KATHOLIEKE UNIVERSITEIT
LEUVEN

Capita Selecta Lectures of Nanoscience and Nanotechnology H6L3 & H6N2

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B-3001 Leuven, Belgium

Program and Abstracts

Academic Year 2015-2016

Introduction

How does so-called Nanoscience and Nanotechnology impact on modern society?
What are important scientific and technological nanotech fields at present?
What novel properties are created by precise manipulation of materials at atomic scale?
Can we construct novel building blocks with nano-scale precision and for what purpose?
What is the link between nanotech and life science?
What are there ethical or legal aspects we should know and care about?
What business opportunities arise in e.g. life-science, biotech, ICT or consumer products?

In the academic year 2015-2016, the 10th edition, Capita Selecta Lectures of Nanoscience and Nanotechnology[1], comprises of 12 lectures that will address a.o. the above questions. The lecturers are local and international experts on the selected topics, of which you can find the program details in this brochure. The topics are selected with input from the Erasmus Mundus program partners[2] and input from the students.

The topics, dates and location of the 2015-2016 lectures are as follows:

	Name	**Affiliation**	**Titel**	**Host**
16-Feb	Filip Frederix	Univ.Hasselt	What can nanobiochemistry do for our health?	KU Leuven, Belgium
23-Feb	Anton Van Dijsseldonk	ASML	Introduction to EUV microlithographic scanner systems	KU Leuven, Belgium
01-Mar	Alexey Popov	Leibniz Institute for Solid State and Materials Research Dresden	Endohedral fullerenes and single molecular magnetism	TUDresden
08-Mar	Peter Vanbekbergen	imec	Success factors for a thriving technology start-up	KU Leuven, Belgium
15-Mar	Julien Claudon	INAC	Spontaneous emission control in the solid-state: application to quantum optics	Joseph Fourrier Univ., Grenoble
22-Mar	Laurent Blanchoin	Research Director at CNRS, Institute of Life Science of CEA	Actin Dynamics, Architecture, and Mechanics in Cell Motility	Joseph Fourrier Univ., Grenoble
12-Apr	Jacques-Aurélien Sergent & Erik Van Miert	Solvay	Regulatory perspective and innovation in nanomaterials sciences	KU Leuven, Belgium
19-Apr	Alexei Kalaboukhov	Chalmers	Magnetic immunoassays using functionalized magnetic nanoparticles	Chalmers Univ., Sweden
26-Apr	Iuliana Radu	imec	From Advanced CMOS to Beyond CMOS	KU Leuven, Belgium
03-May	Kevin Braeckmans	Univ. Ghent	Studying nanomedicine bio-barriers by advanced fluorescence microscopy	KU Leuven, Belgium
10-May	Timur Shegai	Chalmers	Surface plasmons - optics on the nanoscale	Chalmers Univ., Sweden
17-May	Ingrid De Wolf	imec	Mechanical stress in microelectronics: a blessing or a curse?	KU Leuven, Belgium

[1]These lectures are organized in the frame of the Courses H6L3 "Capita Selecta of Nanoscience and Nanotechnology" within the Master of Nanoscience and Nanotechnology at the K.U.Leuven and H6N2 "Erasmus Mundus Lectures on Nanoscience and Nanotechnology".
[2]K.U.Leuven, TU Dresden, Chalmers University and the Université Jean Fourrier Grenoble.

All lectures are broadcast live by the Audio-Visual department of the K.U. Leuven (ICTS) to all Erasmus Mundus partner universities using a Virtual Classroom concept. The lectures are open to everyone interested in the field and compulsory for the students in both Master programs[3]. All lectures are always followed by a discussion session involving the lecturers, the students and nanotechnology professionals.

We look forward to welcome you at the Capita Selecta Lectures.

Prof. Jo De Boeck, Coordinator H6L3/H6N2
January, 2016.

[3] Students have to follow at least 20 lectures in 2 consecutive years and to produce a report each year.

Capita Selecta of Nanoscience and Nanotechnology

Program, Abstracts and CV's

Program

Tuesday, 16 February 2016, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Filip Frederix, University Hasselt, Belgium
What can nanobiochemistry do for our health?

