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EUROPEAN MICROSCOPY CONGRESS 2020

23 - 28 August 2020, Copenhagen, Denmark

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European Microscopy Society

IFSM

Call for Papers

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EUROPEAN MICROSCOPY CONGRESS 2020

23 - 28 August 2020, Copenhagen, Denmark

The 17th European Microscopy Congress will be Europe's largest event dedicated to microscopy and imaging.

emc2020 will include an international conference comprising over 30 sessions within five symposia, an exhibition with over 100 companies, plus a programme of workshops, training opportunities, and a busy social programme.

The breadth of the scientific programme provides an unparalleled opportunity for delegates to not only immerse themselves in their own area of interest but also to be exposed to a range of new techniques that might benefit their current work, or that could feature in their careers in the future.

Anyone who is active in microscopy and it's related techniques will find sessions of interest, and I encourage you to study this call for papers and submit an abstract – or abstracts.

Prof Klaus Qvortrup, emc2020 Conference Chair

Submitting an Abstract

1. Register on the online submission system (www.emc2020.eu/abstract-submission)
2. Download the template and guidelines, and familiarise yourself with them
3. Draft your abstract and prepare the figures in accordance with the guidelines
4. Submit your abstract as a word document using the online submission system
5. You can request an oral or poster presentation, but the Session Organisers will make the final decision
6. The deadline for abstract submission is **1 March 2020**, after the deadline abstracts will not be accessible for correction

Conference Sessions

Life Sciences: Applications (LSA)

LSA.1: Label-free Life Science Imaging

Label-free imaging refers to optical measurements performed on biological samples without the need for labeling agents. Phase contrast and differential interference contrast microscopy are simple optical approaches to label free imaging based on refractive properties of the sample. More powerful approaches generate image contrast based on properties of the sample such as its ability to delay light interacting with the sample due to refractive index changes, or the ability of the sample to create unique spectroscopic, auto-fluorescence, birefringence, or acoustic signatures. Label-free approaches are often used to image delicate primary samples in order to study the dynamics of proliferation, the cell cycle, apoptosis and cell migration. Recent advances in label-free imaging include ptychography and quantitative phase contrast microscopy. More broadly speaking, label-free imaging approaches include pre-clincial methods such as micro-CT and MRI. All advances in these or similar methods are welcome in this session.

Co-Chairs: Tim Self (University of Nottingham, UK) & Kurt Anderson (The Francis Crick Institute, UK)

Invited Speakers: Paola Borri (Cardiff University, UK) & Radim Chmelik (Central European Institute of Technology, CZ)

LSA.2: Dynamic Interactions in Cells, Organoids, Tissue and Entire Organisms

Temporal imaging is necessary to reveal and measure the complex dynamic information of biological systems during development, homeostasis and disease. In this session we will focus on the use of live imaging; from 2 and 3-dimensional cell cultures to intravital and lightsheet microscopy. Particular focus will be on the capacity to examine multiple processes simultaneously, such as: multiscale, multi- molecular or correlative imaging. Among topics that we will cover are the recent advances in the field of imaging host-pathogens interactions in deep living tissues and cell and tissue differentiation during development. A better understanding of the mechanisms involved during cellular interactions through intra vital imaging can help the development and targeting of therapies to particular diseases.

Co-Chairs: Laurent Gelman (Friedrich Miescher Institute for Biomedical Research, CH) & Steeve Boulant (University of Heidelberg, DE)

Invited Speakers: Matthias Gunzer (University of Duisburg-Essen, DE) & Prisca Liberali (Friedrich Miescher Institute for Biomedical Research, CH)

LSA.3: Applications for Imaging Sub-Cellular Events at High Resolution

Recent developments include improvement in the speed of acquisition, tracking the trajectories of single molecules while imaging, high-throughput approaches and development of new probes. Emphasis of the session will be on the applications of various super-resolution techniques and light sheet microscopy at sub-cellular level.

Co-Chairs: Paula Sampaio (University of Porto, PT) & Merja Joensuu (Queensland Brain Institute, AU)

Invited Speakers: *TBA*

Abstracts will be reviewed according to the following criteria:

- Relevance to a specific symposium
- Scientific quality and innovative proposals
- Clarity of text
- Compliance with the format

Abstracts not meeting the criteria will be rejected. Accepted abstracts must be presented by a registered author. The need for major revisions may affect a Session Organiser's decision to accept the abstract, please review it carefully before submission.

