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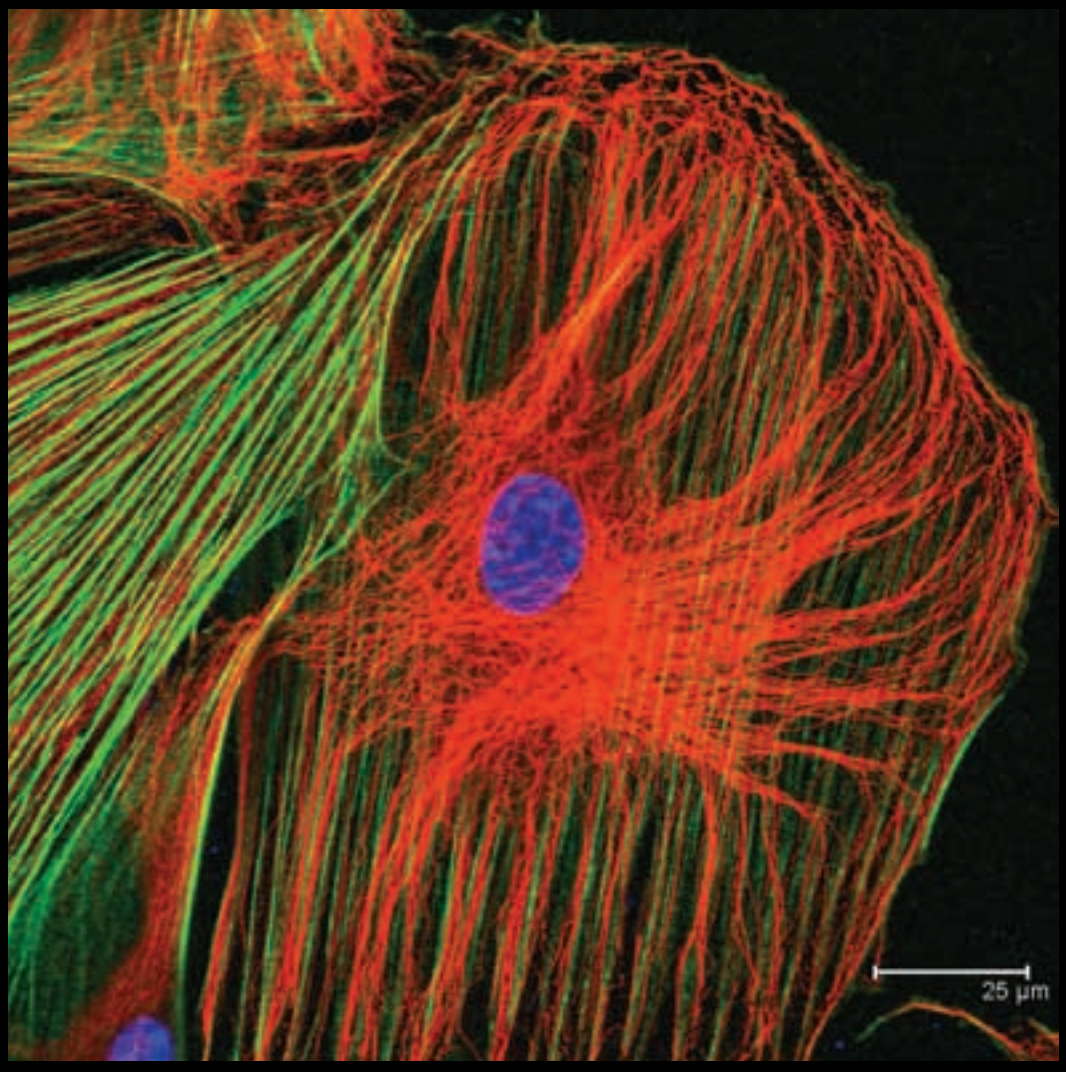

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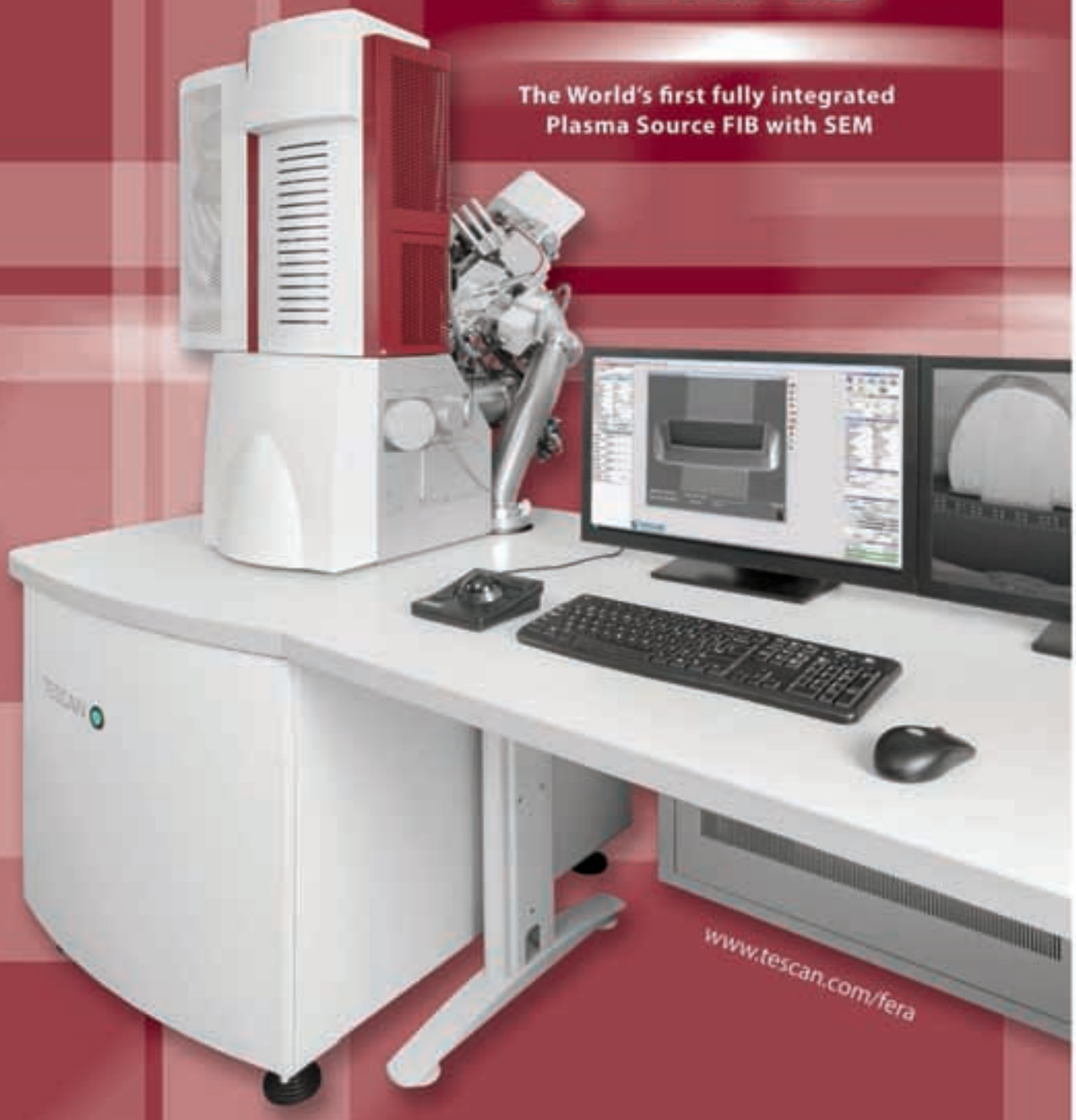

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Preface

With this 2012 EMS Yearbook we continue on the route of a lean and more personalized Yearbook, which has been appreciated by many of our members. For the 2012 Yearbook many of the presented reports refer to the fifteenth European Microscopy Meeting, the emc2012, excellently organized in Manchester by the RMS in close collaboration with EMAG. These include a report of the meeting itself, short reports of the winners of an EMS scholarship for attending emc2012 and extended descriptions of the ceremony and work of the winners of the quadrennial FEI-European Microscopy awards. Also the cover of this Yearbook was selected from the winners of the International Micrograph Competition at emc2102.

But of course 2012 also brought us a new Executive Board, the second round of the EMS Outstanding Paper Award, a successful initiative which is certainly continued, and many new events on the European microscopy scene. You will find reports and commentary on all these matters as well as on some of the most important coming events.

Allow me further to thank Dr. Marie Cheynet who, during previous years and together with the ERI company, has taken care of the proper production of this Yearbook and who was also this time still available for extra support. I also like to thank Prof. Serap Arbak for extra support with proof reading. We are also very appreciative of the many commercial contributions that allow this Yearbook to be published with the highest quality.

Nick Schryvers
Secretary EMS

COVER: 1st prize Light Microscopy - Life Sciences International Micrograph Competition at emc2012 by David Robertson. Cultured cancer associated fibroblasts (CAFs) from a mouse mammery gland tumour model. Fixed cells have been stained with anti smooth muscle actin and anti alpha tubulin. The smooth muscle actin was visualised with Alexa488 a-Mouse IgG2a (green) and the alpha tubulin with Alexa555 a-Mouse IgG1 (red). Nucleus counterstained with Dapi. Image captured on a Leica confocal SP2 TCS system as a single frame at 1024 x 1024 format.

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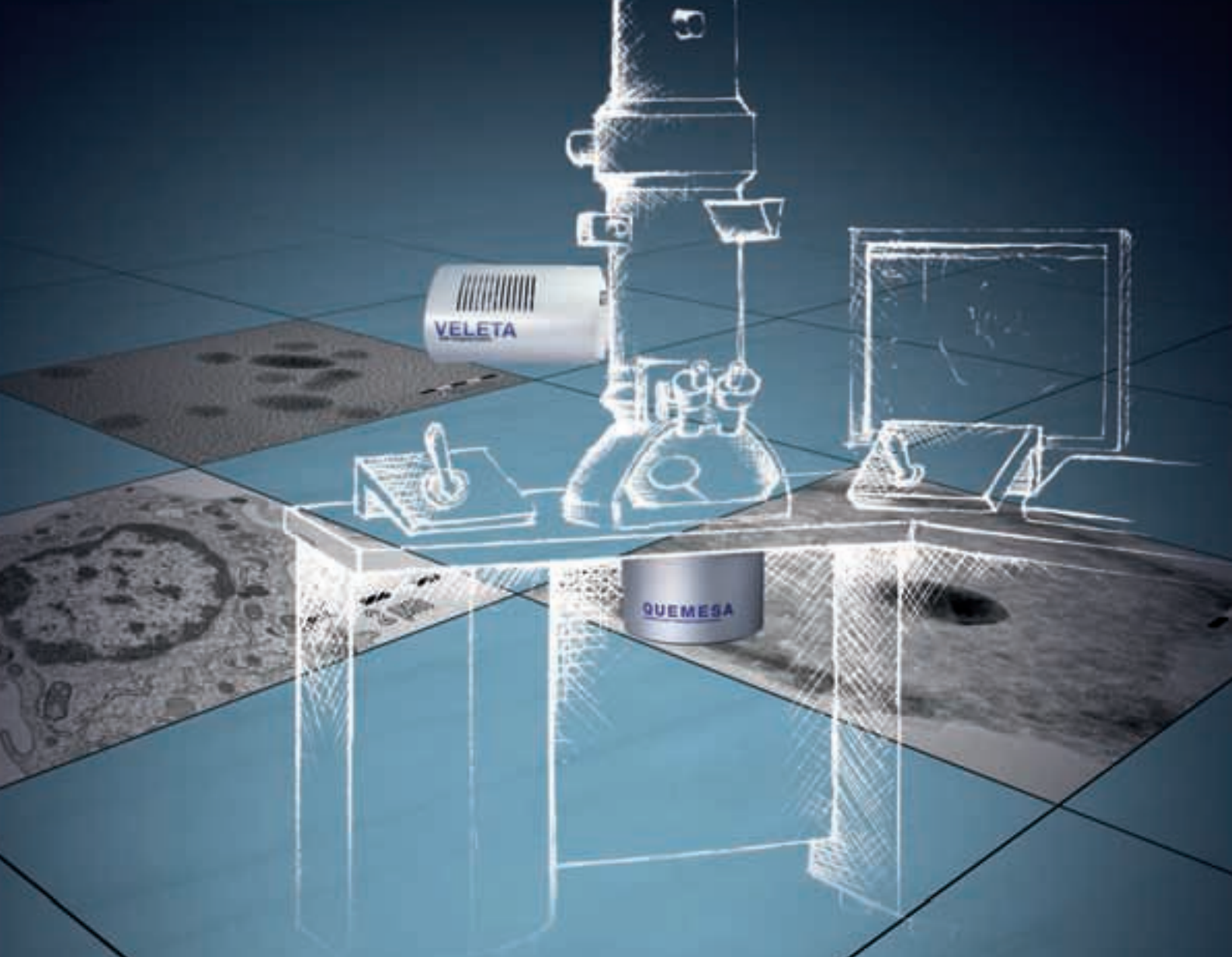

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NEW EXECUTIVE BOARD

During the EMS General Assembly at *emc2012* in Manchester and which was attended by over 80 members, the new EMS Executive Board, which is now in office till September 2016, was installed. Five new members are welcomed and the people leaving, Ueli Aebi (Past-president), Marie Cheynet (responsible for scholarships and yearbook), Bob Hertsens (ECMA representative), Raija Sormunen and Marco Vittori Antisari received congratulations and a commemorative plaque expressing the gratitude of the society for their contributions.

The new President, Roger Wepf, director of the Electron Microscopy Center (EMEZ) of the ETH in Zürich. Roger's recent interests focus on the fields of correlative microscopy, new cryo-preparation techniques for native sample preservation, automatic sample preparation and imaging techniques for particle imaging technology. Paul Midgley (Electron Microscopy Group, Cambridge, UK) moves to the position of Past–president while Nick Schryvers (Electron Microscopy for Materials Science (EMAT), Antwerp) and Christian Schöfer (Department for Cell & Developmental Biology, Vienna) stay on as Secretary and Treasurer, respectively.

As Chair of the next EMC in Lyon in 2016, Thierry Epicier from the Materials, Engineering and Science (MATEIS) department of the National Institute for Applied Science (INSA) in Lyon joins the Board while Debbie Stokes (FEI) now replaces Joachim Mayer Co-director of the Ernst Ruska-Centrum in Jülich and Head of Central Facility for Electron Microscopy at the RWTH in Aachen, the venue of EMC 2004, as Chair of the past European Microscopy Congress. Joachim, also member of the Executive Board of IFSM, will stay on as EMS Board member, partly to ensure good communications with IFSM.
Maria Carmo-Fonseca, Executive Director of the Institute of Molecular Medicine of the University of Lisbon and Director of the Harvard Medical School-Portugal Program joins us from the south of Europe while the north is represented by Randi Holmestad, Professor at the Department of Physics, NTNU (Trondheim) and Scientific Adviser at SINTEF Materials and Chemistry.

Stefan Kuypers from JEOL Europe was elected via electronic vote as representative to the Board for the European Corporate Member Assembly (ECMA).

Serap Arbak (Department of Histology and Embryology, Istanbul), Rik Brydson (Institute for Materials Research, Leeds), Aleksandra Czyrska-Filemonowicz (International Centre of Electron Microscopy for Materials Science, Krakow) and Pavel Hozak, chair of IMC 2014 (Institute of Molecular Genetics, Prague) stay on as EMS Executive Board members for another term of 4 years.

The new Board looks forward to working together on further supporting the European microscopy community through existing actions and new initiatives. Contact details of all EMS Executive Board members can be found on the previous pages 6 to 7.

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FROM THE PRESIDENT...AND THE SECRETARY

Dear EMS member,

It is with great pleasure that we send you the new EMS Yearbook. As last year, the Yearbook contains reports from awarded EMS prizes and scholarships, from EMS sponsored events, as well as special microscopy events throughout Europe and from the special highlight of last year the 15th European Microscopy Congress, emc2012 held in Manchester, UK.

Most of us spend an amazing week at last year's **15th EMC in Manchester** perfectly organized by the RMS in the unique environment of the Manchester Central Convention Complex - an old railway station - with a wonderful space for the company and supplier exhibition. A well-designed scientific program and an ideal exhibition area with an exceptional large and dedicated participation of over 130 microscopy suppliers attracted over 3000 attendants in total – a new record for EMS. The old railway station area was enriched with an outstanding RMS learning zone, which attracted also many day visitors turning this historical place into an exchange and meeting area of scientific and microscopic travellers from all over the country, Europe and the World. This congress was rounded up with an excellent congress dinner in the large rooms of Old Trafford stadium. An extensive report on this event can be found on page 15.

At the EMS General Assembly, which was held on Thursday September 20 in Manchester, the new **EMS Executive Board** was elected. The new constellation of this Board, which contains 5 new members, can be found at pages 6 to 7. We strongly want to thank all departing members for their support of the European microscopy community and look forward to a new period of four years with new ideas and initiatives. Our thanks are also for the now Past-president Paul Midgley for his invaluable contributions to the society as President in the past four years. We are convinced that his experience will remain of great help to the new Board.

Since 2004 and supported by FEI, EMS awards the quadrennial **FEI-European Microscopy Award** to colleagues who have made an exceptional contribution to microscopy in the fields of Physical/Materials Sciences and Optics or Life Sciences. In 2012 this prize was awarded to Mathieu Kociak and Yves Dufrêne in these respective areas. A report on the award ceremony and **manuscripts** from both winners describing their recent and earlier work can be found at pages 17.

Nominations for the 2011 **EMS Outstanding Paper Award** were solicited early 2012 and the jury selected 3 winners, Velimir Radmilovic (Materials Sciences), Sandra Van Aert (Instrumentation and Technique Development) and the joint authors Petra Paul, Tineke van den Hoorn and Marlieke Jongsma (Life Sciences). These awards were presented during the emc2012 Congress Dinner in Manchester and on page 64 you can find a more detailed report on this item.

In the course of 2012 the preparation for already the next European Microscopy Congress has continued and the bid of Lyon by Thierry Epicier and his team has been in unison elected by the General Council. We are looking forward to see you with the same excitement as last year in Lyon, France, in **2016.**

In the mean time EMS continues to sponsor many European meetings in different ways. In 2012 four meetings were selected as **EMS sponsored events,** a somewhat limited number due to the organization of an EMC in the same year. In this Yearbook you will find detailed reports on these meetings on pages 36 to 37.

The selected reports from young researchers who have received one of the 28 **EMS scholarships,** and which are presented on pages 55 to 61, focus on attendees to emc2012 plus one dedicated scholarship for attending the Advanced Microscopy Winter School in Zürich.

In 2012 the **EMS membership** stabilized at around 5600 members, with 50 corporate members. More detailed lists are given on pages 66 to 67.

For the first half of **2013** EMS has selected four sponsored events with the most direct and visible microscopy content from 8 applications: i) Quantitative Electron Microscopy school, France; ii) EDGE 2013, International Electron Energy Loss Spectroscopy Meeting, France; iii) Winter School 2013, Practical course in Advanced Microscopy, Switzerland; iv) EMBO Practical Course in Advanced Microscopy, UK. We hope with this selection that young scientist and microscopists can learn from the more experienced experts, enthusiastically exchange ideas among each other and profit to built-up their network in microscopy across Europe.

