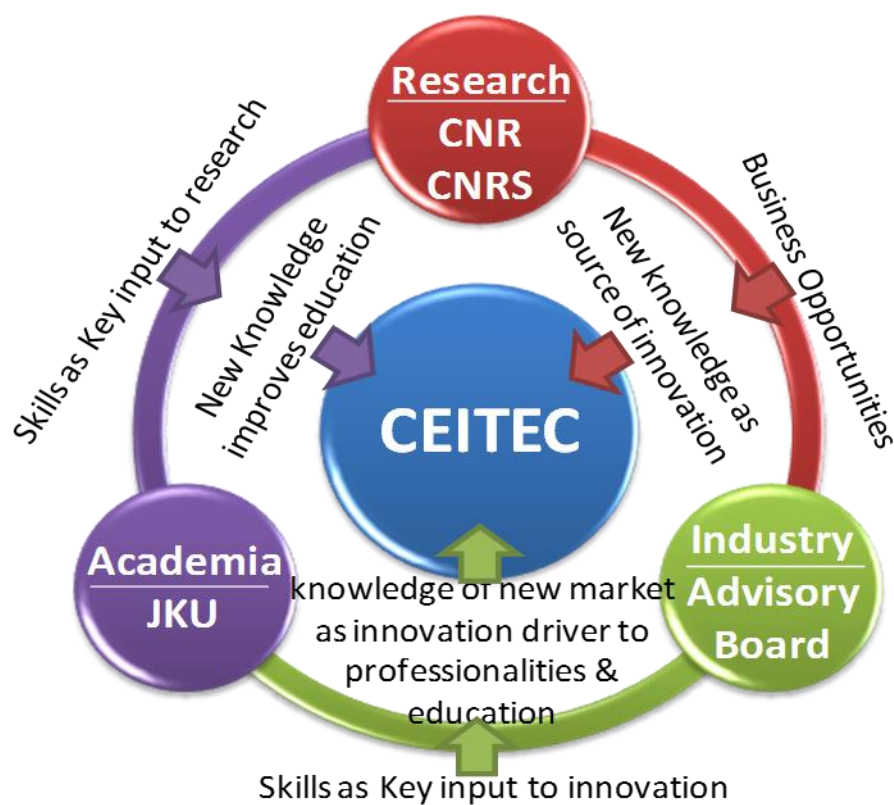
Project consortium

The TWINFUSYON project unites 4 institutions: Masaryk University, Central European Institute of Technology, (CEITEC MU); the National Research Council, Institute of Nanotechnology (CNR-NANOTEC); The Johannes Kepler University Linz (JKU); and The National Center for Scientific Research, Laboratoire National des Champs Mag-

nétiques Intenses (CNRS-LNCMI). More detailed information about consortium partners is available [HERE](#).

The Synergy between academia, research and industry in TWINFUSYON is depicted on the next page. ►

Project consortium



TWINFUSYON people

Prof. Josef Humlíček, the Project Coordinator

is a professor at the Department of Condensed Matter Physics, Faculty of Science, Masaryk University, and the Head of the Centre for Advanced Nanotechnologies and Microtechnologies at Central European Institute of Technology (CEITEC). His research expertise is focused on condensed matter physics, optical spectroscopy, ellipsometry, optical modelling, multifunctional materials. He is a member of several Physics science communities, for example, the Union of Czech Mathematicians and Physicists, the European Physical Society, the American Physical Society, etc. Besides being an author of numerous publications and giving lectures at various scientific institutions, he is an elected fellow of The Learned Society of the Czech Republic and Fellow of the Institute of Physics (Great Britain), and the recipient of the J.M. Marci medal (2012).