Tuesday, 23 February 2016, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Anton Van Dijsseldonk, ASML, The Netherlands
Introduction to EUV microlithographic scanner systems

Tuesday, 1 March 2016, 5-7pm (Broadcast from Dresden)
Dr. Alexey Popov, Leibniz Inst. For Solid State & Mat. Res. Dresden, Germany
Endohedral fullerenes and single molecular magnetism

Tuesday, 8 March 2016, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Peter Vanbekbergen, imec, Belgium
Success factors for a thriving technology start-up

Tuesday, 15 March 2016, 5-7pm (Broadcast from Grenoble)
Dr. Julien Claudon, INAC, France
Spontaneous emission control in the solid-state: application to quantum optics

Tuesday, 22 March 2016, 5-7pm (Broadcast from Grenoble)
Dr. Laurent Blanchoin, Research Director CNRS, Institute of Life Science of CEA, France
Actin Dynamics, Architecture, and Mechanics in Cell Motility

Tuesday, 12 April 2016, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Jacques Orelien Sergeant & Erik Van Miert, Solvay, Belgium
Regulatory perspective and innovation in nanomaterials sciences

Tuesday, 19 April 2016, 5-7pm (Broadcast from Chalmers)
Alexei Kalaboukhov, Chalmers University of Technology, Sweden
Magnetic immunoassays using functionalized magnetic nanoparticles

Tuesday, 26 April 2016, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Iuliana Radu, imec, Belgium
From Advanced CMOS to Beyond CMOS

Tuesday, 3 May 2016, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Prof. Kevin Braeckmans, University of Ghent, Belgium
Studying nanomedicine bio-barriers by advanced fluorescence microscopy

Tuesday, 10 May 2016, 5-7pm (Broadcast from Chalmers)
Dr. Timur Shegai, Chalmers University, Sweden
Surface plasmons - optics on the nanoscale

Tuesday, 17 May 2016, 5-7pm (Broadcast from Leuven, Aud. "De Molen")
Dr. Ingrid De Wolf, imec, Belgium
Mechanical stress in microelectronics: a blessing or a curse?

Capita Selecta of Nanoscience and Nanotechnology

Abstracts & CV's

Tuesday, February 16, 2016, 5-7pm
Filip Frederix, UHasselt, Belgium

What can nanobiochemistry do for our health?

Nanobiochemistry is a field where nanochemistry is combined with biochemistry to enable major breakthroughs for health applications. Unique combinations of nanochemistry and biochemistry show great potential for future medical applications and the first commercial examples are currently introduced. The importance of understanding the nanochemistry, the biological field and the medical application is discussed in this lecture together with the commercial and scientific pitfalls. Furthermore, the first successful commercial introductions of nanobiochemistry will be discussed together with future perspectives.

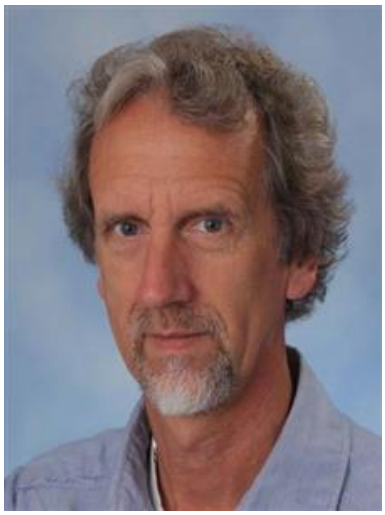
Prof. Dr. F. Frederix

Filip Frederix received his Master Chemistry degree in 1999 and his PhD degree in 2004 from the University of Leuven. His master and PhD thesis were realized in collaboration with IMEC. In 2004, he was awarded with the First Prize in the International DSM awards for Chemistry and Technology. In 2006, he obtained a post-graduate certificate in business administration from the EHSAL in Brussels. After his post-doctoral fellowship at IMEC/KULeuven, he worked for DSM in The Netherlands as a project manager of several medical-related projects. In 2008, he joined NXP Semiconducturs as a program manager for biosensors. Later he became New Business Development Manager and Business Development Manager for the Product Line Personal Health. Since 2012 he is also part-time professor at the University of Hasselt and currently he is active in a co-owned family company.