In addition in 2013 we will have the chance to exchange ideas and know-how again at the **EMS Extension** MC2013 in Regensburg, Germany (August 25 to 30) or later in 2014 at the IMC 2014 in Prague and at many other international meetings were microscopy and imaging techniques show to have an increasing share or interest in the materials and life sciences fields.

FROM THE PRESIDENT...AND THE SECRETARY

EMS as an umbrella organisation in Microscopy, Imaging and Spectroscopy will continue to foster exchange between experts and generations to avoid loss of know-how and skills in our field and we are looking for new ways to support this exchange (repositories and an EMS journal are just some of the ideas, …). As part of the EMS Board responsibility we will try to enhance the exchange of know-how transfer among our members and local societies and help the next generation of microscopists to find their way into this fascinating field which very much depends on passed-on "art handcraft" and basic scientific know-how. We are convinced that European microscopy will continue to reveal ever new and exciting science and we will continue to be amazed by the micro and nano world around us. As always, EMS will continue to support and assist its members, especially its more junior members, in all the ways we can. We are eager to meet many of you again in one of next years' microscopy events.

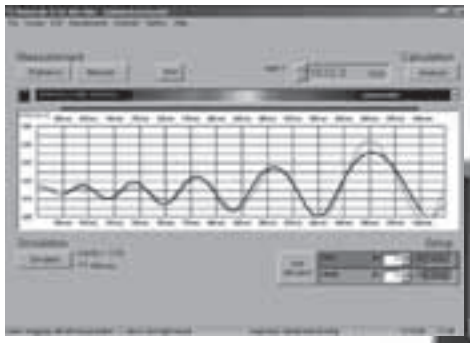
Yours sincerely,

Roger Wepf
President EMS

Nick Schryvers
Secretary EMS

REPORT ON EMC2012 / FEI-EUROPEAN MICROSCOPY AWARD LECTURES AT EMC2012

Film thickness measurement: Optical Profiler with Integrated Spectral Reflectometer



The Schaefer group is presenting the Sensofar PLμ NEOX optical profiler for the measurement of 3D surfaces and thin films. The unique combination of interferometrical or confocal optical profiling and spectral reflectometry on the same sensor head makes the PLμ NEOX the only system in the market able to measure 3D profiles, roughness and thickness of opaque and transparent materials with sub-nanometer resolution.
High NA interferometrical objectives and interferometry technology permits the 3D inspection of extremely polished surfaces to very rough ones.
The optically integrated spectral reflectometer opens an unprecedented combination of an optical profiler and thin-film measurement technology on a single instrument. In real world, white light interferometry is limited to measure thicknesses not less than 500 to 1000 nm. In contrast, the built in spectral reflectometer is able to measure thicknesses down to 10 nm with 0.1 nm of resolution in a tenth of a second and with very high lateral resolution. Measured materials are not limited to be transparent, like in interferometry. With an optically integrated spectral reflectometer it is possible to measure, for example, silicon membrane thickness even if it is an opaque material, and at the same time 3D profile the membrane curvature.

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EMC2012 IN MANCHESTER A TRULY MEMORABLE EVENT

As all of you will be aware, the 15th European Microscopy Congress – emc2012 – was hosted by the Royal Microscopical Society (RMS) in Manchester in September.

Many EMS members contributed to the event – serving on committees, organising sessions, presenting their work, and by attending. Together you helped to make it the largest congress yet in the series, attracting 1,714 registered conference delegates - a 30% increase on 2008.

EMS President, Professor Paul Midgley, welcomes delegates to the congress.

The record breaking numbers were drawn by eight parallel conference sessions that embraced the life and physical sciences, and delivered a balanced programme of optical and electron microscopy. It is the first time that optical microscopy has featured so prominently and it made emc2012 the most inclusive event yet. The full scientific programme and the Proceedings – containing more than 1,200 abstracts - are available online.

The conference opened with plenary talks from Professor Tony Wilson, the President of the RMS and Vice Chair of the Congress, and Professor Peter Dobson. The Plenary Theatre – lit in the blues and red of emc2012 – looked stunning. Best of all, it was full. Delegates were treated to a thought-provoking and entertaining session that set the tone for a week of great talks and high-quality science.

Professor Wilson said, "The conference sessions provided an unparalleled opportunity for delegates to immerse themselves in their own area of interest, and also to witness new techniques and tools that might benefit their current work, or feature in their future activities."

Visitors were drawn from 50 countries - including 22 from Australia and New Zealand - which underlines the outreach of the event.

More than 130 companies were represented in the exhibition.

Sitting side by side with the conference was the largest exhibition of microscopy equipment ever seen in Europe. More than 130 companies were present. This attracted an additional 759 day-visitors to swell the numbers further. If you add the 881 company representatives plus members of the press, it means that the attendance target of 3,000 was passed with ease.

The companies put on a fantastic show and the range of equipment was quite breath-taking. Their efforts to ensure that everything was operational when the doors opened on Monday morning should not be under-estimated. Some were setting-up for four days, and there were stories of late nights, spare parts flying in to Manchester from afar, and heroic efforts to have them fitted in time. For this, and for their support before and during emc2012, the organisers would like to say a very sincere "Thank you" to all the exhibitors.

The Poster Village was a busy and popular place at the end of each day.

EMC2012 IN MANCHESTER A TRULY MEMORABLE EVENT

"The RMS drew on its knowledge and reputation from running MICROSCIENCE every two years, and it was able to bring the light and electron microscopy communities together," said Professor Wilson. "The resulting buzz around the venue was very positive. Some of the exhibitors are saying that if they had realized it would be as busy, they would have brought more products to show."

The RMS Learning Zone - a fully equipped teaching and learning area covering light, electron and confocal microscopy - was a prominent feature within the main hall. It had its own lecture theatre with a programme of talks that ran throughout the week, attracting well over 700 people. Subjects ranged from "Understanding Light Microscopy" to "Using Social Media as a Researcher". The Zone was a hive of activity, and its popularity kept all the volunteers (most of whom were active members of the RMS) very busy.

Students from a Manchester School have a sample preparation tutorial on the Learning Zone.

The Congress wouldn't have been complete without its social programme. This started with a wonderfully attended opening reception, and went on throughout the week with further receptions and late-night parties hosted by exhibitors. It concluded with the Conference Banquet at Old Trafford, the home of Manchester United. Regardless of footballing allegiances, more than 1,000 delegates and company representatives had a great evening.

The short-listed entries in the International Micrograph Competition were on show throughout the week.

Manchester proved itself to be an excellent location. It is easy to get to and it is a city with a fantastic history, stunning architecture and very impressive science credentials. The venue – the converted grand Victorian railway station – provided a memorable backdrop for emc2012. Its open spaces encouraged networking, and the natural light that flooded the exhibition hall was very welcome.

All of the above combined to make what has been hailed as the best event yet in the series. This is the reward for four years of careful and detailed planning by the Organising Committees, headed by the Chair of the Congress, Dr Debbie Stokes, and the staff of the RMS. The International Committee included representatives from all over Europe – from the Nordic Microscopy Society in the North, to the Turkish Microscopy Society in the South.

"Working with representatives from so many national societies was a great experience, and they all contributed to the success of the event," said Dr Debbie Stokes, Chair of the Congress. "The Executive Board and members of the EMS should be extremely proud of what has been achieved. It provides an excellent platform for EMC 2016 and we look forward to supporting Lyon and to another memorable events".

The emc2012 website, complete with the scientific programme, will remain visible until 2017 at:
www.emc2012.org.uk.
The Proceedings can be browsed at:
http://proceedings.emc2012.org.uk.
A gallery of images can be viewed at:
http://gallery.emc2012.org.uk.
See if you can spot yourself or colleagues.

Robert Flavin

2012 FEI-EUROPEAN MICROSCOPY AWARDS

For the third time the quadrennial FEI-European Microscopy Awards have been presented. As before, the work of two excellent researchers was awarded.

The 2012 FEI-European Microscopy award for the category Physical/Materials Sciences and Optics goes to Dr. Mathieu Kociak from the Laboratoire de Physique des Solides, Université Paris-Sud, France, for his outstanding achievements in instrumental and theoretical developments pioneering new branches of nanoscience.

Presentation of the Physical/Materials Sciences and Optics FEI-EMaward to Dr. Mathieu Kociak (right) by Laurent Roussel, FEI Product Marketing Manager.

The Life Sciences award is made to Dr. Yves Dufrêne from the Institute of Condensed Matter and Nanosciences Bio and Soft Matter of the Université Catholique de Louvain, Belgium, for his outstanding achievements in the study of living cells with high-resolution atomic force microscopy. The winners of this prestigious quadrennial award founded in 2004 with the support of FEI receive the amount of 5.000 euro and a metal-on-wood plaque for display.

Both winners have presented their work as invited talks at the closing ceremony of the emc2012 conference in Manchester. Dr. Kociak's talk was entitled "Enlightening electrons" while the talk by Dr. Dufrêne was on "Atomic force microscopy: a nanoscopic window on the cell surface". The papers on these talks are presented in the following pages.

We congratulate our winners once more and look forward to a new round in 4 years.

Presentation of the Life Sciences FEI-EMaward to Dr. Yves Dufrêne (right) by Alberto Tinti, FEI Sales Director.

ATOMIC FORCE MICROSCOPY OF THE MICROBIAL CELL SURFACE

Atomic force microscopy of the microbial cell surface

Yves F. Dufrêne

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Keywords: atomic force microscopy, single-molecule imaging, force spectroscopy, microbes, cell surface, living cells

Introduction

Microscopy and microbiology have long been intimately connected. Optical microscopy is a key tool of microbiologists, enabling counting and identification of microbial cells as well as determination of their general morphology. Fluorescence labelling makes it possible to probe the distribution and localization of proteins in the cell walls. Yet, the lateral resolution of conventional fluorescence-based optical microscopy is limited to 200 nm. High-resolution images of microbial cell walls are traditionally obtained by electron microscopy, which uses high-energy electrons instead of light as the incident beam [1,2]. Elegant techniques have been developed for transmission electron microscopy, such as the use of freeze-fracture and surface replica, to visualize cell surface layers or purified structures such as flagella and fimbriae. These approaches are limited by the requirement of vacuum conditions during the analysis, i.e., native, hydrated samples cannot be directly investigated unless sophisticated cryo-methods are employed. Atomic force microscopy (AFM) has recently established as a powerful technique in microbiology [3,4], enabling researchers not only to observe the structure of hydrated live cells, but also to measure cell wall elasticity, to explore the conformational properties of surface polymers, and to map chemical groups and molecular recognition sites. All these properties have traditionally been difficult to explore at the subcellular level because of the small size of microorganisms. Rather than using an incident beam as in classical microscopy, AFM senses tiny forces acting on the sample surface. Three-dimensional images are generated by scanning a sharp tip over the sample surface while sensing the interaction force between the tip and the surface. The sample is mounted on a piezoelectric scanner which ensures three-dimensional positioning with high accuracy. While the tip is being scanned laterally, the force interacting between tip and specimen is monitored with piconewton sensitivity. This force is measured by the deflection of a soft cantilever which is detected by a laser beam focused on the free end of the cantilever and reflected into a photodiode. Besides imaging, AFM can also localize and manipulate individual molecules, a modality known as single molecule force spectroscopy (SMFS) [5,6]. The cantilever deflection is recorded as a function of the vertical displacement of the scanner, i.e. as the sample is pushed towards the tip and retracted. This yields a force-distance curve which provides key information on the localization, binding strength, and mechanics of single molecules. Here, I review recent breakthroughs we have made in microbiology through the use of AFM imaging and force spectroscopy.

Live cell imaging

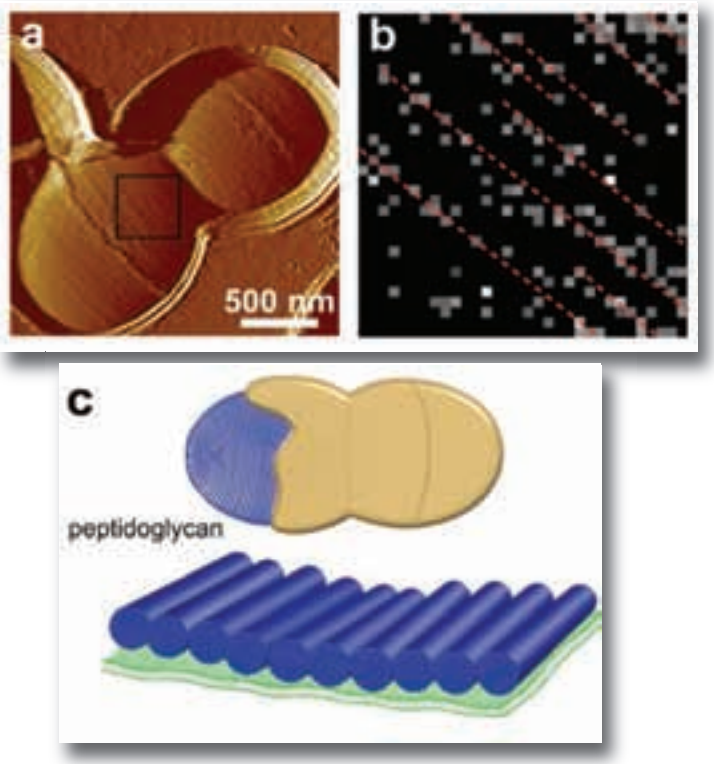

Figure 1. Imaging the nanoscale organization of peptidoglycan in living *Lactococcus lactis* cells. (a) Topographic image of two dividing bacterial cells lacking cell wall exopolysaccharides. (b) Single-molecule recognition map (400 nm × 400 nm) recorded with an LysM probe in the square area shown in the topographic image; peptidoglycan molecules were detected (bright pixels) and found to be arranged as lines running parallel to the short cell axis (red lines). (c) Schematic views of the architecture of the L. *lactis* cell wall : the top cartoon emphasizes the two layers of the cell wall, i.e. periodic bands of peptidoglycan (blue) covered by cell wall polysaccharides (brown), while the bottom cartoon is an enlarged view of the peptidoglycan nanocables (blue) lying on the membrane (green). Reprinted with permission from Ref. [7].

AFM has enabled to record images of living microbial cells to a resolution of a few nanometers [3-6]. A remarkable example is the direct visualization of

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peptidoglycan nanocables on living bacteria [7]. The spatial organization of peptidoglycan, the major constituent of bacterial cell walls, is an important, yet still unsolved issue in microbiology. We showed that the combined used of AFM and cell-wall mutants is a powerful platform for probing the nanoscale architecture of cell wall peptidoglycan in living *Lactococcus lactis* bacteria (Figure 1) [7]. While wild-type cells displayed a featureless surface morphology, mutant cells lacking cell wall exopolysaccharides featured 25 nm-wide periodic bands running parallel to the short axis of the cell (Figure 1a). Consistent with this, further functional imaging by AFM revealed peptidoglycan nanocables running parallel to the plasma membrane (Figure 1b and 1c). Peptidoglycan nanostructures were missing in purified sacculi, emphasizing the importance of probing live cells rather than isolated structures that have been subjected to aggressive treatments. These non-invasive live cell experiments open new avenues for understanding the architecture and assembly of peptidoglycan in Gram-positive bacteria.

Single-molecule imaging of cell surface receptors

offers a powerful means for mapping the distribution of individual cell surface constituents, thus to determine whether they are randomly distributed or organized into nanodomains. In the medical context, SMFS was used to map the surface distribution of the mycobacterial heparin-binding haemagglutinin (HBHA) engaged in host-microbe interactions [8]. Recognition images revealed that the adhesin was concentrated into nanodomains, which might promote the recruitment of receptors in host cells. More recently, we used SMFS to reveal the lateral clustering of Wsc1 sensors in living *Saccharomyces cerevisiae* cells [9]. Individual wild-type sensors were first localized on the cell surface, revealing that they form clusters of ~200 nm size. Analyses of three different mutants indicated that the cysteine-rich domain of Wsc1 has a crucial, not yet anticipated function in sensor clustering and signalling. Clustering of Wsc1 was strongly enhanced in deionized water or at elevated temperature, suggesting its relevance in proper stress response. These nanoscale analyses indicate that in yeast, signalling is coupled to the localized enrichment of sensors within membrane patches, for which the term "nanosensosomes" was proposed.

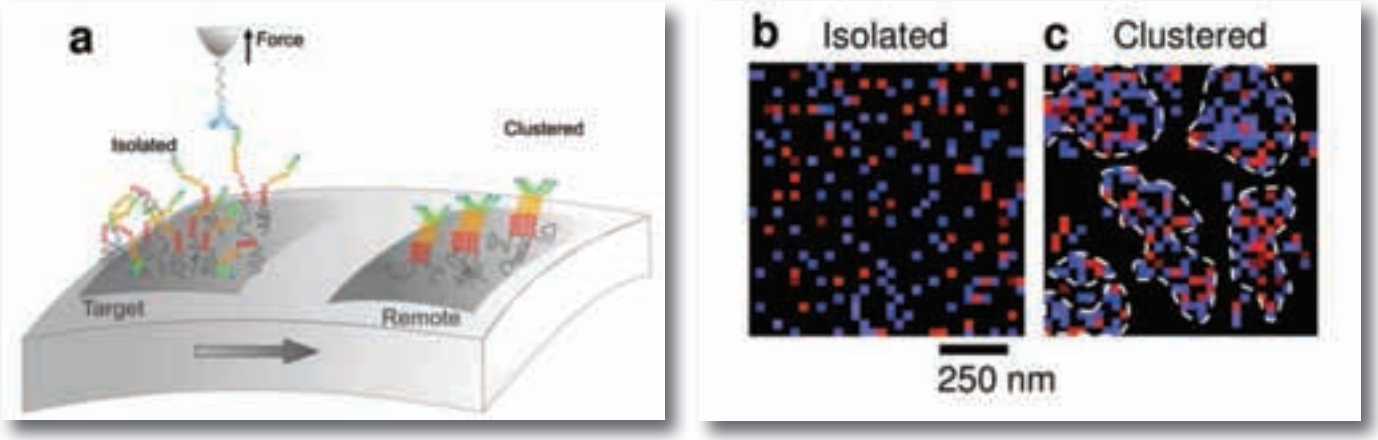

Figure 2. Force-induced formation and propagation of adhesion nanodomains. (a) Yeast cells expressing Als5p cell adhesion proteins tagged with a V5 epitope were probed using AFM tips terminated with anti-V5 antibodies. (b) Adhesion force map recorded on a cell that was never subjected to force. Blue and red pixels correspond to forces in the 0-150 pN and 150-300 pN range, respectively. The Als5p proteins were evenly distributed, without any clear evidence for clustering. (c) Subsequent adhesion force map recorded on a remote area localized several hundred nanometers away. Proteins in the remote map were no longer evenly distributed but formed nanoclusters referred to as "nanoadhesomes". Reprinted with permission from Ref. [10].

A critical issue in cell biology is to understand how cell surface proteins assemble into nanodomains. Today, the direct visualization of such nanodomains in live cells remains challenging due to their small size (≈10-500 nm) and dynamic nature. We have shown that SMFS with tips functionalized with cognate bioligands

We also investigated the clustering behaviour of Als cell adhesion proteins (adhesins) from the pathogen *Candida albicans.* Remarkably, we found that mechanical stimuli can trigger the formation and propagation of adhesion nanodomains in live cells (Figure 2) [10]. Pulling on single Als adhesins with AFM tips terminated with specific antibodies was shown to induce the formation of nanoadhesomes, i.e. adhesion domains of 100-500 nm size. In addition, the force-induced nanodomains were found to propagate over the entire cell surface. Control experiments demonstrated that Als5p nanodomains result from protein redistribution triggered by force-induced conformational changes in the initially probed proteins, rather than from non-specific cell

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wall perturbations. Als5p remodelling was independent of cellular metabolic activity since heat-killed cells show the same behavior as live cells. This study suggests that clustering of cell adhesion proteins in response to mechanical stimuli may be a general mechanism for activating cell adhesion in pathogens and offer exciting prospects in therapeutics for developing new antimicrobial strategies.