Dr. Maria Losurdo

is Director of Research at CNR-Nanotec. Her research interests spread among design of processes MOCVD, CVD, Plasma-CVD, MBE (for the synthesis of materials, as thin films and nanostructures, optically responsive for coatings, optoelectronics, nanophotonics and plasmonics) to self-assembly of bio-molecules (proteins, antigens, antibodies, DNA-single strands) on surfaces. Her mission is to obtain thin films (graphene, TMDs, III-Nitrides, Si-alloys, TCOs, etc) and nanostructures (Au, Ag, Ga, Al, Mg-Co nanoalloys, Ga-Pd core-shell etc.) that perform a function and to understand the interplay between nanostructure and chemical/physical properties through a large variety of structural, morphological, optical characterisations. She is an author of over 250 ISI scientific publications, as well as an author of 2 patents and participant of several EC grants.



Prof. Kurt Hingerl

is the Head of the Central Surface and Nanoanalytics Institute, offering experimental physics techniques to all JKU institutes. His research expertise focus on photonics and photonic crystals, optics (linear polarimetric and nonlinear, (SHG)) optical properties of materials (experimentally (ellipsometry) and theoretically (DFT), material science: surfaces. (waferbonding, surface analytics of semiconductors, steel and steel coatings, analytical techniques). The main research interests are optics and surface properties and combining both fields. He actively collaborates with industry (Voest Alpine Stahl, Siemens, EVGroup, Photon, Konarka), research centers (Profactor Steyr, CNRS Bari, ISAS Berlin, MPI Eisenforschung Düsseldorf), and universities (Ecole Polyt. Palaiseau, Univ. Belgrade, TU Wien, MU Leoben, TU Graz). He is an author of 14 patents and numerous papers.



Dr. Milan Orlita

is a postdoctoral research fellow at Laboratoire National des Champs Magnétiques Intenses, CNRS, Grenoble, France. He is also affiliated with the Academy of Sciences of the Czech Republic. His field of expertise is condensed-matter physics, optical and transport properties. He published more than 70 papers in peer-reviewed journals, including Nature Physics, PRL, Nano Letters, ACS Nano, etc., and is a recipient of several awards: Odehnal prize for young physicists (Czech Republic, 2008), Prize of Learned Society of Czech Republic for young scientists (2011), and Prize of the European Magnetic Field Laboratory for his work on massless electrons in 3D (2014).



TWINFUSYON NEWS

TWINFUSYON kick-off meeting

The kick-off meeting of TWINFUSYON together with two other TWINNING projects took place at the campus of CEITEC Masaryk University in Brno-Bohunice and at the Faculty of Science, Masaryk University on 21st-22nd January 2016. The kick-off meeting was attended by the representatives of

CEITEC MU, consortium partners, and several industry representatives. Discussions were devoted to scientific aspects of the project and planning of project activities.

Photos from the meeting can be found [HERE](#).



GUEST LECTURE by Dr. Ferry Kienberger

On 16th March Dr. Ferry Kienberger gave a lecture on “GHz-AFM: nanoscale microwave imaging to study electrical properties of semiconductor devices, advanced materials, and bio-samples” for CEITEC MU researchers. Dr. Ferry Kienberger is the head of the Keysight research lab in Linz and Keysight Country General Manager for Austria. Furthermore, he is the author of more than 80 peer reviewed scientific papers (h-index 31) in the field of nanotechnology, high frequency microwave imaging, materials and semiconductor sciences,

More information on the lecture is available [HERE](#).



UPCOMING EVENTS

◆ GUEST LECTURES at CEITEC MU

WHEN: 11th July 2016

WHERE: CEITEC MU, Brno, the Czech Republic

INVITED EXPERTS: Prof. Kurt Hingerl, Dr. Maria Losurdo, Dr. Milan Orlita

TOPICS:

Cd3As2: a 3D analogue of graphene by Dr. Milan Orlita (CNRS-LNCMI)

Plasmonic Graphene-metal nanoparticles hybrids: possibilities for biosensing by Dr. Maria Losurdo (CNR-NANOTEC)

Modelling Decoherence and Depolarization via temporal and spatial coherence by Prof. Kurt Hingerl (JKU)

More information [HERE](#).