Tuesday, February 23, 2016, 5-7pm
Anton van Dijsseldonk, ASML Netherlands BV, The Netherlands

Introduction to EUV microlithographic scanner systems

In the near future it is expected that all major IC manufacturers will start implementing EUV lithography in high volume manufacturing of integrated circuits.
What is special to EUV lithography and why is it the optimum solution?
In this lecture an introduction will be given to lithographic scanner systems for IC manufacturing and the evolution of these systems in the past decades will be shown.
EUV lithography, using radiation of 13.5 nm as the exposure wavelength, will be explained and progress in the past years will be demonstrated. With EUV lithography semiconductor manufacturers will be able to continue to follow Moore's law in the foreseeable future.



Anton van Dijsseldonk

Anton van Dijsseldonk currently works for ASML as senior principal architect in the System Engineering Group. He has been manager of the System Engineering Imaging Group and has a long experience (> 10 years) in the development of EUV lithographic systems. He also has extensive experience in many international projects on Extreme Ultra Violet technology and EUV lithographic systems. These projects are multi-national research - and technology development projects involving institutes, large – and small companies.
Before joining ASML, Anton van Dijsseldonk has worked more than 15 years for the European Southern Observatory as instrument manager for infrared astronomical instrumentation. Prior to that period, Anton has worked at the Philips Research Laboratories in Eindhoven. He has studied physics in Eindhoven.

Tuesday, March 1, 5-7pm

Alexey A. Popov, Leibniz Institute for Solid State and Materials Research
Dresden, Germany

Endohedral fullerenes and single molecular magnetism

Discovery of fullerenes, hollow cage-like carbon molecules, triggered a detailed research of carbon nanostructures and eventually reshaped the whole field of nanoscience. One of the specific properties of fullerenes is the free room inside cage, which can be filled with atoms, molecules or clusters – resulting in *endohedral* fullerenes. In this lecture, the milestones in the development of the field will be discussed.
We will particularly focus on endohedral fullerenes filled with lanthanide ions. This discussion will lead us to the second subject of the lecture, single molecule magnetism, and its particular realization in the form of metallofullerenes.

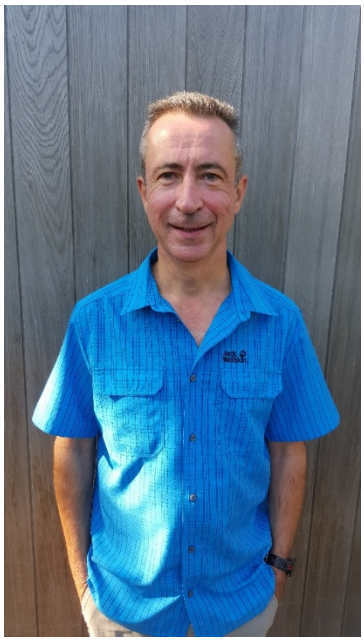
Dr. Alexey Popov

Alexey Popov received his M.S. (1999) and Ph.D. (2003) degrees in Physical Chemistry from Moscow State University (MSU), Russia. He was a Senior Researcher at MSU until 2008, when he received an Alexander von Humboldt Fellowship to study endohedral metallofullerenes at the Leibniz Institute for Solid State and Materials Research (Dresden, Germany), where he now heads the Fullerene Group. His current research interests include experimental and quantum-chemical computational studies of hollow fullerenes and endohedral metallofullerenes, including their synthesis, derivatization, spectroelectrochemistry, optical spectroscopy, and magnetic properties.

Tuesday, March 8, 2016, 5-7pm
Peter Vanbekbergen, Imec, Belgium

Success factors for a thriving technology start-up

After the internet and social media a new wave of applications is coming our way: the internet of things, sensing, medical applications, advanced imaging, low-energy applications, low power connectivity, ... This results in plenty of new opportunities for innovative ideas, potentially leading to new start-ups. In this lecture the success factors of such technology start-ups will be discussed. The reasons why these factors are so important and more importantly, how to positively influence them will be discussed and demonstrated with examples.