Single protein manipulation

The force-induced deformation of cellular proteins plays a major role in mediating physiological functions like cell adhesion. In the past, SMFS has been extensively used to measure the force response of cellular proteins in vitro [11]; however, investigating how single proteins respond to forces in living cells remains a challenge. We have shown that such nanomechanical measurements can be performed directly on living microbial cells in relation to function (adhesion, sensing). SMFS was used to pull on single Wsc1 sensors on living yeast cells to learn about their nanomechanical properties [12]. Wsc1 proteins had been suggested to act as mechanosensors activating stress pathways in response to physical changes in the cell wall, but direct evidence for such a mechanism was lacking. SMFS demonstrated that Wsc1 behaves like a nanospring capable of resisting high mechanical force and of responding to cell surface stress [12]. In the cell adhesion context, stretching single Als5p adhesins revealed sawtooth patterns with well-defined force peaks, each peak corresponding to the force-induced unfolding of the secondary structures of individual tandem repeats involved in cell adhesion [13]. The unfolding probability increased with the number of tandem repeats expressed by the cells and was correlated with the level of cell-cell adhesion, suggesting these modular domains play a role in fungal adhesion. Presumably, the force-induced unfolding of Als proteins leads to extended conformations in which hydrophobic groups are freshly exposed, thus favoring hydrophobic interactions between cells. These single-molecule experiments demonstrate that, in the future, AFM will be a key tool to characterize the cell "unfoldome" [11], i.e. the set of cellular proteins that can be unfolded as part of their physiological function.

Conclusions

Our experiments, together with those of other teams worldwide, demonstrate that AFM has now taken root in the microbiological community. Clearly, the technique is evolving from a qualitative imaging tool to a quantitative molecular toolbox, enabling researchers not only to image cell wall architecture, but also to force probe their individual constituents. These single-cell and single-molecule experiments complement traditional macroscopic methods used to analyze the microbial cell surface, and will contribute to answering many outstanding microbiological questions. We anticipate that a key direction for future research will be the design of high speed instruments for imaging cells, and their interaction with drugs, with unprecedented time resolution [14,15].

Acknowledgements

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ENLIGHTNING ELECTRONS

Enlightning electrons

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Since the last 15 years, nanooptics – the science concerned by the modification of local optical fields by nanostructures or nanostructured materials, or by the modification of the optical properties of the nanostructures themselves due to their reduced size compared to bulk – has been literally exploding.
Quite surprisingly at first sight, electron microscopy and spectroscopy have recently demonstrated that they can be amazingly useful techniques to investigate this new branch of optics, by unveiling, thanks to an unbeaten combination of spectral and spatial resolution, the behaviour of some of the excitations that dominate the optical properties of nanomaterials.

Such a discovery was not an ''eureka", but rather a long adventure over more than half a century. It benefited from the impressive experimental and theoretical skills and knowledge accumulated by our community (essentially the Scanning transmission Electron Microscopy -STEM- and Electron Energy Loss Spectroscopy -EELS- communities). The community was thus quite ready to make the necessary step forward nanooptics when I had the chance to participate to this adventure within the team I am belonging to - the Orsay STEM team, which already pioneered STEM-EELS when I was still drinking milk. Such step forward has been rewarded by the European Electron Microscopy Society, and I was lucky to be the one who got the FEI-EM award courtesy funded by the FEI company. The present text is thus a short summary of the lecture I gave in Manchester, at the 2012 EMC conference. It is by no means supposed to be a review of the field (see the excellent review by J. Garcia de Abajo [1]), nor even a brief state of the art (that has been partially covered recently [2]), but rather a subjective description of how I have seen the fields of "Electron Energy Loss Spectroscopy in the low loss regime" and "Cathodoluminescence" becoming "Nanooptics with fast electrons". I apologize in advance for the many people who, directly or indirectly, contributed to the field and I forgot to mention hereafter.

Nanooptics: size matters

That nanoparticles whose sizes are "sub-wavelength" (smaller than the wavelength of light -say, half a micron in the visible range) do have optical properties that are mostly determined by their shapes, sizes, and dielectric environment rather than by the material they are made from, is used for literally millenaries.
Famous examples for noble metallic nanoparticles are the Lycurgus cup, from the roman age, which has different colours depending on whether it is seen in reflection or in transmission, or the beautiful coloured stained glasses of the middle age Cathedrals. Of course, at those times, it wasn't known that these properties were due to plasmon confinement in sub-wavelength metallic nanoparticles. Plasmons are collective waves essentially made of interacting electrons. Otherwise speaking, they are charge density waves, mixed with photons. When arising in small nanoparticles, the plasmons oscillations are forming stationary waves, much in the same way[(1)] as a textbook oscillating string support stationary mechanical oscillations. In a string, the oscillation frequency (and thus the energy) increases when the length decreases, and so will the plasmon oscillations. Most of plasmons behaviour can be described by the classical Maxwell equations, and thus one can describe this energy/size dependence as a classical confinement effect. Much the same arises in semiconducting nanostructures. However, in this case, this is the exciton (a pair formed by an electron and an hole, strongly glued together by the coulomb interaction), a purely quantum object that will be confined as soon as the nanoparticle is smaller than the typical distance between the electron and the hole. This "Bohr radius" is typically less than few nm in II-VI and III-V semiconducting materials. Quantum confinement is thus responsible for the size dependence of the energy in small semi-conducting structures. Now, it can be shown that because these excitations (plasmons and excitons) are resonant, they are responsible for the optical properties of the nanoparticles: this is the colour of shape!
This said, the questions that automatically arise are : 1. how to experimentally characterizes features (like, for example, plasmon oscillations) that arise at scales that can be one or two order of magnitude smaller

(1) *There are considerable differences between plasmons waves and a mechanical wave, as soon as one wants to be even semi-quantitative, due to the fact that plasmons are not necessarily acoustic waves and may have non-linear dispersion curves, but this does not change the main discussion here.*

than the wavelength of light? And since the structure and the energy are so dependent, how can we 2. measure the exact structure (sometimes, 1 angström resolution is just enough) of the exact object the optical properties of which are probed and 3. Track back the intimate energy / position link (e.g oscillations maxima positions are energy dependent) at the relevant resolution, usually few nanometres?
Of course, this can hardly be done through bulk optical measurements, which are averaging optical properties of many nanoparticles in many orientations. For single particle characterization, one can use confocal microscopy and spectroscopy, but this will work only on diluted samples, and none of the above points will be addressed. Several ways have been and are explored (see the Conclusion) with photons, but here I'll obviously point out the merits of using fast electrons, such as that produced in a (S)TEM.

Indeed, two electron based spectroscopies are known for decades to be useful for probing optical properties of materials. These are EELS and cathodoluminescence (CL). Obviously, when you send an electron in a metal, it will push the electrons already present, which will themselves push the others and so on so forth, thus creating a charge density wave: a plasmon. By doing that, the incoming electron will lose an energy characteristic to the plasmon, and if we are able to analyse this energy loss (which is what EELS is doing!), we get the plasmon energy. This is why EELS is so famous for measuring plasmons, but it can be shown that the whole (absorption) optical properties of the material (the dielectric function) can be measured that way, too. Now, if the energy given by the incoming electrons is released in the form of photons - a mechanism cast as cathodoluminescence and that we find in our old TVs…, their spectroscopy will inform us on the luminescence properties the object. This is well known from, e. g. mineralogy, where this property is used daily for characterizing materials based on their luminescent signature.

On the other side, forming electron beam smaller than an angström is not a problem now, so why not using both techniques to get absorption and luminescence information, much in the same way as bulk experiments, but at the nanoscale? That's what we will see just after introducing refined considerations on the electron-plasmon interaction much in the way I have been taught during my Ph. D, some years ago.

"Low Loss EELS"

When Christian Colliex and Odile Stéphan offered me a Ph. D position to work on plasmons in nanotubes, I couldn't understand that they offered me in fact the unique chance to benefit from a 30 years old culture and expertise in EELS and spectral imaging. I now understand how lucky I was (and I still be). At that time, we used spatially resolved EELS in a STEM to compare the structure of various nanotubes (carbon, but most importantly for our understanding, WS_2) and to what is called the "low-loss" part of the EELS spectrum. This "low loss" part of the spectrum contains all the information on electromagnetic excitations. We could show that this part of the spectrum was dramatically dependent on the aspect ratio of the nanotubes. The ratio of the outer to the inner radius) [3]. Having an electromagnetic signature depending on minute variation of a nanometer scale object, measured with nanometric precision: didn't we already reach our nanooptics goal? In fact, this work did not receive much attention. It should have been expected! It was a rather incremental instrumental work, after the beautiful experimental works of a series of pioneer [4-7,7]. Of course, we already had at that time spectral imaging capacity (the possibility of acquiring one spectrum at a each point of an electron beam scan, together with an image), absolutely necessary to link structure and spectral properties, but this was not new, especially in our team [8]. More, we could not break the experimental limit the community was facing : having access both to the visible range with a sufficient spectral resolution (as commonly done in HREELS with no spatial resolution at that time, see e. g. [9]) and with a high spatial resolution (already demonstrated e.g. by Batson in the 80's [4]!) – and all this, of course, with a decent signal to noise ratio. Indeed, at that time, the "low-loss" region was usually beginning at more than 4-6 eV, closer to the UV than to the visible range…

On the other hand, theoretically, it was clear for us that we were measuring quantities that were very close to optical ones. But, as I have been taught (among many other things in nanooptics) by our theoretician collaborator, Luc Henrard, now Professor in Namur, Belgium, many low-loss EELS theories explicitly used optical quantities. In fact, the theory of low-loss had been developed, and heavily devised by yet another set of pionners (theoreticians, in this case) [10-14]… It was clear that, in the case of symmetric objects (planes, stacks, spheres, cylinders, multilayers spheres and cylinders…) the low loss EELS was to some extent proportional to a polarizability, and that this polarizability could be compared, if done with caution, with that measured in optics. However, such an analysis was missing for a general object, which rose two questions: Were there a generic description of EELS – a way of discussing low loss EELS in an arbitrary symmetry?

And a universal one – some quantity that we could relate to EELS and that could serve as a "Rosetta stone" for discussing with other physicists (opticians…)?
Finally, another disturbing issue was that of "delocalization", stating that the electron/object interaction being delocalized (coulomb coupling), the images generated would be blurred by this delocalization, which would then blur the access to the material optical properties.

Towards nanooptics

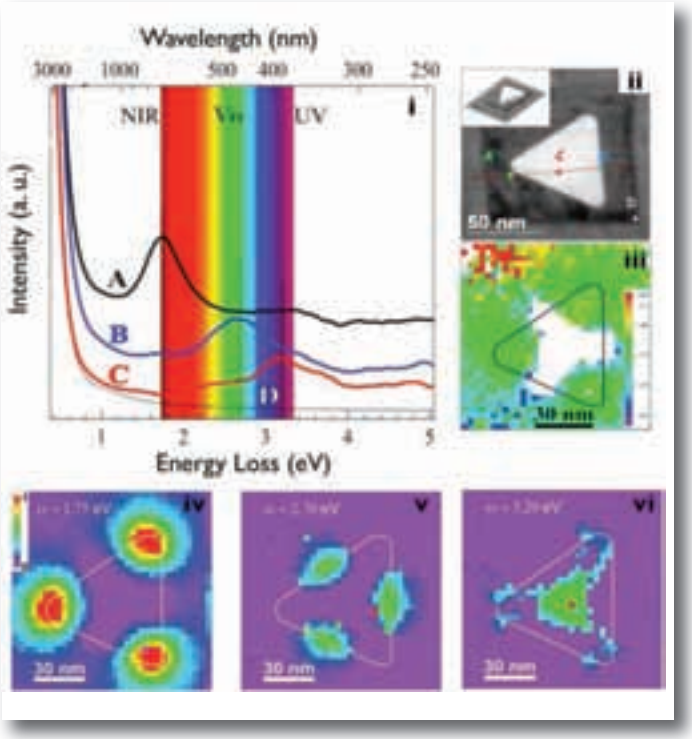

Figure 1 : Mapping plasmons in the visible range with EELS. i) Four EELS spectra taken on a silver triangular nanoprism at the corresponding points shown on the HAADF in ii). iii) Map of the energy position of the first peak (labelled A in i)), showing almost no shift of the mode energy over the particle. iv-vi) Intensity maps of the three main modes detected in the prism. Adapted from [20].

Despite all these issues, several teams in the community, almost independently, were looking for EELS applications on metallic nanoparticles at the beginning of the 2000's. I think most of them were convinced that spatially resolved EELS could help in the nanooptics field, and that this could probably be feasible. Most of us were probably guided by the seminal work of [4], who saw already in the 80's spatial variations of an EELS signal between two nanoparticles, due to an electromagnetic coupling between both nanoparticles. It is however not sure that most of us were aware of the seminal work of Yamamoto et al. [15]. This cathodoluminescence study of multipolar modes in sub-100 nm nanospheres of silver is most probably the first paper showing plasmon mode mapping in the visible range, and, despite the limitations of cathodoluminescence at that time (especially the weakness of the signal and the absence of spectral imaging), it has to be considered to my opinion as the true start of nanooptics with fast electrons. Note that most of the weaknesses are now overcome, at least for nanoparticles larger than few hundred of nanometers, and CL is an interesting, and most of the time cheaper, alternative to EELS to study plasmons [16].

On our side, we were, with C. Colliex and O. Stéphan, looking for the perfect sample to start with. An apparently obvious choice at that time was looking at dimers of metallic nanoparticles, as the field between the two particles was supposed to be possibly made almost arbitrarily high. Such an high field engineering is one of the canonical application of nanooptics, as it can be used to enhance, for example, the SNR of single molecule spectroscopy (SERS, surface enhanced raman spectroscopy) [17]. Ironically, it turns out that EELS is very bad at measuring this kind of fields for symmetry reasons, as it was demonstrated much before people even though at visible range applications [18]. Any way, TEM microscopists reality facts (such as contamination) made most of our attempts failing, until we were lucky enough to get in touch with the team of Luis Liz-Marzan, Professor at Vigo, Spain, at that time. Some of the beautiful samples they produced – flat triangular prisms - were exactly fitted to the EELS geometry (see [19]) and have been a key ingredient in the success of the experiments, and their understanding. We of course also had to beat the limit imposed by the zero loss peak - the peak in an EELS spectrum containing all the electrons that did not interact inelastically with the sample. At that time, the issue was that the spectral resolution was bad (in our lab and that of Bosman et al. who published similar results at the same time [21], using a cold FEG with ca 0.3 eV resolution, this was not the main issue), its tail extending largely up to the ultraviolet was hiding the interesting optical information, and its intensity was several order of magnitude larger than that of a typical plasmon.
A large gain in energy resolution, and more importantly a drastic reduction of the zero loss peak tail was made possible thanks to the development in the team of a new deconvolution scheme (Richardson Lucy) by A. Gloter [22], based on a proposal by A. Douiri and helped by M. Tencé. O. Stéphan showed the proof of principle interest of this approach to access visible range plasmon in a gold film as early as the Durban EMC conference in 2002. After this huge increase of signal to background ratio, the next step was to gain in signal to noise ratio, which was achieved thanks to

the development of the chrono-spectrum imaging by Marcel Tencé (see [23] for more details). It was time for J. Nelayah (now assistant professor in Paris) to make his Ph. D with us, and to produce the now canonical results presented in Figure 1 and published in ref [20]. In this work was demonstrated the possibility of mapping surface plasmons in the near Infra-red/visible range on silver triangular prisms with sub-10 nm resolution. What we showed was that we could evidence in each spectrum several peaks; that their energy positions were not changing with probe position, but of course that their intensities were changing quite rapidly over the prism; and that for each energy, a different spatial distribution of the intensity was seen. Almost at the same, using also a VG Stem, Bosman et al. [21] mapped surface plasmons on different noble metals nanospheres and nanorods.

To confirm our finding (we first though it was some fake!), we asked for the help of Javier Garcia de Abajo, who was able to simulate the experiments through its smart Boundary Element Model. The simulations were matching nicely the experiments, however they did not tell us much about what we were really mapping. This is J. Garcia de Abajo who proposed, in the same paper, that EELS could be related to an Electromagnetic Density of States (EMLDOS) – a statement that we proved rigorously few time after [24], and that was deeply analyzed for nanoparticles later in [25].

Such an intuition was really great. On the one hand, it gave us the easy interpretation we were looking for such a long time : at a given energy, we were probing the electric field component along the electron path associated with a (plasmon) eigenmode of the system. This is a good definition of plasmon mapping!

Also, it shed light on the long disputed issue of delocalization (the fact that the coupling between the electron and the plasmon eigencharge is non local): if we understand that we are mapping electrical field, not charges, then there is no delocalization!

The link to the eigencharges was given later [26]. On the other hand, the EMLDOS is a universal quantity, well known from the near-field optic community [27]. We thus got the also long awaited "Rosetta stone" that we were missing to discuss with other communities.

All these elements (increase in signal to noise and signal to background ratios, spectral imaging, quality and adequacy for EELS of the samples, simulations and EMLDOS interpretation) made this finding a success. We have been lucky to be the right team at the right time – indeed, the team of Pr McComb was essentially on the good path at the same time and, unfortunately, did not have spectral imaging when they published their seminal work on silver nanoparticles dimers and trimers [28].

Otherwise they would probably be writing this paper… We also have been quite lucky that our demonstration arrived almost at the same time as the rise of monochromators and bright electron guns, and thus could be reproduced very soon after our publication. This made this thematic a competitive, fast advancing and hot subject! Now, EELS is a robust technique used to understand plasmons physics, that is attractive even for opticians. Of course, EELS suffers from genuine problems (poor spectral resolution, no access to polarization, among many others) compared to optics, but it has now sufficiently proven advantages when understanding plasmon physics requires nanometer spatial resolution, broad spectral range (now extending deeply in the infra-red![29]) or combined measurement of the spectral and spatial features of plasmons. These advantages are sufficient for opticians to now consider it has yet another tools in the opticians toolbox. [26,30-33].

Cathodoluminescence

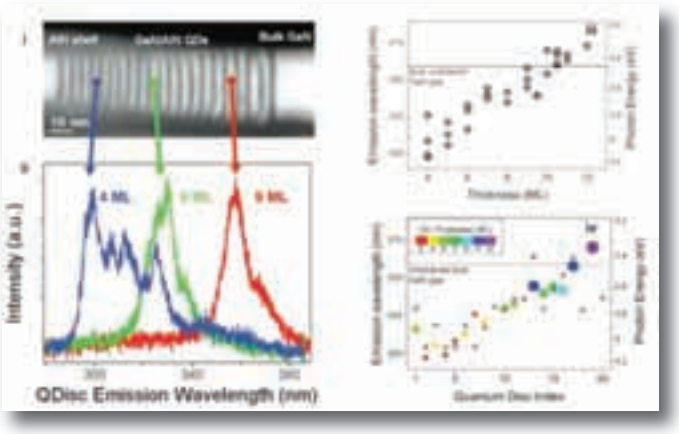

Figure 2 : Nanometer scale luminescence properties of quantum emitters. i) HAADF image of stack of GaN Quantum Discs (QDs) embedded in AlN within a nanowire. ii) Cathodoluminescence spectra taken on QDs of different thickness given in Monolayers (ML). The thickness is determined on high resolution HAADF. iii) Emission wavelength of individual QDs as a function of the thickness of the QDs measured with ML precision. The emission wavelength of the individual QDs are extracted from cathodoluminescence spectral images (see [39]). A linear relationship is obvious. iv) emission wavelength of individual QDs as a function of their position along the nanowire (the QD index numbered the position of the QD along the growth axis of the nanowire). For a given thickness, the emission wavelength redshift along the growth direction of the nanowire. Adapted from [39].