The **Guest lecture series** is ongoing and invited talks will continue during the Fall of 2016. Check for the updates [HERE](#).

◆ Advanced School on Modelling and Statistics for Biology, Biochemistry and Biosensing

WHEN: 11-19 September 2016

WHERE: Johannes Kepler University Linz, Austria

TOPIC: The school is focused on stochastic processes and stochastic chains in biology, thermodynamics and statistical physics. The school will include lectures and tutorials on the following topics: modelling stochastic processes, understanding statistic evaluations and data, big data mining and machine learning, relation to physics / chemistry nomenclature: classical thermodynamic quantities, and statistical thermodynamics.

More information [HERE](#).



Advanced School on Modelling
and Statistics for Biology,
Biochemistry and Biosensing

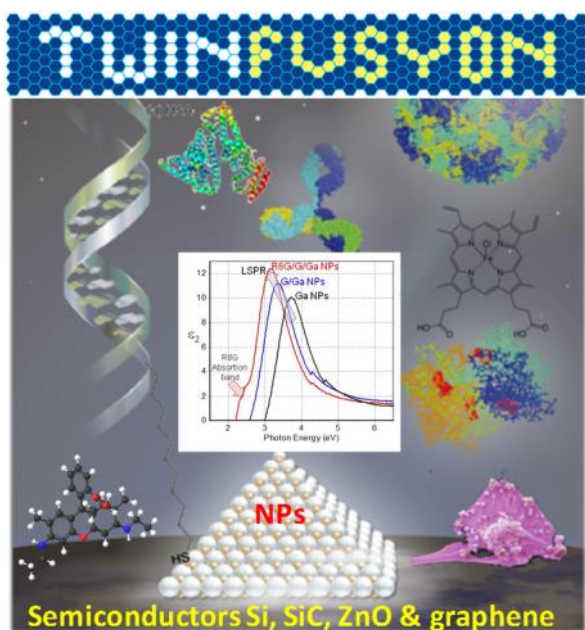
PROJECT DISSEMINATION

TWINFUSYON dissemination activities

In the first 6-months, TWINFUSYON has been introduced at two major International events.

At the **E-MRS Symposium DD**, last May in Lille (France), TWINFUSYON has delivered a talk entitled "Extended range advanced spectroscopies analysis of the light coupling into novel plasmonic hybrids"

The talk presented the TWINFUSYON aim of addressing new opportunities for plasmonics and biosensing offered by novel hybrid heterojunctions combining, semiconductors, graphene and metals. In those hybrids, graphene activates interfacial charge transfer, metal nanoparticles, in turn, activate the plasmonic electromagnetic coupling of light. In order to design these hybrid platforms to take advantage of applications exploiting interfacial charge transfer, better understanding the optical and electronic phenomena at interfaces of those hybrids is needed. With this contribution, TWINFUSYON presented extensive optical characterisation using ellipsometry to describe phenomena arising from coupling wavelength-resolved light into various heterojunctions based on plasmonic metals from NIR to UV (Au, Ag, Ga, Al, ..) coupled to semiconductors (Si, GaAs, ..) and graphene.



TWINFUSYON has been present with several talks and posters to the **ICSE-7, International conference on spectroscopic ellipsometry**, held in Berlin

(Germany) from 5-10 June 2016. Subjects of the contributions spanned from properties of materials including silicon, III-V semiconductors, topological Insulators, complex heterostructures and plasmonic systems all investigated under TWINFUSYON, to fundamental aspects of polarimetry. A keynote on Optical response of ferroelectric and related materials was delivered by Prof. Josef Humlíček, coordinator of TWINFUSYON.