All correspondence relating to abstract submission will be by email. If you have an queries, these should be addressed to katejermey@rms.org.uk.

Conference Sessions (continued)

LSA.4: Applications of AFM in Geological and Biological Context

Using AFM in a geological, biological and material context can provide answers to topics ranging from the origin of life, to decipher the processes for mineral nucleation and growth, to quantify forces between organic molecules or organic molecules and surfaces as well as protein recognition studies. Recent years have seen an advance in biologic applications of the AFM and self-assembly of organic compounds on different substrates, how bacteria interact with different surfaces, how cells responds to nanoparticles used for drug delivery or the crystal structure of photosynthetic membranes are being addressed. Video rate AFM is increasingly used to study the dynamic behaviour of macromolecules in contact with other compounds or surfaces. There has also been an increase in number of AFM derived techniques enabling a more comprehensive characterization of physical and chemical properties of surfaces.

We welcome contributions on all aspects of AFM including imaging techniques, physical and chemical characterization and quantification of bond parameters using dynamic force spectroscopy. We encourage contributions describing the fundamental processes and mechanisms in geological, biological and material sciences as well as applied studies in e.g. geochemistry, mineralogy, polymer chemistry, cell biology, molecular engineering, tribology etc. The common ground for the session is the use of a inorganic or organic substrate in some form and both purely inorganic systems and bio-mineral systems are of interest.

Co-Chairs: Karina K. Sand (Aberystwyth University, UK) & Stanislav Jelavic (University of Copenhagen, DK)

Invited Speakers: TBA

LSA.5: Metabolic and Large Scale Imaging

Advances in modern microscopy techniques such as light sheet, super-resolution or cryoelectron microscopy create significant data stream. This session will present examples of microscopy-based projects that not only facilitate the state-of-the-art high-resolution imaging of organs and whole organisms but also provide tools to integrate large scale data into image processing pipelines. Specifically, the session introduces how to reconstruct large three dimensional (3D) images of cleared and expanded biological samples imaged by the light sheet microscopy using a novel tool - BigStitcher. It will also feature the newest interdisciplinary approaches to image the entire development of embryos at a single cell level using a combination of quantitative image processing and multi-view light sheet microscopy. The overall goal of the session is to introduce the latest top-notch research in the field of large-data microscopy leading to the future of smart microscopes.

Co-Chairs: Jakub Sedzinski (NNF Center for Stem Cell Biology (DanStem), DK) & Jonathan Brewer (South Denmark University, DK)

Invited Speakers: Stephan Preibisch (Janelia Research Campus, Howard Hughes Medical Institute, US)

LSA.6: Applications of Correlative Microscopy of Biological Systems

Correlative microscopy is a growing family of techniques that combine, on one sample, a sequence of various imaging modalities, enabling structure-function analysis in the life sciences. This session will focus on examples of ground-breaking applications in biology, and at the same time covering the range of methodological implementations used on the various model systems. We welcome contributions that reveal new biology from correlation of any of the following imaging modalities (but not restricted to): fluorescence imaging, electron microscopy, cryo-EM, volume EM, micro-CT, soft X-ray, AFM, and sub-cellular stable isotope and molecular mapping using NanoSIMS and TOF-SIMS.

Co-Chairs: Lucy Collinson (The Francis Crick Institute, UK) & Louise Helene Søgaard Jensen (EPFL, UK)

Invited Speakers: Maximiliano Gutierrez (The Francis Crick Institute, UK) & Niculina Musat (Helmholtz Center for Environmental Research, Leipzig, DE)

LSA.7: Pathology, Immunocytochemistry and Biomolecular Labelling

This session focuses on electron and/or light microscopy approaches for the localization of biomolecules in cells and tissues. In particular new biomolecular labelling approaches as well as immunocytochemistry in relation to pathological conditions will be emphasized. Oral or poster contributions dealing with new methodological concepts, as well as with new types of probes, are of particular interest.