Already one or two years before we got the data of the ref [20], I was stimulated by J. Garcia de Abajo to built a system to inject and detect light in a STEM. This was motivated by the CL work of Yamamoto [15], the advantages of CL with respect to EELS in terms of spectral

resolution in particular, and some considerations about Electron Energy Gain. Although Electron Energy Gain principle was already demonstrated 30 years ago [34], it wasn't demonstrated in a TEM at that time, and had been a subject of intense interest for Pr A. Howie and later J. Garcia de Abajo [35]. The corresponding experiments have since then been done in a TEM with a pulsed gun [36]. Missing a pulsed, gun, we haven't been eventually able to perform the experiment, but at that time I was not aware of these limitations, and the motivation, plus the keen pressures of my colleagues O. Stéphan and C. Colliex was sufficient for me to begin to try building such a device. Developing a CL system in a STEM (as compared to a SEM) with a high throughput is quite cumbersome. Indeed, working in the gap of a TEM pole-piece, where in addition to the CL mirror one has to fit a sample holder, puts stringent requirements on the mirror and other optical elements. As typically one is left with 1 or 2 mm for the thickness of the mirror, then very high curvature mirrors have to be employed, which are not only difficult to machine, but also to align. One can think at other alternatives, such as optical fibers or light guides, but they can be shown to be degradating the spectral resolution very quickly when used in cathodoluminescence systems. Although the initial design revealed to be the good one, it needed 5 years of work, and especially the skills of L. F. Zagonel (now Professor in Unicamp, Brazil) during his stay as a postdoc, to transform the first prototypes (micron spatial resolution, no spectral imaging, no speed, random alignment) to a daily working device with nanometer spatial resolution, meV spectral resolution, and high speed spectral imaging capabilities. This allowed us to perform experiments that we think can hardly be done with commercial systems. It also allows to perform experiments that cannot be performed in a SEM, whatever the intrinsinc quality of the cathodoluminescence system.

Spectral imaging of plasmons in CL, after the pioneering work of Yamamoto [15], has been popularized, in a SEM, by the work of the Polman team in the netherland [16] (note that they developed their own CL system, too), and proven to be an interesting alternative to EELS especially for large nanoparticles.
However, working in a TEM allows to work on smaller nanoparticles. But the main interest in working in a STEM is the direct comparison to EELS. We could perform combined EELS and CL experiments on the same plasmonic nanoparticles (unpublished data) – which was one of the initial motivations of J. Garcia de Abajo. Surprisingly, differences arise, that have still to be analysed, but which clearly point to the fact that we have there the nanometer counterpart of optical exctinction (with EELS) and luminescence (CL).
Chronologically, we first concentrated on semi-conducting objects. The reason is that plasmon resonances are broad, and their quantum efficiency is small, making it really hard to use when developing the CL device. Of course, CL is known to be very good at triggering luminescence of semi-conductors, but when we first discussed the idea of measuring luminescence properties of quantum confined nanoobjects with semi-conductors specialists, the output was quite negative. The argument was twofold. First, the spatial resolution gained by using a nanometer wide beam should totally disappear in semiconductor. Indeed, in a regular SEM, samples are so thick and acceleration voltages so small that the incoming electron is randomly travelling through the sample and may excite, several times, emissions at different places in the excitation volume (the "excitation peer"). Also, even if one electron creates only one electron-hole pair at a given place, this electron-hole pair may diffuse over large distances (up to microns in clean samples) before deexciting at a place unrelated to the excitation position. Second, it was not clear why measuring luminescence at sub-wavelength would be interesting at all.

However, coming from the EELS in a STEM community, where experimental conditions are, ideally, always pushed so that the inelastic interaction between the electron and the sample is arbitrarily small, and being not guided by the work of the very few pioneers in the field of CL in a TEM (Yamamoto[37], Albrecht[38]…), we did not see the diffusion length as an issue.
For the first point, we were quite lucky. Indeed, in a STEM, the excitation peer can be made negligible. Thus, the transfer of one (at most) energy quantum between the electron and the object of interest is possible. This makes possible to work in CL in a linear regime, just like with PL, even with the most easily saturable systems. We have recently shown it [40] on individual Nitrogen-Vacancy (NV) defects in nanodiamond – indeed, NV centres are ideal two level systems, and proving that we can excite them one at a time without saturation is a direct proof of how gentle an electron interaction can be. Also, in nanostructured system, diffusion length can be found to be extremely small, whether the object itself is very small (a Quantum dot, for example), or the electron hole pair diffusion is stopped by huge gradients that arise at very short scales.

For the second point, it turns out that densely packed quantum emitters can have emission properties that depend drastically on their local environment. It is only by probing them one by one, at the nanometer scale, that we can understand their properties. This is exemplified in Figure 2, were the cathodoluminescence spectral imaging of individual GaN in AlN quantum disks (QD) of few monolayers embedded in a nanowire,

separated by few nanometers, has been performed. Together with the atomically resolved HAADF imaging, it is then possible to relate the emission wavelength to the exact thickness of the quantum disk. If this relationship is linear, as expected - the wavelength is proportional to the width of the "box", two points are rather troubling. First, the emission wavelengths of the largest QDs are larger than that of the bulk material, which is totally counterintuitive for a quantum confined object. Second, for a given QD thickness, the emission wavelength is rather dispersed, which cannot be explained by an error in thickness or emission wavelength measurements.

The first point is due to the Quantum Confined Starck Effect (QCSE), a well-known effect in the physics of the III-V and II-VI compounds, which is here directly evidenced. In systems with huge internal electrical fields (for example piezo and pyro electric fields, as in the presented example), the valence and conduction bands are so bent that the transition energy may become smaller than the bulk band gap energy. The reason for the wavelength dispersion for a given QD width was explained by a variation of the local band gap due to changes of the strain state along the wire, itself due to a modification of the AlN shell thickness along the wire.

Thus, cathodoluminescence of semi-conducting objects in a STEM, with nanometer spatial resolution is indeed yet another tool to add to the nanooptics toolbox. Contrary to what was believed, it certainly compares with PL in terms of linearity, and having nanometer scale resolution certainly helps in the understanding of the underlying problematics.

Conclusions and outlooks

In this paper, I carefully avoided to discuss other nanooptics techniques, and to mention drawbacks of using fast electrons and related spectroscopies.
Opticians have made stunning improvements in terms of spatial resolution – yet keeping most of the flexibility associated with laser spectroscopy in terms of time and polarization control. Among many other advances, one can cite the incredible spatial resolutions in 3D obtained with Stimulated Emission Depletion (STED) microscopy [41], or the ability to map phase of plasmons on individual nanoparticles [42]. It is also worth mentioning the great success of Photo-Emission Microscopy (PEEM) in the recent years [43].
Electron based spectroscopies are still in their infancy regarding the optical techniques – we miss a proper scheme for pump probe spectroscopy, non-linear optics is still to be done with fast electrons, as well as quantum optics. We thus clearly have to keep exploring new possibilities of performing nanooptics experiments with fast electrons. With the advance of time resolved microscopy in a TEM [36,44], EELS/CL pump probe spectroscopy are at hand. Also, knowing that, in a STEM (as opposite to a SEM), the electron-exciton or electron-plasmon interaction can be finely tuned, it makes it obvious that non-linear nanooptic experiments will be possible; this is also true for quantum nanooptics experiments, as predicted recently [45].

Acknowledgments

I already mentioned some of my mentors and colleagues in the text. They played a decisive role in the success of our work, and I want to warmly thank them for that. I want to deeply acknowledge the team I am belonging to (the STEM group at Orsay), whether they directly participated or not to this adventure. Having the chance to work in such an intellectually stimulating and, most importantly, friendly atmosphere makes all the difference.

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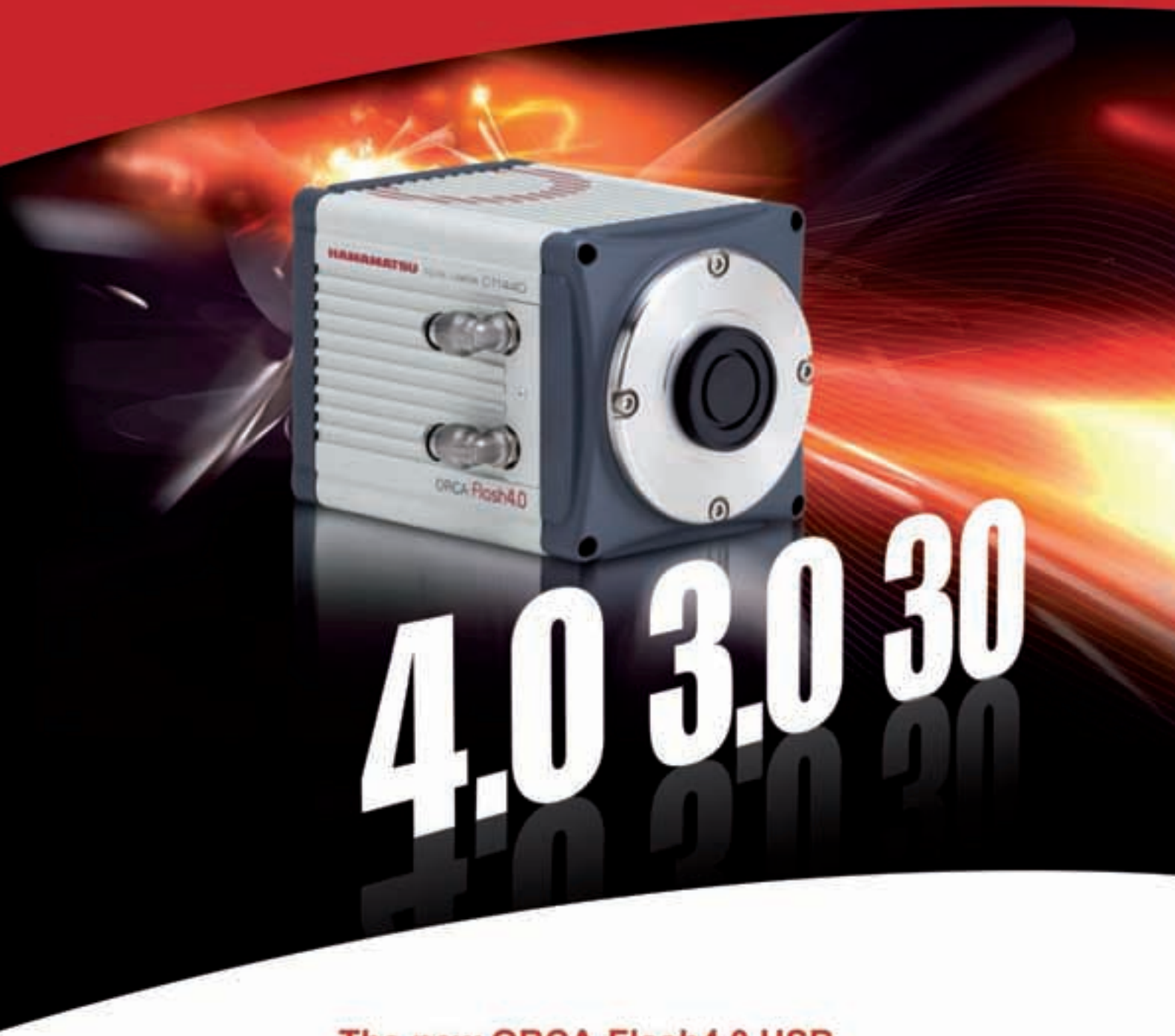

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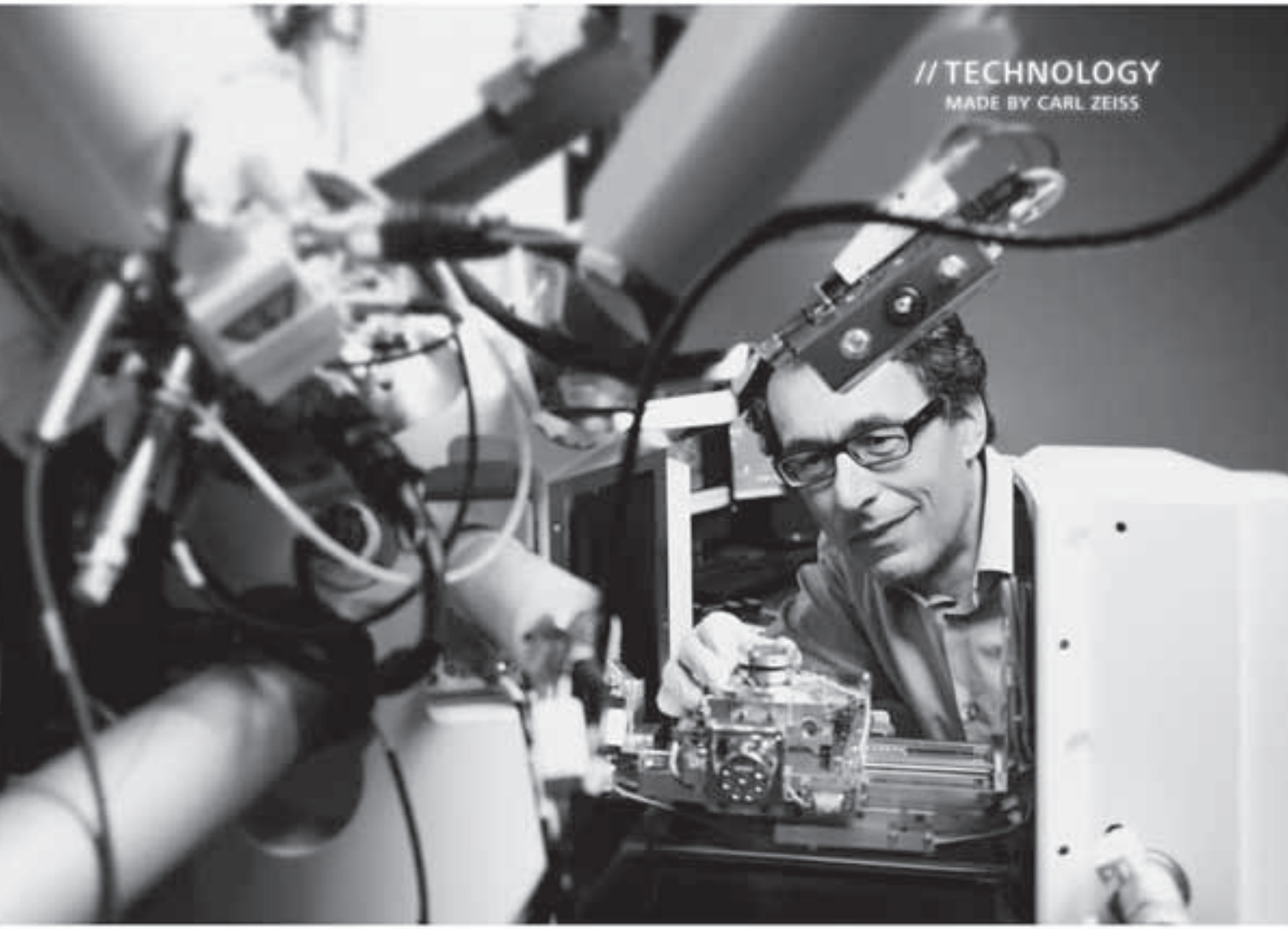

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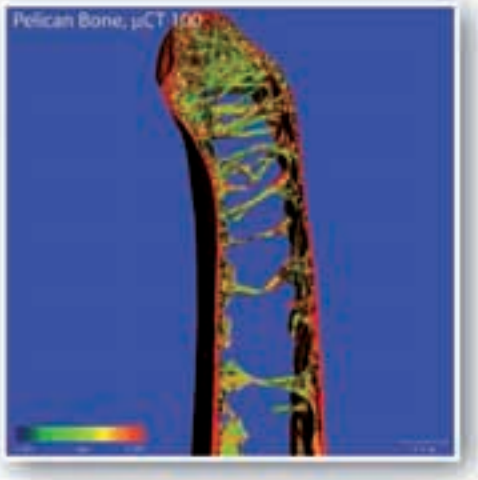

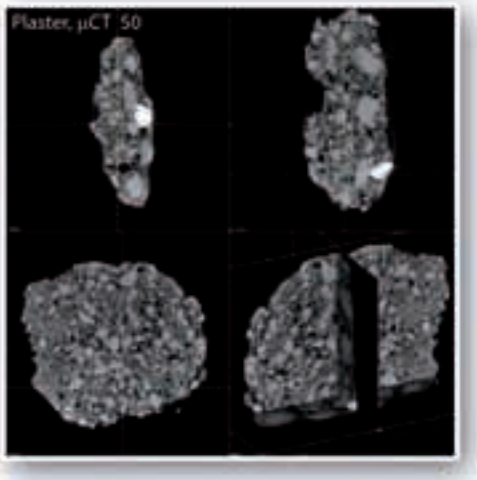

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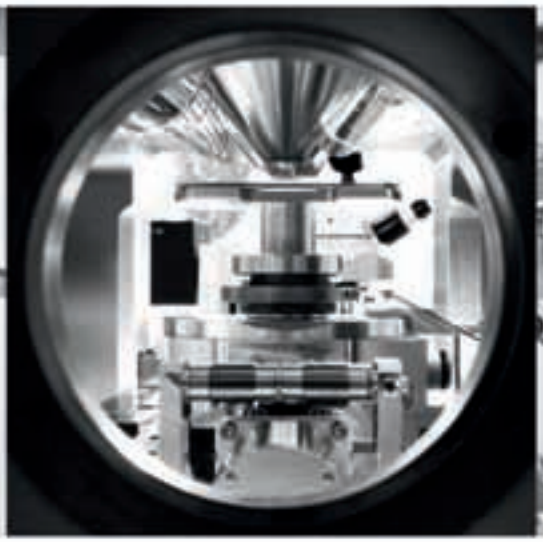

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APPLICATIONS OF PRECESSION ELECTRON DIFFRACTION

14th -15th September 2012

Materials Science Centre, University of Manchester

Group photo of the attendants

Prior to the European microscopy congress (EMC) 2012 the University of Manchester, School of Materials played host to a two day workshop exploring precession electron diffraction and its applications to a wide variety of microscopy and crystallography applications. The school was over-subscribed with a group of 19 delegates and had a group of 8 lecturers and demonstrators. The first day saw lectures from the chairman on the fundamentals of the technique and from Prof. Damien Jacob (Lille) on the advantages in determining symmetry, point- and space group from precession electron diffraction data. These were followed by a lecture on the various approaches to solving the phase-problem by Dr. Owen Saxton (Cambridge) and the application of direct phasing of diffraction patterns using high resolution images by Prof. Sven Hovmöller (Stockholm).