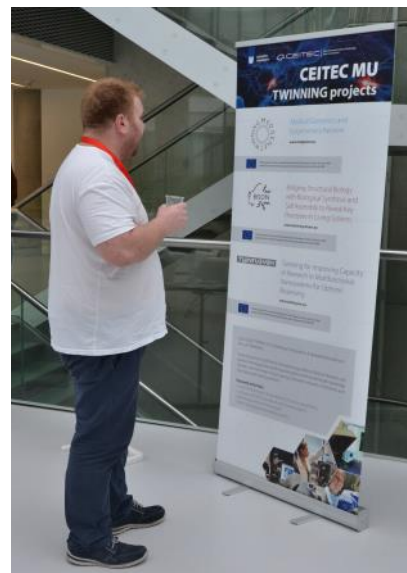


The whole TWINFUSYON Consortium presented the poster entitled *Several Views on the Occurrence of Depolarisation Discussion on Frameworks to Deal with It*. With this contribution, we intended to stimulate an open discussion involving broader ellipsometry community, and from an educational point of view to get students and young researchers involved in a deeper understanding of some basic questions of polarimetric techniques. The younger members of the ellipsometry community were challenging with their questions the senior ones at this poster.

Also **Dr. Christoph Cobet**, one of the young scientists active in TWINFUSYON, has been awarded the **Paul Drude Award**, which is named in honor of Paul Karl Ludwig Drude (1863 - 1906), a well-known German physicist specializing in optical properties of matter. His pioneering work in integrating optical properties of metals with Maxwell's theories of electromagnetism led to the famous Drude model of metals, the first microscopic theory of metal optics. Paul Drude is one of the earliest pioneers in spectroscopic ellipsometry, which is one of the major techniques that TWINFUSYON is exploiting for monitoring biosensing events also in real time. ▀

Additionally, from the very beginning of the project we've tried to spread information about its existence. We used CEITEC and Masaryk University media, e.g. [Masaryk University monthly](#), [CEITEC Spring Newsletter](#), to inform our fellow researchers about the project. Scientific and business community in Brno and South Moravian region, the Czech Republic have learned about the project via articles in [Brněnský deník Rovnost](#) and [Časopis Echo](#)). Also we used CEITEC MU Open day as an opportunity to inform Brno citizens interested in science about our networking and training activities within the project.

Looking forward to see you at CEITEC and Brno local events in the future!

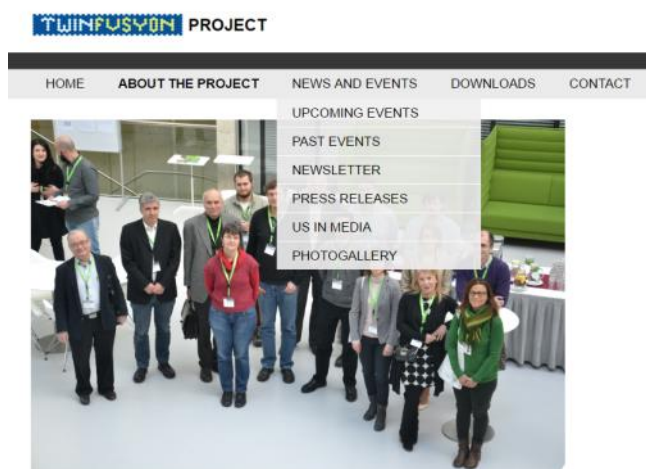


TWINFUSYON website

The TWINFUSYON website is the main communication channel to our key stakeholders (scientific community, industry stakeholders, policy-makers and authorities, as well as general public). On our website one you can find general information about the project, events organised (upcoming and past), and other project news and updates. Discover our website on the address www.twinfusyon.eu.

Major website upgrades will take place in upcoming months. What to look forward to? TWINFUSYON website will soon offer:

- ♦ **Observatory:** collection of literature on label-free biosensing technology
- ♦ **E-library:** collection of open-access electronic database (articles, PhD theses, presentations, study materials, etc.)
- ♦ **E-lab:** lectures' videos, technical notes, and other materials from TWINFUSYON events, as well as answers to students' questions from experts.
- ♦ **Interactive web-forum and discussion group**



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