Dr. Peter Vanbekbergen

Peter Vanbekbergen received his engineering degree in 1987 and his PhD degree in 1993 from the University of Leuven. From 1987 to 1993 he was a researcher at IMEC. In 1993, he moved to Silicon Valley and worked in the advanced technology group at Synopsys, a leading EDA provider. In 1997, Peter became director of engineering at CoWare, an IMEC start-up focusing on system level EDA tools, headquartered in Silicon Valley. In 2003 Peter returned to IMEC to help organize the system level research work in research programs. In 2006 he became associate VP of the system level division at IMEC. In 2007 Peter was part of the founding team of M4S, another IMEC spin-off focusing on cellular RF transceivers. This company was acquired by Huawei in 2010 and continued to develop RF technology for the Huawei smartphone-line. Recently, Peter joined IMEC again as innovation manager to take on responsibility for the venture process at IMEC, targeting exits of the IMEC technology.

Tuesday, March 15, 2016, 5-7pm
Julien Claudon, Research scientist at INAC, Grenoble, France

Spontaneous emission control in the solid-state: application to quantum optics

In this lecture, we will see that the spontaneous emission of a light emitter can be tailored to large extent by inserting it into a controlled electromagnetic environment. Such ideas were initially proposed and demonstrated thirty years ago in atomic physic. Thanks to the tremendous progress in semiconductor growth and processing, it is now possible to exploit these concepts in the solid-state, opening appealing perspectives for the realization of a novel generation of optoelectronic devices. Indeed, semiconductor quantum dots constitute nearly ideal artificial atoms (at least at cryogenic temperature). Using proper clean room processing, they can be integrated into various photonic structures. We will focus here on optical micro-cavities and some specific high-index waveguides, and show their interest for the realization of ultra-bright sources of quantum light.

Dr. Julien Claudon

Julien Claudon received his master degree in 2002 from the 'Ecole Normale Supérieure' de Lyon, and his PhD degree in 2005 from the Joseph Fourier University (Grenoble). Since 2006 he is a staff member of INAC (Grenoble, France) and works in the field of quantum photonics, a very active research area at the cross-road of photonics, solid-state (semiconductor) physics and quantum optics. His interests include device design, the development of state-of-the-art fabrication procedures and physical studies. In particular, JC has pioneered the development of nanowire antennas and realized one of the two brightest single-photon sources to date. In 2014, he was awarded the Bronze Medal of CNRS for these achievements. JC has co-authored 35 peer-reviewed journal articles (including 2 Nature group and 7 Phys. Rev. Lett.) and 4 patents. He has given 20 talks in international conferences and workshops.

Tuesday, March 22, 2016, 5-7pm

Laurent Blanchoin, CNRS,
Institute of Life Science of CEA, France

Actin dynamics, architecture and mechanics in cell motility

Tight coupling between biochemical and mechanical properties of the actin cytoskeleton drives a large range of cellular processes including polarity establishment, morphogenesis, and motility. This is possible because actin filaments are semi-flexible polymers that, in conjunction with the molecular motor myosin, can act as biological active springs or "dashpots" able to exert or resist against force in a cellular environment. To modulate their mechanical properties, actin filaments can organize into a variety of architectures generating a diversity of cellular organizations. I will describe the feedback loop between biochemical and mechanical properties of actin organization at the molecular level in vitro, I will integrate this knowledge into our current understanding of cellular actin organization and its physiological roles.

Dr. Laurant Blanchoin

Laurent Blanchoin graduated in cell and molecular biology from the university of Paris VI in 1996. He then pursued his postdoctoral work first at Johns Hopkins Medical School in Baltimore USA and then at the Salk Institute for Biological Studies in La Jolla USA. In 2001, he was awarded a young investigator grant to start his own group at the Cell & Plant Physiology Laboratory in Grenoble, where he started investigating molecular mechanisms controlling actin cytoskeleton dynamics using a combination of biochemical, biophysical and theoretical approaches. In 2009, together with Manuel Théry, he created the Cytomorpho team (http://cytomorpholab.com/) part of the Nanobiology Campus in Grenoble where he is trying to connect in vitro biophysical approaches with cell biology to establish the rules directing cytoskeleton organization during morphogenesis. An important part of the effort in their team is to develop original technological tools that can be used at the molecular and cellular levels, thus helping to bridge these different levels of complexity.