In the afternoon the school split into groups for practical demonstrations on a CM200 TEM equipped with a Digistar system to allow precession electron diffraction. Computer based demonstrations were also given of various phase-retrieval procedures highlighting the potential benefits of quasi-kinematical diffracted intensities.

APPLICATIONS OF PRECESSION ELECTRON DIFFRACTION

The second day saw a range of talks on techniques that, like PED, seek to utilise reciprocal space information more completely. Two techniques, rotation electron diffraction presented by Prof Peter Oleynikov (Stockholm) and diffraction tomography, presented by Dr Andrew Stewart (Mainz), showed how completeness in the data-set could dramatically improve the ability to solve and refine structures from electron diffraction data. The final talks described the development and some applications of scanning precession electron diffraction given by Dr Stavros Nicolopoulos (Nanomegas) and Prof. Muriel Veron (Grenoble). At the complementary afternoon practical session the delegates again split into groups of ~4 for interactive demonstrations of all the techniques.

The school provided an excellent opportunity for researchers of many ages to share their thoughts and experiences of these and other aspects of electron crystallography, our hope is that the delegates can take this knowledge and improve their research as a result. We found the talks and demonstrations extremely illuminating and they showed how far electron diffraction in general, and how the precession technique in particular, has enabled ways of achieving near-routine crystallographic analysis of even nano-scale materials. The evening event saw delegates sharing a canal-boat cruise with delegates from the SuperSTEM meeting taking place in the Manchester materials centre, providing an opportunity for networking and socialising with researchers across a wide range of electron microscopy disciplines.

We would like to thank all of the speakers who we agree passed their knowledge and enthusiasm for the subject on to the delegates; to the delegates for helping to make the school a success with their interest and inputs; to the hosts at the Manchester materials centre for providing the lecture rooms and electron microscopy facilities and finally to the sponsors, the RMS, EMS, IUCr, Nanomegas, Calidris and Analitex for all of their support for the organisation and staging of the school.

Alex Eggeman & Sarah Haigh

SYMPOSIUM X @ E-MRS 2012 SPRING MEETING

Symposium X "Quantitative Microscopy of Energy Materials"

Thomas Klassen, Helmholtz-Zentrum Geesthacht, Germany, during his presentation on "Nanostructured reactive hydride composites for hydrogen storage" at symposium X on "Quantitative microscopy of energy materials".

Meeting Report

A symposium on "Quantitative microscopy of energy materials" was held during the E-MRS 2012 Spring Meeting in Strasbourg, France, May 14-18, 2012. The symposium was organized by Thomas Höche, Fraunhofer Institute for Mechanics of Materials IWM, Halle, Germany, Aïcha Hessler-Wyser, EPFL, Lausanne, Switzerland, Wolfgang Jäger, Kiel University, Germany and Hugo Bender, Imec, Belgium. It was a successor of the symposium on "Quantitative electron microscopy for research and industry" organized at the E-MRS 2010 spring meeting.

The symposium gave a forum to researchers interested in quantitative application of different advanced microscopy methods, including atomic force microscopy, transmission electron microscopy and spectroscopy, and scanning electron microscopy to different fields of energy-related materials, such as H production and storage, fuel cells, batteries, reactors, and silicon and organic photovoltaics. This symposium had more than 60 contributions received from 23 countries from within Europe as well as from China, Israel, Japan, Korea and the USA. The symposium was one of several symposia on materials for energy of the E-MRS conference. The topical areas are reflected by the contributions of the invited speakers and addressed a wide range of methods and application aspects in this important field: "Quantitative electron tomography" (Paul Midgley, Cambridge University, UK), "Nanometric defects in materials in transmission electron microscopy"

SYMPOSIUM X @ E-MRS 2012 SPRING MEETING

(Robin Schäublin, EPFL Lausanne and Paul Scherrer Institute, Villigen, Switzerland), "Quantitative characterization of deformation and transformation of microstructures of advanced steels using electron diffraction techniques in the SEM" (Stefan Zaefferer, Max-Planck Institute for Iron Research, Düsseldorf, Germany), "Effect of interfaces on the ionic conductivity of SOFC materials" (David McComb, Ohio State University, Columbus, USA), "On the help of microscopies in the understanding of degradation mechanisms observed on materials in pressurized water reactor" (Laurent Legras, EDF, France), "Designing semiconductor photocatalyst/metal cocatalyst composites for water splitting" (Rik Brydson, University of Leeds, UK), "Electron energy-loss spectroscopy of dopant concentration profiles and optical absorption in thin film silicon solar cells" (Rafal Dunin-Borkowski, Forschungszentrum Jülich, Germany), "Microscopy study of thin-film polycrystalline silicon solar cells: where optical, electrical and structural material characterizations in the sub-micron range meet each other" (Dries Van Gestel, imec, Belgium), "Materials science for high-efficiency III-V solar cells" (Frank Dimroth, Fraunhofer Institute for Solar Energy Systems ISE, Freiburg, Germany), "Investigation of aged organic solar cell stacks by cross-sectional transmission electron microscopy coupled with elemental analysis" (Paola Favia, imec, Belgium), "Advances in spectroscopic nano-scale characterization in electron-optical instruments" (Nestor Zaluzec, Argonne National Laboratory, USA), "HAADF-STEM of layered structures in materials for photonics, thermoelectronics and photovoltaics" (Miran Ceh, Jozef Stefan Institute, Ljubljana, Slovenia), "Nanostructured reactive hydride composites for hydrogen storage" (Thomas Klassen, Helmholtz-Zentrum, Geesthacht, Germany).

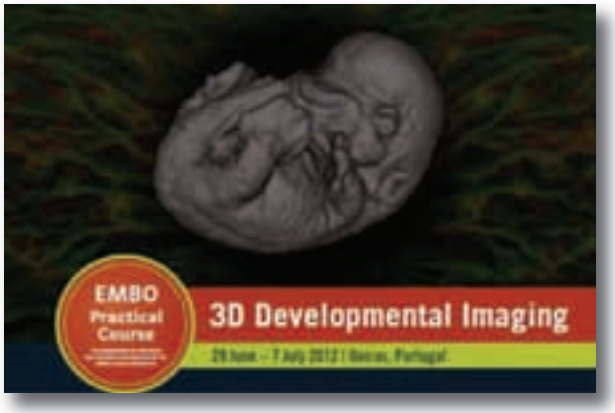
Panagiotis Karagiannidis from the Aristotle University of Thessaloniki, Greece, proudly shows his diploma for the best graduate student contribution to symposium X on "Quantitative microscopy of energy materials".

The graduate student award for the best paper submitted to the symposium went to Panagiotis Karagiannidis from the Laboratory for Thin Films, Nanosystems and Nanometrology, Physics Department of the Aristotle University of Thessaloniki, Greece, for his presentation on "Impact of thermal annealing on the morphology and interfacial composition of bulk heterojunction organic solar cells". Two best poster awards were granted in the categories "materials" and "techniques" to András Kovács and co-worker from the Ernst Ruska-Centre, Jülich, Germany for the poster on "Resolving the surface structure of iron-silicide alloy nanocrystals" and to Kjetil Valset and co-worker from the Department of Physics, University of Oslo for the poster on "Quantitative study of structure factors at large reciprocal vectors using convergent beam electron diffraction: Application to anharmonicity of the thermal motion in Mg2Si". Full papers of the symposium contributions will be published in a special volume of Journal of Materials Science.
The organizers greatly appreciate the sponsoring from the European Microscopy Society which allowed to invite David McComb from the Ohio State University, Columbus, USA, ("Effect of interfaces on the ionic conductivity of SOFC materials") and Nestor Zaluzec from the Argonne National Laboratory, USA ("Advances in spectroscopic nano-scale characterization in electron-optical instruments"). **Hugo Bender**

IIIRD EMBO COURSE ON 3D DEVELOPMENTAL IMAGING

This practical course is aimed at young researchers working on Developmental Biology, interested in answering specific questions that require observation of cell movement and tissue morphogenesis in whole embryos, particularly difficult using conventional optical microscopy techniques.

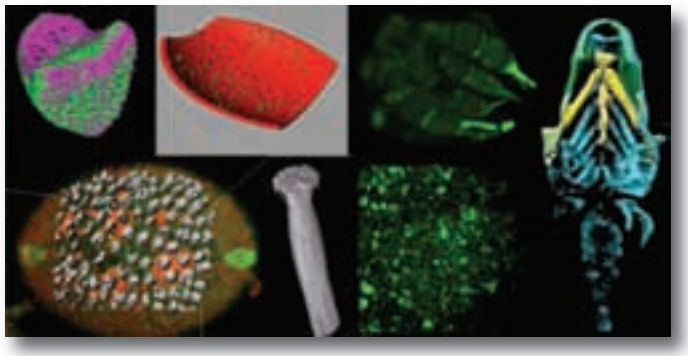
The 3rd edition was held at the Instituto Gulbenkian de Ciência in Oeiras on June 29th - July 7th of 2012. The course included lectures from invited speakers and vendors who explained the techniques and equipments available for the course and which included: OPT, SPIM/DSLM, Multiphoton and confocals, wide-field+deconvolution, Ultra-microscope, DSD confocal, Spinning disk confocal.



The course was mostly practical and included the preparation of student samples which were then used to image with the different available imaging instruments. The student samples included Arabidopsis, Chara, moss, sea urchin, Drosophila, zebrafish, chicken and mouse, which were organized into seven mini-projects. Aside from these live samples, students also brought fixed embryos which were imaged in the different systems, as well as datasets which were analyzed during the last days of the course.

The course counted also with the collaboration of several of the leading vendors in microscopy and imaging software/hardware. The general schedule of the course, as well as more information can be found online at: ***http://events.embo.org/12-developmental-imaging***

The course ended with a 5min presentation by each student showing their results (figure below includes a few examples of images prepared during the course) and a brief discussion of problems and solutions found. Given the success of the course, a 4th edition for 2014 in envisioned.



More details will be provided in this edition's website. EMS sponsored this event by contributing to the travel expenses of Prof Robert Bryson-Richardson from Monash University, Melbourne Australia who gave the talk entitled "Zebrafish imaging, OPT and 3D Anatomical Databases".

Gabriel G. Martins, course organizer

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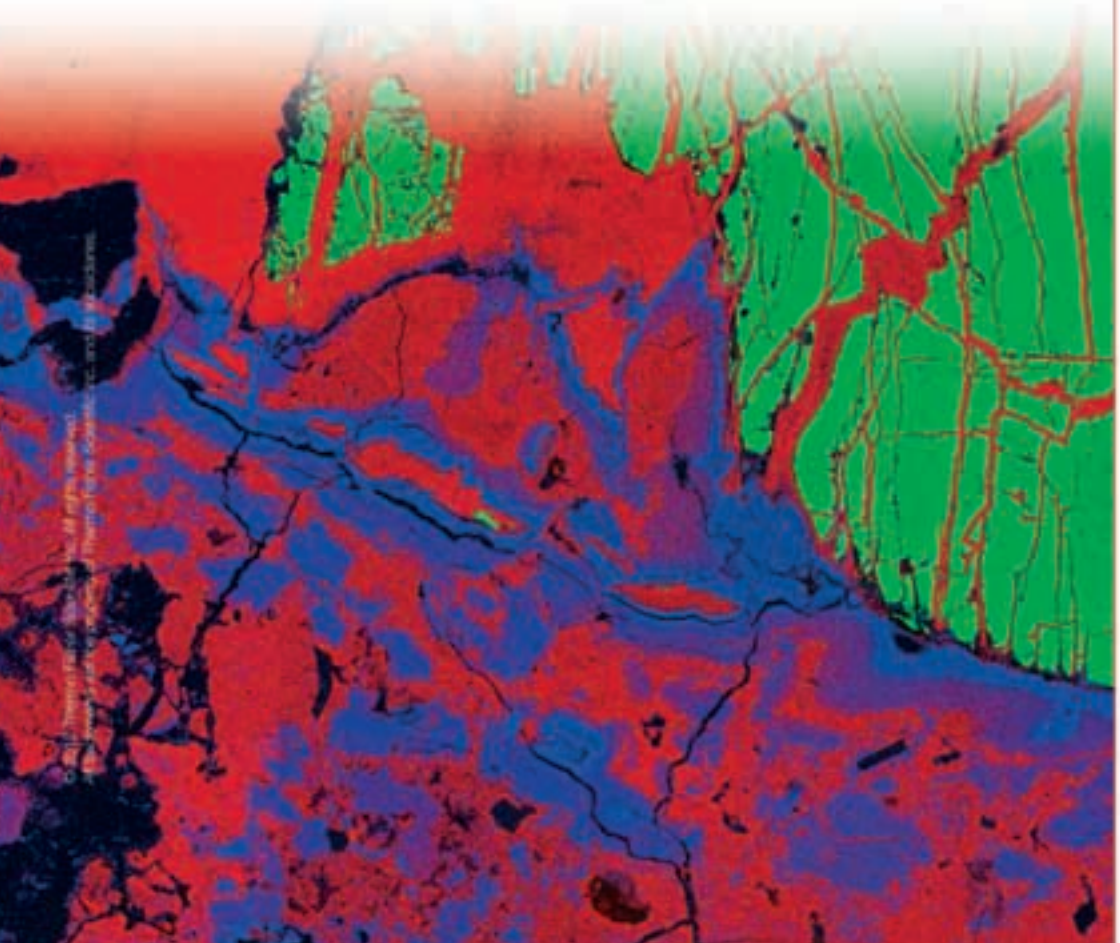

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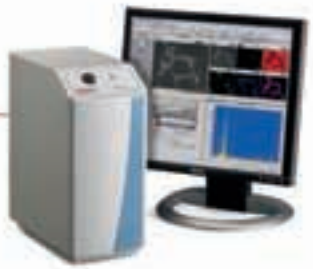

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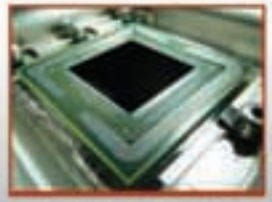

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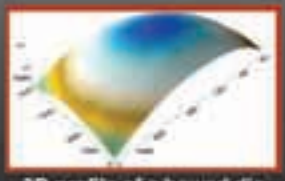

3D profile of a bowed die before thinning

3D profile of a bowed die after removing 600 µm

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REPORTS ON SPECIAL EVENTS

Notes :

MC 2013 Regensburg

August 25–30, 2013 • Regensburg/Germany

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Universität Regensburg

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General Information

Date
August 25–30, 2013

Venue
University of Regensburg
Regensburg/Germany

The Microscopy Conference (MC) 2013 will be held at the University of Regensburg, Germany, from August 25–30, 2013. The MC 2013 will be jointly organized by ten microscopical societies from 11 countries: Switzerland, Austria, Germany, and Croatia, Czech Republic, Slovakia, Hungaria, Italy, Serbia, Slovenia, and for the first time, Turkey.
The official conference language will be English.
Reduced conference fees will be available to members of all participating Societies for Microscopy. The MC 2013 will receive the status of an „EMS extension". As committees, there will be a Local Organizing Committee, a Scientific Program Committee and an International Scientific Advisory Board.

Topics
- Instrumentation and Methods
- Materials Science
- Life Sciences
- Multidimensional and Interdisciplinary Microscopies

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In memory of Andranik PETROSYAN (1948 - 2012)

PETROSYAN Andranik Ph.D. - (09/02/1948 - 20/09/2012)

Past-president of the Armenian Electron Microscopy Society (1991-1996), Head of the Eye Research Laboratory, Buniatian Institute of Biochemistry NAS of Armenia, Yerevan.

Dr. Andranik M. Petrosyan, was one of the leading research scientists in Neurochemistry of retina and retina morphology.

Dr. Andranik Petrosyan led the investigations dedicated to the role of Taurine and other neuroactive aminoacids in primary vision. He has suggested the existence of Schiff base conjugate between taurine and retinaldehyde - tauret in the retina which nearby with specific retinoid binding proteins can play a serious role in the process of retimoid transport via connections between disks and plasma membranes and can regenerate the visual cells after light induced damage. Dr. Petrosyan led a number of projects in this direction. He has participated in a number of conferences devoted to Taurine and primary mechanisms of vision in Germany, Italy, Japan, Mexico, Norway, Russia, USA. During the last years Dr. Andranik Petrosyan initiated cooperation with Armenian, Russian, USA and French scientists to use Taurine and its derivatives in ophthalmology.

In 1991 Dr. Andranik Petrosyan with Dr. Robert P. Apkarian (USA) has founded the Armenian Electron Microscopy Society (AEMS) in the most dramatic time for Armenia. He was elected the AEMS President and served in the post until 1996.

Dr. Andranik Petrosyan has organized many scientific meetings. The last event, the International Symposium devoted to the Defense mechanisms of the retina was held in the fall of 2008. Leading specialists from Armenia, Russia, USA, France and Great Britain were participants of the symposium.

Dr. Andranik Petrosyan is survived by his wife Jasmina Harutyunyan, two of his children and four grandchildren.

by Karlen Hovnanyan, Ph.D., D.Sc.,
President of Armenian Electron Microscopy Society

INAUGURATION OF THE FEI-TITAN^3 ULTIMATE MICROSCOPE AT THE NANOCHARACTERISATION CENTRE (PFNC) OF CEA-MINATEC

Grenoble, France - 22nd-23rd October, 2012

The Centre of Electron Microscopy of CEA-Minatec at Grenoble has been engaged in Transmission Electron Microscopy for many decades. Involved in the early developments of the High Resolution Transmission Electron Microscopy (HR-TEM), at the beginning of the seventies, in 2005 CEA expanded its frontiers with the acquisition of the first FEI-Titan delivered by FEI. This microscope was equipped with a probe Cs-corrector and a Lorentz lens combined to a biprism for electron holography. Thanks to this tool CEA developed HR/STEM imaging and electron holography for electric, magnetic and strain field mapping.

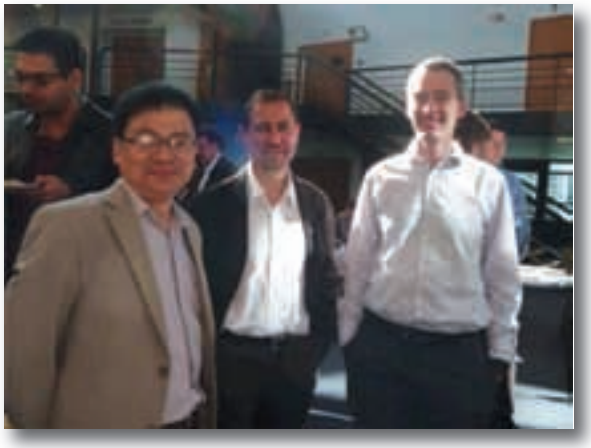
October 22nd and 23rd of this year 2012, CEA has inaugurated its new FEI-Titan^3 Ultimate microscope. This new microscope is equipped with an X-FEG, a monochromator, both image and probe Cs correctors, with electron holography capability and a GIF Quantum for ultra fast acquisition of energy loss mapping. The stability of this system allows 50 pm resolution at 300 kV and better than 80 pm at 80 kV. Atomic resolution chemical mapping has been demonstrated, as well as strain mapping directly from STEM images, atomic resolution electron holography and full rotation tomography. This microscope is dedicated to research and development in nanotechnology and nanoscience, with emphasis on materials for electronics, optics, spintronics and magnetism devices and on materials for new and renewable energies such as batteries, solar cells, lighting and fuel cells.

The purchase of this microscope was supported by a national grant of the *Recherche Technologique de Base* (RTB Program) attributed to the CEA-Leti, one of the main partners of the nanocharacterisation platform which also associates CEA-Liten and CEA-Inac.

The microscope was officially launched in Grenoble, during a ceremony which was held at the World Trade Center. The ceremony gathered during two half-days more than 120 participants, composed of collaborators and invited speakers such as Prof U. Dahmen (NCEM, Berkeley, USA), Prof O. Stéphan (LPS-CNRS, Orsay, France), Dr D. Cooper (CEA-Leti, Grenoble, France), Dr S. Kujawa (FEI-company), Prof R. Dunin Borkowski (ERC, Julich, Germany), Dr C. Gatel (CEMES-CNRS, Toulouse, France), Dr J. Verbeeck (EMAT, Antwerp, Belgium). A dinner was offered to the participants by FEI Company, on Monday evening in the château du Touvet. This inauguration was followed by the French meeting on EELS (JEELS2012).

Dr P Bayle-Guillemaud

The TITAN ULTIMATE installed on the Electron Microscopy Centre of the PFNC, CEA-Grenoble.



Prof J. Zuo, Dr JL Rouvière and Dr J. Verbeeck -invited speaker-EMAT- at a coffee-break during the TITAN ULTIMATE inauguration.

LAUNCH OF THE LARGEST NANOTECHNOLOGY CENTRE IN SOUTH POLAND

The University of Rzeszów launches an innovative Microelectronics and Nanotechnology Centre and Innovation and Knowledge Transfer Center with Facilities for Electron Microscopy & Sample Preparation and for Nanolithography.

In February 2007, an application to the Ministry of Regional Development and to the Ministry of Science and Higher Education of Poland for the construction of a research and technology transfer center was issued. It was accepted for realization in mid 2009 with a quote of 18 mln EUR in the frame of the Operating Program Infrastructure and Environment. Thus, on the 17 July 2009 the University of Rzeszów signed the contract for financing a Microelectronics and Nanotechnology Center. Simultaneously, a second contract for financing an Innovation and Knowledge Transfer Centre from the Regional Operating Program was signed with the local Government for 31 mln EUR.

Photograph of the new building of the Center for Microelectronics & Nanotechnology and of the Innovation and Knowledge Transfer Centre with 15 000m² of usable area.

The priority of the University is to create an innovative infrastructure as a scientific and educational basis for new faculties: Nanotechnology and Materials Engineering featuring numerous domains such as: nanotechnology and materials for aviation (nanomaterials and nanocomposites) as well as for medical bioengineering, bioinformatics, analytical biotechnology and biomaterials. These faculties will provide educational preparation for young people to be concurrent on the employment market.

It is planned, that the Microelectronics and Nanotechnology Center executes research projects concerning growth, characterization and application of nanostructures based on III-V and II-VI semiconductors materials. We also would like to introduce nanolithography and develop MBE technology, as methods for the fabrication of nano-structures such as: quantum wells, quantum dots or super-lattices. The characterization of these objects will include techniques such as electron microscopy (SEM, TEM), time-of-flight secondary ion mass spectrometry (TOF-SIMS), Raman spectroscopy integrated with AFM (Nano-Raman), XRD, EPR, micro-luminescence at low temperatures as well as magneto-transport phenomena measured at super-low temperatures and high magnetic fields.

On the contrary, the Innovation and Knowledge Transfer Centre with Laboratory nr. 1 (additional quote of 6 mln EUR), is constructed to develop more industry oriented technologies such as for example magnetron sputtering but also material testing techniques such as metallography and optical microscopy. Thus the Microelectronics and Nanotechnology Center and Laboratory 1 form a complex, which enables us to implement fabrication technologies of novel materials into industry, in particular to aviation industry. Therefore the Microelectronics and Nanotechnology Center works in close cooperation with WSK-PZL Rzeszow, being a member of the Pratt & Whitney Group, located in the nearby Aviation Valley.

Both Centers have a usable area of 15 000 m² accommodating laboratories, equipped with instruments allowing for measurements of different properties of nanomaterials such as crystal structure, chemical composition with several spectroscopic techniques and mechanical and structural properties, which will thus allow performing research activities in various interdisciplinary areas.

In the frame of this Project 200 m² of clean room surface for MBE technology, nanopatterning and nanolithography were built. Moreover, photolithography and electron lithography for the production of integrated circuits and element of quantum wells will belong to the clean room equipment, as well as instruments allowing for measurements of magneto-transport at low temperatures and optical properties of nanostructures. In addition, students can learn how to conduct investigations of nanodevices and quantum structures in specially organized and equipped laboratories.

LAUNCH OF THE LARGEST NANOTECHNOLOGY CENTRE IN SOUTH POLAND

As a first result of the project activities, two facilities for multipurpose and multi-technique microscopy, were recently opened in the Microelectronics and Nanotechnology Center. The first one is for the scanning electron/ion imaging and nanopatterning, whilst the second one will allow for studying the structure and composition of the fabricated quantum devices with the application of high resolution TEM techniques. The first laboratory is currently equipped with a dual beam FEI Helios Nanolab system supported by a Raith Multibeam lithography attachment, the second one successfully runs a FEI Tecnai Osiris™ transmission electron microscope and a smaller dual beam scanning electron microscope FEI Quanta 3D dedicated mainly for TEM sample preparation.

Nanolithography Facility

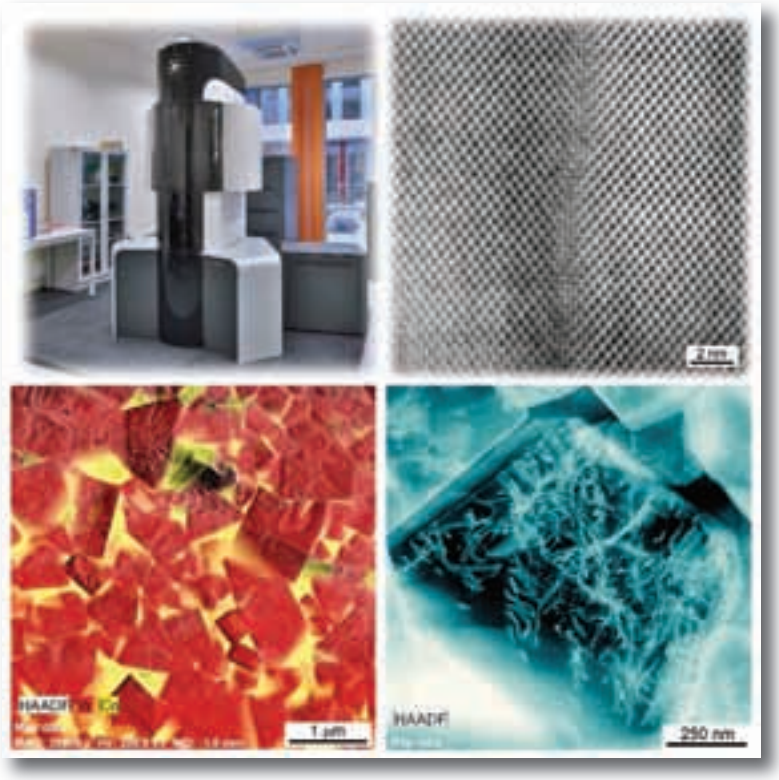
The Helios 650 dual beam SEM/FIB microscope is the first of the NanoLab instruments line installed in Poland by FEI. Due to its particular column design, it delivers a sub-nanometer SEM resolution (up to 30 kV acceleration voltage) and provides a high thermal stability, good deflection linearity and fast electrostatic scanning. Such parameters, combined with a precision piezo-stage and accurate ion-milling, will enable a high through-output, multi-level lithography and will have an immediate impact on microscope based quantum device research, conducted in the Center.

The Helios NanoLab 650 relies on FEI's latest ion column, the Tomahawk FIB. The Tomahawk's exceptional low-voltage performance is proven to produce the world's best quality nanostructures using direct (dry) ion-beam lithography.

The multi-technique patterning and nano-fabrication based on electrons and helium atoms, which is enabled through the MultiBeam attachment, is able to handle rather complex patterns and overlay lithography jobs. For example, the so-called "patterning on SEM image", important for prototype devices usually patterned on untypical substrates, is provided by the GDSII editor. Furthermore, flexible directional exposure modes, essential for precise ion-milling, are also supported. Finally, the application of nanoPECS system, which calculates the proximity corrections and simulates developed resist profiles, will shorten considerably the development time needed for new device fabrication.

Facility for Electron Microscopy & Sample Preparation

The Tecnai Osiris™, installed in October 2012 at the Facility for Electron Microscopy & Sample Preparation, is a remote controlled, high performance 200kV S/TEM system, offering outstanding performance in all imaging and analytical modes. The combination of a high brightness field emitter and a windowless EDX detection system using Silicon Drift Detector (SDD) technology, lead to extremely high count rates for a given beam current and significantly improved sensitivity for light elements. Fast mapping reduces the acquisition time for elemental mappings down to the one for a high quality STEM image, turning the grey-scale image contrast into color-coded elemental information.



Top row: *Tecnai Osiris™ installed at the Facility for Electron Microscopy & Sample Preparation in the Center for Microelectronics & Nanotechnology. HAADF HRSTEM image of a dislocation in a TeHg single crystal.*

Bottom row: *EDX map with underlayed HAADF STEM image of W (red) and Co (yellow) distribution in a WC-Co ceramic taken within 10 min. with the Super-EDX. Dislocations in a WC grain imaged with the HAADF STEM detector. The color is artificial.*

The Quanta 3D SEM/FIB dual beam with a tungsten cathode is an excellent alternative for the classic mechanical polishing and ion milling technique for TEM sample preparation. It brings new capabilities and flexibility to engineers and researchers needing to

LAUNCH OF THE LARGEST NANOTECHNOLOGY CENTRE IN SOUTH POLAND

characterize materials and conduct failure analysis in an industrial or academic environment. It allows for TEM sample preparation and extends the applications range for 3D characterization and nano-analysis or structural modification of sample surfaces at the nanometer scale. In particular the Omniprobe micromanipulator system for lifting out the lamellas allows to re-thin samples, which were found to be too thick for TEM observations.

The opening of the Nanolithography Facility and Facility for Electron Microscopy & Sample Preparation is planned for April/May 2013 and will by accompanied by a Symposium on Nanostructured Materials. Detailed information will be available on the respective websites.

Acknowledgements

The Center for Microelectronics & Nanotechnology acknowledges the support the Ministry of Regional Development and to the Ministry of Science and Higher Education of Poland, project nr UDA-POIS.13.01-018/08-00, in the frame of the Operating Program Infrastructure and Environment as well as the project nr WND-RPPK.01.00-18-001/10 in the frame of the Regional Operating Program of the Podkarpacki Region in Poland.

E. M. Sheregii, J. Wrobel & M. Parlinska-Wojtan

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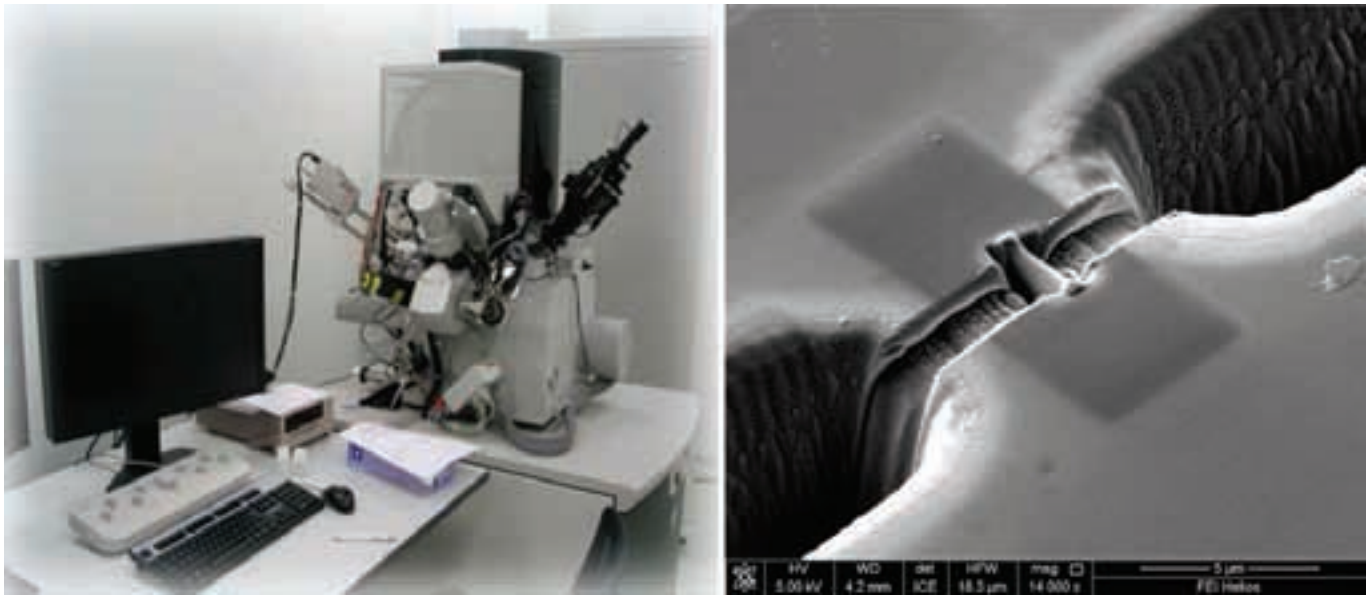

On the left: Nano Lab Helios 650. On the right: the 1D-channel (Quantum Point Contact) performed from a 2D-structure using the FIB of the Helios 650.

NEW ELECTRON MICROSCOPY RESEARCH GROUP

New electron microscopy research group in Saarbrücken, Germany

The INM Leibniz-Institute for New Materials, Saarbrücken, Germany, has founded the new group Innovative Electron Microscopy (IEM) in January 2012. The group is headed by Prof. Dr. Niels de Jonge, a biophysicist working on biological electron microscopy and nanotechnology. Dr. de Jonge was recruited from Vanderbilt University School of Medicine, Nashville, TN, USA, where he pioneered the imaging of biological specimens and nanoparticles in liquid using scanning transmission electron microscopy (STEM) [1,2]. The IEM group conducts interdisciplinary research at the interface of bio-nanotechnology, materials science, cell biology, physics of electron microscopy, and image processing.

The research will focus towards in-situ electron microscopy of liquid specimens using the recently installed state-of-the-art aberration corrected STEM/TEM (ARM200, JEOL, Japan, see Fig.1), and a dedicated liquid specimen holder (Poseidon system, Protochips Inc., NC, USA). The group also houses an environmental scanning electron microscope (Quanta 400 FEG, FEI, USA) and combines light and electron microscopy via correlative approaches [4, 5]. This unique combination of equipment will be used to study the oligomerization of proteins in whole eukaryotic cells via the use of nanoparticle labels [1], to probe the interaction of nanoparticles with cells [3], to investigate nanoparticle growth and self-assembly processes in-situ, to study energy materials, and to conduct research on fundamental processes occurring at the interface of solid materials and liquids. The same systems will also be used to study nanoparticles in a gaseous environment at atmospheric pressure [6].

An important aspect is the inclusion of the time domain in the electron microscopy experiments. A further focus area of the group will be three-dimensional aberration corrected STEM via focal series [7] also combined with tomography.

Contact:

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References:

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OTHER NEWS

Mini-Symposium In Electron-Microscopy Of Materials Honoring The 85th Birthday Of Prof. Enrique Grunbaum. March 21, 2012.

A minisymposium was organized at the Weizmann Institute in honor of the 85th birthday of Prof. Enrique Grunbaum, Prof. Emeritus at the Department of Physical Electronics, Faculty of Engineering, Tel-Aviv and adviser on electron microscopy and diffraction for the last 15 years. Prof. Grunbaum was the Founder and first chairman of this department in 1978-1983.

This event was organized by Prof. Reshef Tenne of the Institute and Dr. Maya Bar Sadan of the Ben-Gurion University. The Chairman of the symposium was Prof. Guy Deutscher of Tel-Aviv University, an early collaborator since 1972.

Emphasis was placed on the research of Prof. Grunbaum at the Imperial College in 1956-58 on the analysis of magnetic domains in cobalt single-crystals by electron diffraction, considered a precursor of Lorentz electron microscopy. Prof. Grunbaum also used the original method of selected diffraction spots for visualizing nanoparticles in low-temperature superconductors.

Lectures were given by:
1) Prof. Gustaaf Van Tendeloo, EMAT, University of Antwerp, Belgium, on "Electron Microscopy in the 21st Century".

2) Dr. Lothar Huben from the Research Center Jülich, Germany on "Imaging Spectroscopy and Nanomanipulation in modern ultra-high resolution transmission electron microscopy".

3) Dr. Maya Bar Sadan from the Ben-Gurion University in Beer Sheva on "Imaging single Au atoms in GaAs nanowires using HRSTEM."

The minisymposium was attended by members of the Israel Society of electron microscopy (of whom Prof. Grunbaum is an honorary member) and by some of his former students.

The symposium was supported by the Martin Kimmel Center for Nanoscale Science.

Zahava Barkay from the Israel Society for Microscopy received the Professional Technical Staff Award of the Microscopy Society of America for her talk "Quantitative Wettability Study at Nanometer Scale Based on Wet-STEM in ESEM" at the Microscopy & Microanalysis 2012 meeting in Phoenix, Arizona, USA.

18TH INTERNATIONAL MICROSCOPY CONGRESS 2014

The preparations of the upcoming International Microscopy Congress (IMC 2014) have advanced substantially in the year 2012. At the beginning of the year the following committees were established in order to help the local organizers in preparing a top-class scientific programme:

- International Scientific Programme Committee - 35 members divided into four workgroups: Instrumentation, Materials Science, Life Sciences, Interdisciplinary,
- International Advisory Board - 40 members selected on basis of a balanced geographic distribution,
- International Studentship Committee - 12 members whose main task will be a fair distribution of funds available for students and young scientists.

In spring 2012, the structure of the scientific programme was created. In summer the local organizing committee invited members of the committees to nominate session chairs, invited and plenary speakers. During emc2012, the IFSM executive committee had an extensive discussion on IMC 2014 preparations, especially on the IFSM Presidential Symposium that is planned for the last day of the Congress. The main task for autumn 2012 was to select plenary speakers and session chairs.

We have also initiated cooperation with industry partners. The exhibition prospectus was distributed to companies and published on the IMC 2014 website in August.

During emc2012, IMC 2014 president Pavel Hozak had meetings with key industry players and most of them have already confirmed their participation in the commercial exhibition.
There will be also a wide selection of pre- and post-Congress activities, including theoretical lectures and demonstrations. The call for organizers will be announced before the end of this year through the congress website, IFSM and EMS channels. Moreover, the IFSM School for young scientists will be organized as a traditional IMC 2014 side-event.

Important dates:

Autumn 2013	On-line registration and abstract submission available
3 March 2014	Abstract submission deadline
1 July 2014	Standard registration deadline

We are looking forward to seeing you in Prague.

Pavel Hozak
IMC 2014 President

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REPORTS ON SCHOLARSHIPS

SCHOLARSHIPS

In 2012, 27 extended scholarships (early career stage registration fee plus partial travel expenses) have been awarded to early stage career EMS members for presenting the results of a trans-European research collaboration at emc2012 in Manchester from 16 till 21 September, 2012. Also one scholarship was awarded to attend the Advanced Microscopy Winterschool at the ETHZ in Switzerland. Let us remind you that any young EMS member can apply for a scholarship (criteria and eligibility can be found at http://www.eurmicsoc.org/scholarships.htm).