Tuesday, April 12, 2016, 5-7pm
Jacques-Aurélien Sergent &
Erik Van Miert, Solvay, Belgium

Regulatory perspective and innovation in nanomaterials sciences

Since 2011, the European commission had provided a recommendation of definition for nanomaterials in Europe. The United States and Australia have recently launched their own definition. Some sectors in Europe have also defined a definition introducing slight differences or additional characteristics. The current regulatory context across Europe and also worldwide is therefore heterogeneous and rapidly evolving. The impact of this regulatory situation on the toxicological and environmental evaluation of nanomaterials will be presented using examples of nanomaterials used for decades and recently developed ones.

Dr. Jacques-Aurélien Sergent

Jacques-Aurélien Sergent received a PhD in Biomedical Sciences from the University of Montréal (Canada) and a PhD in Molecular and Cellular Biology from the University of Cergy-Pontoise (France) in 2008. He was then appointed for two years as an associate professor of the University of Cergy-Pontoise in Molecular Biology and Bioinformatics. In 2010, he joined the CEA as Researcher to establish an in vitro screening platform combining conventional and innovative methods for the evaluation of toxicological impact of nanomaterials. He was then recruited in 2012 by the Environmental Department of L'Oréal as an Expert in Ecotoxicology of nanomaterials to establish innovative screening platform for internal development of new formulations. Since 2013, he is working in the Toxicological and Environmental Risk Assessment Unit of Solvay to evaluate the impact of substances among them nanomaterials produced by the Solvay Group. Recently recognized as a European Registered Toxicologist, Jacques-Aurélien is also active in Research and Innovation, supporting some Research Teams of the group and participating to some FP7 projects. He is in charge of transversal actions related to Nanomaterials and Toxicological Evaluation and is part of the OECD Working Party in Manufactured Nanomaterials group, the ECHA Nanomaterial Working Group and CEFIC NanoManagement Team.

Dr. Erik Van Miert

Erik Van Miert studied biochemistry at the University of Antwerp and experimental toxicology at the University of Louvain. He obtained a doctoral degree in medical sciences at the University of Louvain in 2011. Erik started his professional career in 1998 as a study director managing primarily inhalation studies at the Philip Morris Research Laboratories. In 2009, he joined the HSE department of Solvay as a Senior Toxicologist being heavily involved in REACH and other regulatory processes. Since 2013 he manages the Toxicological and Environmental Risk Assessment unit 2 which comprises a team of 12 professionals in the field of regulatory (eco-)toxicology and risk assessment. Erik is a European Registered Toxicologist since 2009 and has a special interest in inhalation toxicology, (nano-)particle toxicology, (Q)SARs and Risk Assessment. He is the Solvay Representative at ECETOC and currently chairs the Environmental and Occupational Health Committee of the European Chlorinated Solvents Association and the Task Force on Nanomaterials of the Belgian Industry Association (VBO/FEV).

Tuesday, April 19, 2016, 5-7pm

Alexey Kalabukhov, Chalmers University of Technology, Sweden

Magnetic bioassays using functionalized magnetic nanoparticles

There has been an increasing interest in biological assays using magnetic nanoparticles coated with bio-molecule markers, such as antibodies or antigens. A new technique based on detection of Brownian relaxation time of magnetic nanoparticles has been developed that has several orders higher sensitivity as compared with enzyme-linked immunosorbent assay (ELISA). There is also a parallel development within the biotechnology area where the magnetic nanoparticles have been refined and specialized for specific tasks both for biological assays, hyperthermia, and for targeted drugs delivery. Microelectromechanical systems (MEMS) are being developed into lab-on-a-chip, containing microfluidic systems simplifying the transport, handling and analysis of the reagents under investigation. In this lecture, basic principles of magnetic bioassays will be discussed in view of potential applications in bio-diagnostics.

Assoc. Prof. Alexey Kalabukhov

A. Kalabukhov was born in Moscow, Russia, in 1975. He received the MSc and Ph.D. degrees in physics and mathematics from Moscow State University in 1998 and 2003, correspondingly. Since 2003, he is with Quantum Device Physics Laboratory at the Department of Microtechnology and Nanoscience – MC2, Chalmers University of Technology, Göteberg, Sweden. His main research interest is in bio-magnetic applications of high-T_C SQUIDs. He is also actively involved in emerging field of functional oxide interfaces and oxide electronics. He is teaching several courses in superconductivity, superconducting electronics, and nanoscience at Chalmers University of Technology.