15th European Microscopy Congress (emc2012), 16 – 21 September, 2012, Manchester, UK

Name	Society	Lab & Country
Almeida Trevor	RMS	Dep of Earth Science and Engineering, Imperial College London, UK
Blom Tobias	SCANDEM	Department of Engineering Sciences, Uppsala University, Sweden
De Backer Annick	BSM	EMAT, University of Antwerp, Belgium
de la Mata María	SME	Institut de Ciència de Materials de Barcelona, ICMAB-CSIC, Spain
Dobranska Kamila	CSMS	Institute of Scientific Instruments of the ASCR, v.v.i., Brno, Czech R
Egoavil Ricardo	BSM	EMAT, University of Antwerp, Belgium
Ek Martin	SCANDEM	Division of Polymer - and Materials, Lund University, Sweden
Goris Bart	BSM	EMAT, University of Antwerp, Belgium
Grieten Eva	BSM	EMAT, University of Antwerp, Belgium
Heidari Hamed	BSM	EMAT, University of Antwerp, Belgium
Hetaba Walid	ASEM	Institute of Solid State Physics, Vienna University of Technology, Austria
Jeangros Quentin	SSOM	Ecole Polytechnique Fédérale de Lausanne, Switzerland
Kovacevic Zorana	CSEM	Faculty of Textile Technology, University of Zagreb, Croatia
Larraona Puy Marta	RMS	Arrhenius Laboratories, Stockholm University, Sweden
Löffler Stefan	ASEM	Institute of Solid State Physics, Vienna University of Technology, Austria
Martinez Gerardo T	BSM	EMAT, University of Antwerp, Belgium
Mayoral Alvaro	SME	Universidad de Zaragoza, LMA, INA, Spain
Meshi Louisa	ISM	Dept of Mat Engineering, Ben Gurion University of the Negev, Israel
Misják Fanni	HSM	Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest
Seabourne Che	RMS	Faculty of Engineering, University of Leeds, UK
Shmeliov Aleksey	EMAG (IOP)	University of Oxford, Department of Materials, Oxford, UK
Tan Haiyan	BSM	EMAT, University of Antwerp, Belgium
Thersleff Thomas	SCANDEM	Department of Engineering Sciences, Uppsala University, Sweden
van der Veen Monique	BSM	Centre for Surface Chemistry and Catalysis, KU Leuven, Belgium
von Cube Felix	DGE	Physikalisches Institut, Universität Bonn, Germany
Wallace Rachel	RMS	Institute for Materials Research, SPEME, University of Leeds, UK
Xie Ling	SCANDEM	Department of Engineering Sciences, Uppsala University, Sweden

Advanced Microscopy Winterschool, 15-20 January, 2012, ETH Zürich, Switzerland

Name	Society	Lab & Country
Prystopiuk Valeria	RMS	Institute of Physiology-II, Wilhelms-University of Münster, Germany

Short reports from awarded students, European Microscopy Congress emc2012

Trevor Almeida (UK)

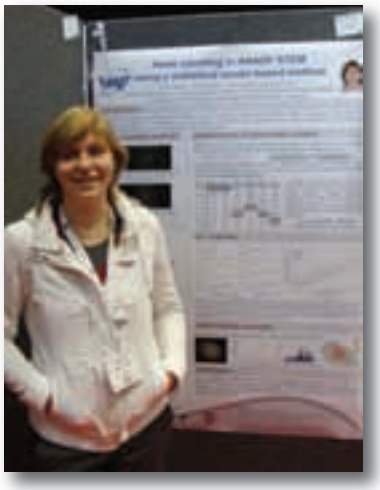
I attended the 15th European Microscopy Congress (EMC) held in Manchester under the auspices of the European Microscopy Society. The Congress provided an update of the challenges at the frontiers of applied scientific research, bringing together, through all forms of microscopy, advances in nanotechnologies and applications; medicine and healthcare; energy conversion; environmental protection, and much more. I attended several plenary and invited talks on topics both closely and broadly related to my research. By way of example, a presentation by Jeff Lichtman went into great detail of new electron microscopy methods to map the entire wiring diagram of the developing and adult brain. This "connectomics" approach aims to uncover ways information is stored in neural connections and his presentation showed some wonderfully coloured images allowing visualisation of neural connections and how they alter over time. Another interesting presentation was given by Christian Colliex on the advances of electron energy loss spectroscopy (EELS) in scanning transmission electron microscopy. I found the ability to identify the individual atoms in crystal structures using high spectral resolution EELS remarkable. These are just a couple examples of improved functionality of instrumentation used for material characterisation over the past decades. However, a variety of materials was presented ranging from biological to catalytic to energy-related to magnetic and semi-conducting materials.

In particular, the focus on dynamic chemical processes monitored by in situ and environmental transmission electron microscopy (TEM), using aberration correction, high-resolution imaging, spectroscopy and chemical mapping is directly related to my current project. Further, symposiums which had some emphasis on Lorentz imaging and electron holography were very interesting and gave me some ideas to help progress my research and optimize the techniques I use. The conference also provided me the opportunity to present orally my work on "Dynamic exsolution of titanomagnetites and their associated magnetic response examined by complementary environmental TEM and off-axis electron holography" and a poster "Hydrothermal growth mechanism and reduction of α-Fe2O3 nanorods examined by in situ and environmental TEM".

Overall, **I enjoyed speaking to people coming from such diverse fields of study that were willing to engage in open discussion about microscopy and nanomaterials.** Further, the opportunity to visit such a vibrant city as Manchester will always be remembered. The Manchester Central exhibition centre was a perfect venue to hold this conference with stylish seminar rooms and advanced audio visual facilities. The tour and conference dinner at the Manchester United Football Club's Old Trafford Stadium was very impressive and further set the tone for the rest of the conference. Accordingly, I feel the conference was a great success and would look forward to attending the 16th EMC meeting in Lyon.

Annick De Backer (Belgium)

I am very grateful to EMS for supporting me to attend the European Microscopy Conference in Manchester. It is always a great experience to take part in an international scientific conference. This gives you the opportunity to keep informed of the latest progress, which has been made in a wide range of microscopy topics. During the conference, I followed many lectures in miscellaneous sessions given by experts and young researchers. The speakers showed many interesting results using state-of-the-art instrumentation and different advanced methods.



I also enjoyed the poster sessions, where I also presented my work. During these sessions, it is easier to meet other researchers with similar fields of interest and to have valuable discussions. Overall, **this conference motivates me to carry on my daily research activities.**

Short reports from awarded students, European Microscopy Congress emc2012

Kamila Dobranská (Czech Republic)

The European Microscopy Congress emc2012 was held in Manchester, The United Kingdom, during the week from the 16th to 21st of September, and it was my first opportunity to attend such a great microscopic event. Therefore I would like to thank the European Microscopy Society that allowed me to participate. The emc 2012 took place in Manchester Central, a huge building, which in the past served as a train station, really fascinating place.But the weather was changeable and often rainy and windy, however sunny at times, which is probably typical for this area. It was for me, as a young scientist, very useful and interesting to exchange insights in the field of life science with other students and recognized experts.

I would like to mention that **the entire event was very well organized.** The program was divided into four main sections: Life Sciences: Tools and Techniques, Life Sciences: Applications, Physical Sciences: Tools and techniques and Physical Sciences: Applications, as well as plenary lectures presented by the greatest experts brought me a lot of knowledge. During the breaks between lectures there was an opportunity to see an exhibition of companies showing their latest equipment and tools for light and electron microscopy, or to attend some workshops, where for example experts explained different approaches to biological sample preparation, which is the main area of my interest.

I'm really glad that I was able to attend the emc2012 and to present some of the initial results of my work on a poster: during the poster section I had discussions about my topic. I met many young scientists and other experts in the field of microscopy; this participation became a great asset for me and an inspiration too. Once again, I thank you very much.

Ricardo Egoavil (Belgium)

Thanks to the support of EMS, I had the opportunity to attend The 15th Electron Microscopy Congress, in Manchester, UK. During the first 2 days of the scientific program I presented a poster entitled "TEM investigation of LSMO/STO interfaces", in the session of Advances in spectroscopy in STEM and CTEM. It was a good experience since I could get to know the scientific community about the progress of my PhD work. This well organized scientific event helped me to meet and discuss my results with others PhD students and professionals all around the world. I have enjoyed and learned quite a lot from the plenary talks and lectures. In particular, the ones related to advanced spectroscopy techniques like HAADF, STEM EELS, vortex and applications to oxides hetero-structures.

I am really thankful with the EMS support since it was indeed a rich experience in all senses, and helped me to consider different scientific aspects related to my PhD work in order to be professionally better prepared for the forthcoming events.

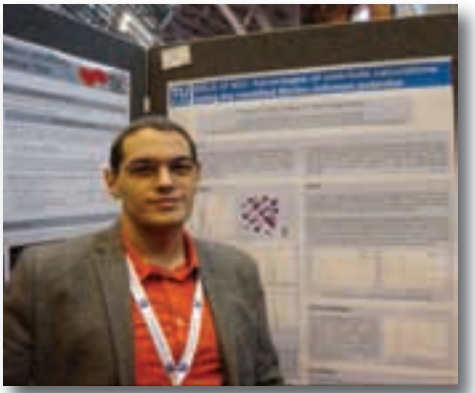
Eva Grieten (Belgium)

I would like to start by thanking EMS for the financial support that made it possible for me to participate in emc 2012. I particularly liked the way the conference was organized which allowed the participants to follow different presentations, workshops and visit the exhibition and learning zone. The pre-workshop "Focused ion beam" provided a good overview of the technique compared to other preparation methods. During the conference I mainly followed the presentations on applications, where the different lectures presented interesting results and approaches to characterize materials. Amid all lectures and presentations, I especially enjoyed the presentation from Henry Zandbergen, who gave an overview of the possibilities of in-situ transmission electron microscopy. To me, as a new scientist, it opened all new manners to approach my own research. The poster session gave me a chance to present my work and meet with people that are working in the same area. I liked the concept of a poster session where it was possible to discuss my research with experts of electron microscopy as well as young scientist. Overall, I enjoyed the conference and I'm looking forward to the next EMC2016 in Lyon.

Short reports from awarded students, European Microscopy Congress emc2012

Walid Hetaba (Austria)

Preparations began almost half a year before the actual date of the European Microscopy Congress. As time went by very quickly, many important informations about the conference came only in the last minute. So I was wondering whether the organisers would be able to handle this large number of attendees. But as the conference emerged it was clear that everything was well organised and we could see a lot of talks and posters of high scientific quality.



During the coffee breaks as well as in the poster sessions many fruitful discussions emerged. The poster sessions were very crowded, the only drawback was the limited space in the poster area. In the evenings we were able to discover some of the nice restaurants located in the central area of Manchester and also to taste some typical Mancunian food. There was also the opportunity to meet friends and colleagues and to get to know new people and learn more about their work.

I'm very grateful to the EMS for awarding me a sholarship and making all this possible. Altogether, attending the European microscopy congress in Manchester was a very important experience for me and also helped me in pushing forward my career as a young scientist.

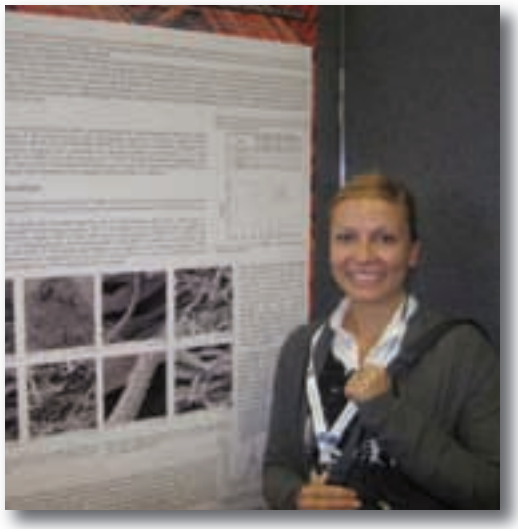
Quent Jeangros (Switzerland)

The plane lands in Manchester in a pouring rain, welcome to the UK! Fortunately, some fine Indian curry soon cheers up the atmosphere. Joking aside, there is no time to rest. I have my presentation the first morning in the in situ and environmental electron microscopy session, which I'm enthusiastic to attend as it gathers many aspects related to my work. So there it is, Monday 11 a.m, I'm in the spotlight for 15 minutes. My talk goes according to plan, at least from my perspective, and I have now nearly the full week left to enjoy the conference. Microscopists from all around the world have converged here and **Manchester Central feels like a particular microcosm;** performances of the different electron or light microscopes are compared and scrutinized like cars would be. The multidisci plinary aspect of the conference is stimulating as problems in radically different fields may be assessed using a common strategy. Famous scientists are attending and it's inspiring to listen to those, who have been contributing actively to make the field of microscopy as advanced as it is now. So after a week of exciting talks, stimulating discussions related to science (and to the girl in red of the emc2016 stand), networking, and, in general, great fun, there is plenty to bring home for a PhD student like me and, in that sense, I would like to gratefully acknowledge the European Microscopy Society for their financial support.

Zorana Kovacevic (Croatia)

The 15th European Microscopy Congress, emc2012 was held from 16 till 21 September in Manchester, UK.

I'm very honored that EMS choose me among 41 received applications and awarded me with a scholarship to attend such a great congress and be able to present my poster on "SEM and thermal characterization of flame retardant functional protective textiles".



The scientific programme was preceded by seven interesting workshops and it was very difficult to choose in which of them I wanted to participate. Every session I've attended was highly visited and received a quite large attention. I'm sure that one of the many reasons that affected this high quality meeting was very good organization of lecture halls, exhibition hall and poster hall. The only negative thing I can say was the minor problem with registration because of which I couldn't officially participate with my poster.

Short reports from awarded students European Microscopy Congress emc2012

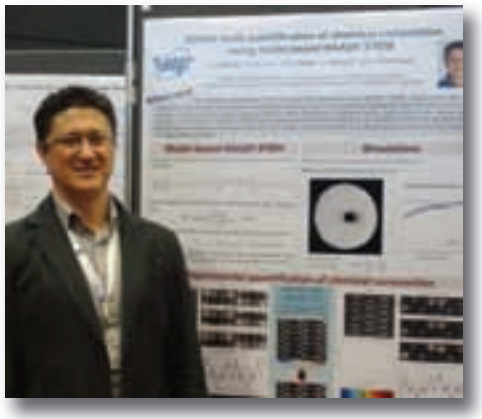
Nevertheless, I would like to thank the organization committee who gave me the chance to present my work. Emc2012 was the biggest congress I've ever attended and **I would recommend it to every young scientist** because it is a great opportunity to meet new people, share ideas and find co-workers for future cooperation.

Stefan Löffler (Austria)

During my preparations for the European Microscopy Congress (EMC), I had some small doubts regarding the congress. Between wrong e-badges and statements like "conference delegates will be able to obtain-up to two cups of coffee or tea per day [...]", I wondered how manageable such a big conference would be. However, these doubts were washed away in an instant the moment I stepped into Manchester Central, the venue of the conference. Everything was well-organized, the staff was friendly and helpful, and there was a great, constructive atmosphere everywhere. Amenities aside, the congress was also a huge scientific success. I got some very encouraging feedback for my talk, and there was also a lot of interest in my posters. Moreover, it was an excellent opportunity to meet friends and colleagues from all over Europe (and the world) as well as to get to know new people and learn about their fascinating research. In addition, it allowed me to **learn more about the EMS by taking part in the general assembly held during the congress.** All in all, I am convinced that taking part in the emc2012 has furthered my career prospects in electron microscopy; I want to express my gratitude towards the EMS for awarding a scholarship to me and thus making all this possible.

Gerardo Tadeo Martinez Alanis (Belgium)

The European Microscopy Conference emc2012 took place in Manchester, United Kingdom. It was an international and interdisciplinary event relating the research on microscopy techniques, with a wide variety of topics, not only in the academic/research field, but also about industry and innovative products as well. It was a very nice opportunity to learn the state of the art research, but also to get to know the product developments in the exhibition area. **I found it very complete in all aspects,** since the symposia lectures were very interesting and inspiring, the exhibition area and its workshops were innovative and the poster presentations and social activities included a nice twist of networking and getting to know scientists in a more relaxed way, while introducing my research topic.



This is the second conference I attend during my PhD studies. I am glad to have had this opportunity, since I got very useful feedback and remarks on the research I am focusing on. I was also able to meet other scientists and discuss about different points of view that made a "bigger and clearer" picture on my research topic. As a PhD student, I think is very useful to attend to this events since there is a great amount of learning in a very short time and it is also very motivating to get better research done.

Alvaro Mayoral (Spain)

The 15th European microscopy congress held in Manchester resulted in very well organized symposium, which I particularly found very exciting and interesting.
The ultimate developments in instrumentation were presented as well as the most advanced results in materials science that this technique has allowed to obtain.
Regarding the oral presentations, I did find tremendously interesting the presentations related to the low voltage conditions (Prof. Sawada and Prof. Zach) and the in-situ experiments with gas and temperature variations (Pratibha L. Gai, Stig Helveg and Christopher Kiely).

Short reports from awarded students European Microscopy Congress emc2012

Concerning my poster presentation; in both days, I enjoyed fruitful and motivating **discussions which have already helped me to establish collaborations** with scientist who are also working on porous materials.
Finally, I would like to express my gratitude to the European Microscopy Society (EMS) for the financial support, which allowed me to attend the conference.

Sebastian Tacke (Germany)

Due to an EMC bursary, which was funded by the EMS & RMS, I had the great opportunity to participate in emc2012 in Manchester. The conference was held at the impressive location of Manchester Central and completely fulfilled my expectations concerning the range of company booths and scientific contributions, both by oral and poster presentations. Additionally, I want to highlight the workshops and the Learning Zone, in particular. From my point of view, **the Learning Zone is a valuable concept, which should be established in every conference.** Especially, young scientists have the chance to profit from the knowledge of experienced scientists and to network within the society. However, with the participation in this EMC, I had not only the chance to get in contact with numerous companies, in order to test their microscopes or equipment, but also to discuss about the latest improvements, developments and new trends in the field of electron microscopy in life science. Furthermore, the talks about cryogenic techniques and correlative approaches left a lasting impression on me. Additionally, there was plenty of room for discussions in order to establish collaborations and new contacts during the poster presentations. My prospective work will definitely benefit from these impressions and new motivations.
All in all, it can be stated that the conference became a wonderful meeting due to the appreciating efforts of the organisers. Therefore, I am very pleased that I was one of the bursary awardees and I want to express my gratitude to the EMS & RMS committee for the financial support which enabled me to participate in this conference.
With these experiences, I am looking forward to the MC 2013 in Regensburg.

Thomas Thersleff (Sweden)

Overall, I was very impressed with the organization and execution of the European Microscopy Congress 2012. The conference gave me a good opportunity to get caught up on the recent advancements in the field over the last year and was an inspiration to me in my own research. It also provided an excellent review of what is possible with the new generation aberration corrected devices when combined with advanced analytical techniques. **I left the conference excited and optimistic about the future of microscopy in Europe.**
Among the highlights of the conference for me was session PS2.7: Advances in spectroscopy in STEM and CTEM. The invited talks by G. Botton and L. Allen demonstrated in a powerful manner one of the biggest strengths of the TEM in nanotechnology: the combination of structural and analytical (EELS and EDX) data in the same data set with nanoscale spatial resolution. This was expanded upon through the demonstration of the Nion microscopes by O. Krivanek as well as numerous other talks and posters throughout the congress. I was also quite impressed with the work by J. Verbeek and P. Schattschneider on the topic of vortex beams in the microscope. I look forward to seeing this technique used in the nanoscale characterization of advanced magnetic materials.
On a more personal level, I was very impressed in the work done by N. Gauquelin et al., R. Guzman et al., and Reich et al. on functional thin film superconductors. I researched this topic during my PhD and am pleased to see how recent advancements in aberration correction is being put to excellent use to characterize the strain fields in these materials. This has been a major advancement in the field of applied superconductivity and will only increase in significance as the influence nanoscale defects have on macroscopic supercon¬ductivity is better understood. I was also especially excited to see that a technique I am currently working with - EMCD - is being applied to complex superconducting materials by W. Zhou. I look forward to the developments in this field.
I presented three posters at the conference covering a range of materials and techniques I'm developing at Uppsala University. I received some excellent feedback on these posters and was impressed by the level of engagement in the congress participants.

Monique A. van der Veen (Belgium)

The European Microscopy Congress 2012 in Manchester was the **ideal platform for me to present my results** as this congress uniquely focuses on microscopy in both life and physical sciences. The method we recently developed to determine the point group symmetry with second-harmonic generation microscopy is indeed

Short reports from awarded students European Microscopy Congress emc2012

important for both communities. It can be applied to any type of non-centrosymmetric material, both biological and non-biological, as well as in situ of in vivo in complex samples. The congress was not only a great opportunity to present my results, but also to learn about the most recent developments in microscopy and to interact with leading scientists in the field. On top of that Manchester and the interaction with the other participants were great fun. I am thankful to the European Microscopy Society for awarding me with a travel grant to attend this conference.

Felix von Cube (Germany)

The EMS in Manchester was a very good opportunity for me to get up to date with the latest developments and trends in electron microscopy. Besides the many lectures on low-loss EELS, which are of particular interest to me, **I found the numerous workshops very elucidating.** Considering my own work, I would say that my research is also of interest to other scientists. After my talk I had lots of inspiring conversations and I could gather some nice ideas for my project. In particular the poster sessions in the early evening were a good platform to meet new people and see some new microscope techniques and applications. The open bar made a great atmosphere, which allowed some nice and casual conversations. The conference dinner took place at the old Trafford, the stadium of Manchester United and was one of the highlights to me - a really nice location with really good food. I shared a table with (up to that point) strangers and I had a really good time. All in all I would say that it was a really successful conference. Thank you!

Hamed Heidari (Belgium)

The EMC European microscopy conference is the largest convention in Europe being held on microscopy and which is arranged every four years. This year it was organized in Manchester, UK. All microscopy societies in Europe are gathered together and share the latest results in the area of microscopy from optical microscopy to electron and atomic probe microscopy techniques. It is also worth to mention that such conferences open the opportunity to attend some cross-disciplinary talks which trigger some new ideas on what we do.
The emc2012 conference was organized in 2 major topics, life sciences and physical sciences. Since I principally work on electron tomography I attended some talks on life science applications and most of the talks on microscopy imaging techniques and recent developments in 3D imaging. It was an exciting experience since in electron tomography there are two groups of people mostly working one in life science applications and the other on materials science (inorganic materials) and which barely contact. The emc2012 has provided the opportunity for both these groups to share their knowledge and discoveries in the field.
On the other hand the conference had provided a rich atmosphere for the industry to exhibit the latest improvements on the instruments. Moreover there were also some workshops to present these instruments to the scientists participating in the conference.
Poster presentation part was the most interesting part for me since I could show latest results of my works and discuss them with colleagues more specialized on the subject. **These discussions I must say were quite fruitful.** I need to thank EMS for the financial support providing me the opportunity to attend the emc2012, Manchester. It was a rare experience since this microscopy conference was one of the largest microscopy conferences in the world.

Martin Ek (Germany)

Emc2012 was very inspiring and packed full of insights, and I'm very happy to have been given the chance to attend. I had a great time at the conference, and was able to stay until Sunday evening in order to see parts of the town outside of the Central. In the Low-dimensional materials session (where I contributed a talk) every single presentation felt very relevant and there were more posters to visit than in the entire conferences I have attended before. Although, or perhaps because, I work with TEM on semiconductors the life science and optical microscopy plenaries were very entertaining. The automatic brain-sectioning for SEM certainly gave me something to think about when crushing, grinding or polishing my samples (but then I recall all the work that was needed to segment that enormous dataset and the jealousy disappears).
While not being much of a football fan, it was still **very fun to visit "Old Trafford"** just to see the size of the arena. The century old shoes and jerseys on the other hand …
Once again I would like to thank the EMS (and the RMS) for sponsoring my trip.

Short report from awarded student Advanced Microscopy Winter school 2012

Valeria Prystopiuk (Ukraine)

I hasten to express my gratitude to the European Microscopy Society for providing me a scholarship of 400 Euros to attend the Advanced Microscopy Winterschool on 3D High Resolution Light and Electron Microscopy and Correlative Microscopy Techniques, which took place on 15-20 January 2012 at the ETHZ in Zürich, Switzerland.

The Practical Course in Advanced 3D Microscopy generally consisted of 8 practical modules and theoretical basis of lectures.
I, as histologist and cell-biologist, was interested in specific techniques of cell imaging and microscopy, especially life cell. I work in the Institute of Endocrinology and Metabolism (Kyiv, Ukraine) on testing the potential antitumor effects of nanogold on hormone-dependent prostate cancer and need to investigate mechanisms of drug effects on cellular level, so the knowledge and skills in confocal microscopy were very useful for our future projects. That was the reason, why I selected the module of Life Cell Microscopy.

During the period of the Winterschool we had three types of practical sessions in our module:

1. Fast acquisition live cell imaging (spinning disk confocal microscope) to investigate dynamics of microtubule ends by observation of microtubule end, binding protein EB3 in Retina pigment epithelial cells;
2. Bleaching experiment FRAP (fluorescence recovery after photobleaching) to analyse intracellular dynamics of microtubule growth in U2 Osteosarcoma cells;
3. Slow acquisition live cell imaging (widefield system) to investigate mitosis of Hela cells (Histon 2B- DsRed and - tubulin-GFP).

We were also trained in Image Analysis and Image Processing, such as 3D reconstruction, deconvolution, tracking of spots, etc. with the help of Imaris and ImageJ software.

It was a brilliant opportunity for me to get acquainted with the latest achievements of the microscopy industry on the Industry Day. Companies such as Olympus, Leica, Zeiss, Nikon, Till Photonics, Visage Imaging etc. presented their most modern innovations, and sometimes we had even a possibility to try the devices ourselves.

In addition, I'd like to mention the remarkable social part, during which all the participants tasted delicious Swiss dishes in a traditional restaurant, got acquainted with each other and had a lot of fun. Zürich is a very beautiful city during the day-time, but when you are sitting in the evening with good company in a small cozy restaurant not far from the bridge, and observing the opposite bank of the river with a lot of lights – it's extremely adorable and fantastic.

So, during the week in Zürich I not only learned useful knowledge for my future scientific projects in the area of Life Cell Microscopy, but also met new friends and learned more about science in Switzerland.

Notes :

REPORT ON OUTSTANDING PAPER AWARD

FINANCIAL REPORT

EUROPEAN MICROSCOPY SOCIETIES

EUROPEAN CORPORATE MEMBER ASSEMBLY (ECMA)

EMS CALENDAR 2013

APPLICATION FORMS (MEMBERS - ECMA)

2011 EMS OUTSTANDING PAPER AWARD

For the second round of the EMS Outstanding Paper Award and based on an evaluation of the first round The EMS Executive Board made some changes to the submission rules for the nomination of the papers.

The most important changes include the condition for the nominator to be EMS member and the request for a cover letter supporting the paper and selecting the category. By the deadline of January 15, 18 excellent papers had been nominated with a good balance between the different categories. The jury*, chaired by Rik Brydson as non-voting member of the EMS Executive Board, selected a winning paper for each of the three categories of the Award, which was later confirmed by the EMS Executive Board. The following papers received the 2011 EMS Outstanding Paper Award in the respective categories:

1. Instrumentation and Technique Development: "Atomic resolution imaging in three dimensions", S. Van Aert, K. Batenburg, M. Rossell, R. Erni, G. Van Tendeloo, Nature 470, 376-377 (2011); DOI:10.1038/nature09741
2. Materials Sciences: "Highly monodisperse core-shell particles created by solid-state reactions", V. Radmilovic, C. Ophus, E. Marquis, M. Rossell, A. Tolley, A. Gautam, M. Asta, U. Dahmen, Nature Materials 10 710-715 (2011); DOI:10.1038/NMAT3077
3. Life Sciences: "A Genome-wide multidimensional RNAi screen reveals pathways control ling MHC class II antigen presentation", P. Paul, T. van den Hoorn, M. Jongsma, M. Bakker, R. Hengeveld, L. Janssen, P. Cresswell, D. Egan, M. van Ham, A. ten Brinke, H. Ovaa, R. Beijersbergen, C. Kuijl, J. Neefjes, Cell, 145(2) 268-283 (2011); DOI:10.1016/j.cell.2011.03.023



Sandra Van Aert, Velimir Radmilovic and Marieke Jongsma, first authors of the winning papers received their metal-on-wood plaque at the congress diner of the emc2012 meeting at Old Trafford in Manchester from EMS President Paul Midgley. The Executive Board extends its warmest congratulations to all winners and we look forward to a new round of excellent papers for the 2012 competition.

* EMS Outstanding Paper Award jury members

Chair:
Rik Brydson (Institute for Materials Research, University of Leeds, UK)

Members:
Alan Craven (Department of Physics & Astronomy, Solid State Physics, University of Glasgow, UK)
Etienne Snoeck (CEMES, CNRS, Toulouse, France)
Bob Pond (University of Exeter, UK)
Wolfgang Jäger (Mikrostrukturanalytik, Christian-Albrechts-University, Kiel, Germany)
José Carrascosa (Centro Nacional de Biotecnologia, Universidad Autonoma Madrid, Spain)
Varpu Marjomäki (Dept of Biology and Environmental Science, University of Jyväskylä, Finland)

FINANCIAL REPORT OF EMS BUDGET

Presented at the General Assembly at emc-2012, Tuesday, 18th September 2012

Budget 2011 final, budget 2012 running, budget 2013 outlook

Budget 2011, final

Incomings

The majority of incomings were the contributions from the national societies and the ECMA members. By the end of the year, contributions from 5 national societies and from 6 ECMA members were pending. Further incomings came from the interest rates of the giro account. In summary, an amount of € 28.747,70 was accrued.

Expenses

EMS supported 8 sponsored meetings, each of them with € 750 and 2 EMS Extensions (€ 1.500 support each). 25 scholarships, at € 250 each, were issued to young scientists for supporting their attendance at the two EMS Extension meetings this year, i.e. MC2011 in Kiel (11) and MCM2011 in Urbino (14). This year, we had for the first time the three Outstanding Paper Awards with € 1.000 each. Two board meetings were held, one embedded in the Urbino meeting and one extra meeting held in March in Antwerp. Together with the costs for a half-time secretary and bank costs we had a total of expenses of € 42.031,17. Thus, in the year 2011 we ended with a minus of € 13.283,47, mainly due to the pending membership fees. At the end of the year EMS had € 64.898,57 at our deposit. As of December 31st, 2011 EMS had total assets of € 106.260,89.

Budget 2012, running; (August 27th, 2012)

Incomings

The major revenues will again be accrued by the annual contributions of EMS members of the national societies and of ECMA members. Invoices to ECMA members were sent out beginning of March, invoices to national societies in the course of May as soon as the updated EMS membership numbers were available. Societies and ECMA members with pending fees for 2011 received invoices for both years. The majority of members already submitted their fee, for those with pending fees reminders will be sent out beginning of October. As conservative estimation, we expect revenues of € 8.000 from the emc2012 in Manchester. Together with interest rates, incomings can be expected to amount to € 50.750.

Expenses

As decided at the previous board meeting in Urbino, EMS will increase the number of scholarships for young colleagues (à € 300) attending the emc 2012 in Manchester to 35, amounting to € 10.500. Because of the EMC, no EMS Extensions will be supported this year. EMS sponsors four meetings or courses with € 750, amounting to € 3.000.

The three EMS "Outstanding Paper Medals" at € 1.000 per each category will amount to € 3.000 plus € 500 for the plaques. In addition, there will be the administrative costs covering the salary of a half-time secretary, two board meetings (one board meeting held in Lyon in February this year and another embedded in the emc2012) and bank costs, so that the total of expenses are calculated to be € 50.750. As of August 27th, 2012 on account there remains € 43.860,81.

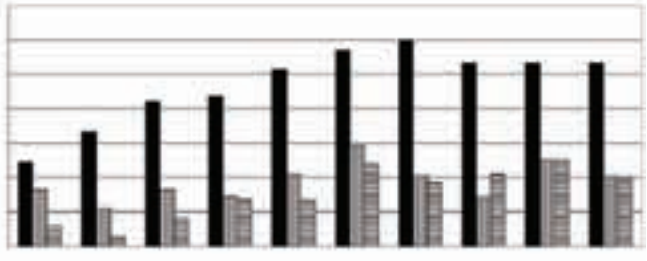
Budget 2013, proposal

Incomings

As every year, the major incomings will be accrued by the annual fees of EMS members of the national societies and of ECMA members. Together with interest rates of the savings account we can expect incomings of € 40.500.

Expenses

With these estimated incomings it will be possible to support one EMS Extension meeting (MC2013 Regensburg) with € 1.500. 18 scholarships à € 250 for students and young scientists can be issued (€ 4.500) and 6 sponsored meetings can be supported with à € 750 (€ 4.500). Further expenses include the Outstanding Paper Award, costs for half-time secretary, two board meetings and bank costs, amounting to € 40.500.



Christian Schöfer, m.p.
Treasurer EMS/EMF

Vienna, 29th August 2012

EUROPEAN MICROSCOPY SOCIETIES

Number of EMS Members by societies (2012)

Society			*Number of Members*
Armenian Electron Microscopy Society	AEMS	Armenia	8
Austrian Society for Electron Microscopy	ASEM	Austria	120
Belgian Society for Microscopy	BSM	Belgium	326
Croatian Society for Electron Microscopy	CSEM	Croatia	74
Czechoslovak Microscopy Society	CSMS	Czech Republic	248
German Society for Electron Microscopy	DGE	Germany	342
Electron Microscopy and Analysis Group	EMAG	UK	310
Hellenic Electron Microscopy Society	HSEM	Greece	60
Hungarian Society for Microscopy	HSM	Hungary	102
Israel Society for Microscopy	ISM	Israel	110
Microscopical Society of Ireland	MSI	Ireland	92
Dutch Society for Microscopy	NVvM	The Netherlands	214
Polish Society for Microscopy	PTMi	Poland	91
Royal Microscopical Society	RMS	UK	1402
Nordic Microscopy Society	SCANDEM	Scandinavia	303
Slovene Society for Microscopy	SDM	Slovenia	81
French Microscopy Society	SFμ	France	506
Italian Society of Microscopical Sciences	SISM	Italy	312
Spanish Society for Microscopy	SME	Spain	281
Portuguese Society for Microscopy	SPMicros	Portugal	175
Serbian Society for Electron Microscopy	SSM	Serbia	92
Swiss Society for Optics and Microscopy	SSOM	Switzerland	346
Turkish Society for Microscopy	TEMD	Turkey	107
ECMA	ECMA	Corporate	50
Individual members	IND	Individual	24

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- Skyscan NV
- SmarAct GmbH
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- Ted Pella, Inc.
- TESCAN, s.r.o
- Thermo Fisher Scientific
- Thorlabs
- Tietz Video and Image Processing
- Tissue Gnostics
- VSG

EMS CALENDAR 2013

EMS Extension

- **MC2013**

  August 25-30, 2013
  Regensburg, Germany
  Organization: DGE, ASEM, SSOM, CSEM, CSMS, HSM, SDM, SISM, SSM, TEMD

EMS sponsored events (Jan. - Jun.)

- **Winterschool 2013 - A Practical Course in Advanced Microscopy**

  January 20-25, 2013
  ETHZ and UNI Zürich, Switzerland

- **EMBO Practical Course in Advanced Optical Microscopy**

  April 3-13, 2013
  Citadel Hill, Plymouth, UK

- **QEM2013 - Quantitative Electron Microscopy**

  May 13-24, 2013
  Saint-Aygulf, France

- **EDGE (Enhanced Data Generated by Electrons) 2013**

  May 26-31, 2013
  Sainte-Maxime, France

APPLICATION FOR MEMBERSHIP

Individual Member Subscription form

Individual membership of the European Microscopy Society is open to all microscopists for €25 per year. Note that the membership fee is €5 for members of European national microscopy societies. Please return the following form to:

To subscribe to the EMS, please complete this form* and post or fax to:

Nick Schryvers, Secretary EMS, University of Antwerp, CGB,
Groenenborgerlaan 171, B-2020 Belgium
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Notes :

EUROPEAN CORPORATE MICROSCOPY ASSEMBLY (ECMA)

Subscription form

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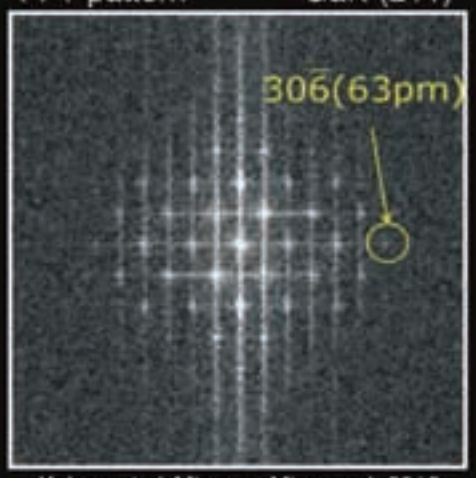

Kohno *et al.* Microsc. Microanal. 2010

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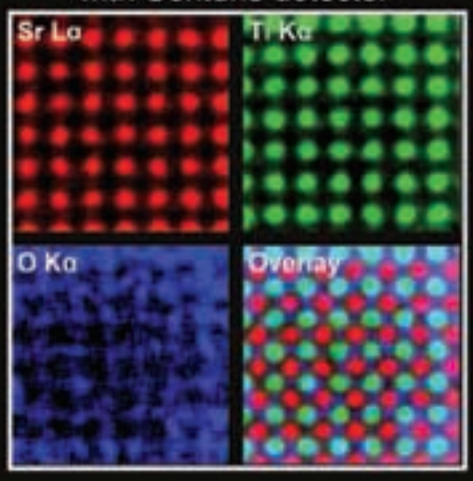
with Centurio detector



Direct imaging of hydrogene-
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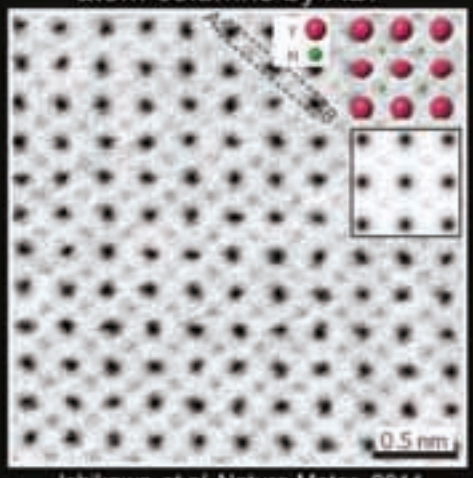

Ishikawa *et al.* Nature Mater. 2011

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