Tuesday, April 26, 2016, 5-7pm
Iuliana Radu, Imec, Belgium

From Advanced CMOS to Beyond CMOS

The information infrastructure is growing and becoming ubiquitous around us. Continuous connectivity, which we take for granted now, did not exist 10 years ago. This growth has been largely fueled by the scaling of the transistors which has allowed increased performance for comparable energy consumption and lower cost. Continuing growth further will demand a variety of electronic systems with different performance and energy efficiency requirements to satisfy a large set of functionality and cost needs.
Early on, the scaling of the transistors was driven by the lithographic improvements. More recently, the scaling is that of the performance and relies on new materials (high K dielectrics and metal gates) and on devices structure innovations (fully-depleted channel devices). The performance scaling of the next decade will likely bring concerted changes not only at the transistor level but also at the interconnect and at the architecture level as the 3rd dimension will be conquered.
The pace of innovation will like continue further as it is driven by technological needs. The scaling of the transistor will be influenced by fundamental physical limits of device switching. As these fundamental limits are reached revolutionary devices that do not rely on simple charge states will likely be used. Devices which employ spin, exciton or plasmon states as the information carrier and state variable have already been proposed and are being actively investigated as replacements for the CMOS transistors.
At imec, we are a investigating not only advanced CMOS devices and "end of the roadmap" transistors, but also Beyond CMOS devices which rely on new materials like graphene and 2D semiconductors and devices that employ a different state variable. This talk will outline these activities.

Dr. Iuliana Radu

Iuliana Radu is Manager in the Logic Program at imec, where she is leading the Beyond CMOS activities. Prior to joining the Logic Program at imec in 2013, she was a Marie Curie and FWO fellow at KU Leuven and imec. Her work at imec and KU Leuven includes devices using the metal to insulator transition, ionic and electronic transport in functional oxides and devices with graphene and other 2D materials.
Iuliana has received a PhD in Physics from MIT in 2009 where she worked on the Fractional Quantum Hall effect and searched for non-abelian quasiparticles. She has received a MSc and a BSc in Physics from University of Bucharest. She has been an author on over 100 papers in leading peer-reviewed journals and conferences. She has given more than 15 invited talks at international conferences and seminars.

Tuesday, May 3, 2016, 5-7pm

Kevin Braeckmans, Bio-Photonic Imaging Group, Ghent University, Belgium

Studying nanomedicine bio-barriers by advanced fluorescence microscopy

In drug delivery, intensive research is being carried out to develop 'intelligent' nanocarriers that are capable of efficiently delivering biopharmaceuticals (nucleic acids, peptides, proteins) to target cells. Advanced fluorescence microscopy methods are indispensable to obtain better insight in the ability of nanomedicines in crossing biological barriers that are of relevance to the drug delivery process. In this lecture, several of these microscopy techniques will be introduced and examples will be given of their application to studying the interaction of nanomedicines with various biological barriers, such as the blood circulation, extracellular tissues as well as cells. It will be illustrated how this knowledge is essential to optimize the design of these nanocarriers in a rational manner in order to increase their drug delivery efficiency.

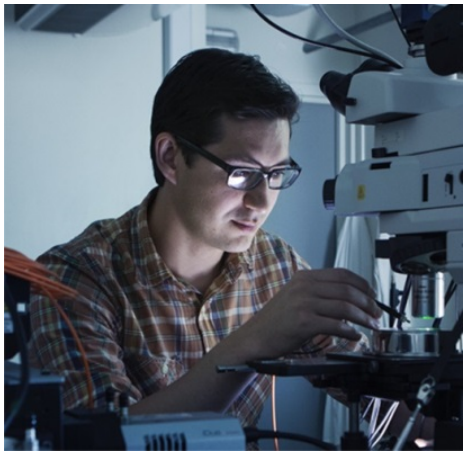
Prof. K. Braeckmans

Having obtained a Licentiate degree in Physics at Ghent University (Belgium) in 1999, Kevin Braeckmans joined the Laboratory of General Biochemistry and Physical Pharmacy (Ghent University) to perform research on advanced optical microscopy methods for pharmaceutical applications. During his Ph.D. he was involved in the development of a new type of encoded microcarriers for diagnostic applications, for which he received the first price for Young Biotechnology Researchers from the Funds of Biotechnology (FBBF, Belgium) in 2005. In 2004 he received a post-doctoral fellowship from the Fund for Scientific Research – Flanders, focusing on single particle tracking microscopy. In 2008 he was appointed as professor at Ghent University where he is currently leading the Bio-Photonic Imaging Group in close collaboration with the Ghent Research Group on Nanomedicines (prof. Stefaan De Smedt). His research involves the development and application of microscopy-based methods for studying the interaction of nanomaterials with biological barriers. In 2015 he was awarded an ERC Consolidator Grant (2015-2020) to continue his recent work on light-enabled drug and nanoparticle delivery.

Tuesday, May 10, 2016, 5-7pm
Timur Shegai, Chalmers University of Technology, Sweden

Surface plasmons - optics on the nanoscale

Bound electromagnetic waves existing in a form of collective oscillations of surface charges in thin metallic films and nanoparticles are now widely known as surface plasmons. The most prominent property of surface plasmons is that they are able to concentrate electromagnetic energy to deep subwavelength volumes, thereby greatly increasing the local density of photonic states. This in turn gives rise to a number of possible amplification mechanisms for various spectroscopic and light-matter interaction phenomena including Raman scattering, fluorescence, local refractive index sensitivity and light harvesting. In this lecture we will discuss recent progress along these lines.



Prof. Timur Shegai

Prof. Timur Shegai received his MSc degree in 2003 from Novosibirsk State University (Novosibirsk, Russia) and PhD degree in physical chemistry in 2008 from the Weizmann Institute of Science (Rehovot, Israel). He then moved to Chalmers University of Technology (Göteborg, Sweden) where he at first worked as a postdoctoral fellow (2009-2012) and afterwards as an assistant professor (2013-present). In his research career, he has been working on various research topics including single-molecule spectroscopy, optical microscopy and imaging, plasmonics and nuclear magnetic resonance. He is a lecturer in materials, spectroscopy and microscopy oriented courses at Chalmers University.

Tuesday, May 17, 2016, 5-7 pm
Ingrid De Wolf, imec and K.U.Leuven, Belgium

Mechanical stress in microelectronics: a blessing or a curse?

Already very early in the development history of microelectronics components, researchers ran into problems with 'stress'. Actually, one could have expected this: When putting different materials together, with different thermal expansion coefficients or lattice distances, and subjecting them to high temperature steps, stress is bound to pop-up. And too high stress easily results in damage. However, mechanical stress is not always bad. It affects important material properties such as the mobility of charge carriers and helps MEMS to stay straight. As such, it can be turned into something positive. Indeed, also microelectronics devices, in some cases, work better under stress.
This lecture will present the never-ending story of stress in microelectronics and show how stress was measured and modeled, and, depending on the situation, solved, used or circumvented. It is a story of the good, the bad and the ugly.

Prof. Ingrid De Wolf

Ingrid De Wolf received the PhD in Physics from the KU Leuven university, Belgium, in 1989. In the same year she joined imec in Belgium, where she worked in the field of microelectronics reliability, with special attention for gate oxide reliability, mechanical stress analysis using micro-Raman spectroscopy and failure analysis using emission microscopy. From 1999 to 2014, she headed the group REMO, where research is focused on reliability, test, modelling and failure analysis of 3D technology, interconnect, MEMS and packaging. She managed to grow this group from a small team of 3 members to a highly recognized group of about 40 people which is involved in several research programs within imec (3D, interconnect, Optical IO, GaN, Litho, PV, MEMS, STT-MRAM,...). She authored or co-authored 14 book chapters and more than 350 publications, and won several best paper awards at conferences focusing on reliability and failure analysis. She is chief scientist at imec, IEEE senior member and professor at the department of Materials Engineering of the KU Leuven where she teaches courses on non-destructive testing, MEMS reliability and failure analysis, characterization techniques and FMEA.