Co-Chairs: Andreas Brech (University of Oslo, NO) & Jana Nebesarova (Czech Academy of Sciences, CZ)

Invited Speakers: Wiebke Möbius (Max Planck Institute for Experimental Medicine, DE) & Pavel Hozák (Institute of Molecular Genetics, CAS, CZ)

LSA.8: Imaging Self Eating - Autophagy under the Microscope

Autophagy is a life-supporting catabolic process conserved from yeast to man. It was originally described using electron microscopy, soon after the first electron microscopes became available for researchers. Genes and proteins regulating autophagy were discovered in the 1990ies and these findings were awarded with a Nobel prize to Yoshinori Ohsumi in 2016. The knowledge on autophagy proteins has made it possible to image this process in live cells and to combine live cell imaging with other cutting-edge microscopy methods including super resolution, electron tomography and focused ion beam scanning electron microscopy. Imaging has brought autophagy field forward more than any other methodology, with the exception of yeast genetics that revealed the identity of autophagy genes. We aim to invite the world leaders on autophagy research to demonstrate how different types of imaging technologies are applied in their work. The approaches are likely to include live-cell imaging, super resolution, focused ion beam scanning electron microscopy, electron tomography and immuno electron microscopy.

Co-Chairs: Eeva-Liisa Eskelinen (University of Turku, FI) & Nicholas Ktistakis (Babraham Institute, Cambridge, UK)

Invited Speakers: Lucy Collinson (The Francis Crick Institute, UK) & Muriel Mari (University Medical Centre Groeningen, NL)

LSA.9: Applications of Volume Scanning Electron Microscopy in Life Sciences

Volume SEM is a family of imaging techniques that enable automated acquisition of series of cross-sections through a specimen. They include focused ion beam SEM (FIB-SEM), serial block face SEM (SBEM) and array tomography (AT). Aiming at imaging large volumes, they impressively bridge scales from tissues morphology to subcellular architecture. Session will cover applications from all areas of life sciences, ranging from neurobiology to all model organisms and from cell organelles to entire organisms.

Co-Chairs: Christel Genoud (Friedrich Miescher Institute for Biomedical Research, CH) & Saskia.Lippens (VIB, Ghent, BE)

Invited Speakers: Toby Starborg (University of Manchester, UK)

LSA.10: Recent Advances in Cellular Cryo-Electron Tomography

In recent years, cryo-EM has become an important technique to analyze the structure of molecules. Similarly important will be the implementation of these structures in the cellular context. In order to study cells in their native environment cryo-electron tomography (cryo-ET) is the method of choice. In cryo-EM, the sample remains in a close-to-native state by rapid freezing of the EM grid, which turns the water in the sample into amorphous ice unlike in conventional EM where the sample is dehydrated and stained with heavy metals leading to artifacts. Cells can be grown on EM support films (grid) and e.g. pinched of nerve endings (synaptosomes) can directly be added to the EM grid, and with the addition of fluorescent markers samples can be imaged at a cryo-fluorescence microscope. The combination of these techniques, referred to as cryo light and electron microscopy (CLEM), allows for the localization of cellular structures, which can then be pinpointed with high structural resolution by cryo-ET. Additionally, time resolved approaches have been developed to image ongoing processes in the cell i.e. exocytosis in synaptosomes with millisecond resolution. Imaging spatiotemporal processes in their native state with high structural resolution is a challenging yet very important method for future research. In this session, we will introduce methodological advances and strategies that can be employed to cope with e.g. thick cells or a crowded cellular environment and show how cellular cryo-ET has recently resolved important biological questions.

Co-Chairs: Julika Radecke (Diamond Light Source, UK) & Benoit Zuber (University of Bern, CH)

Invited Speaker: Lu Gan (National University of Singapore, SG)

LSA.11: CryoEM from Membrane Proteins to Large Complexes

1. Single-particle cryo-EM studies of membrane protein complexes: Membrane protein complexes are difficult samples to present optimally for single-particle cryo-EM studies with 3D reconstruction. Grids are typically prepared from detergent-solubilized samples or from samples based on lipid-based nanoparticles such as nanodiscs and saposin-lipid nanoparticles. Particular challenges are found in getting proper sampling of orientations, avoiding aggregation and denaturation at the air-water interface. The symposium will highlight recent developments in rational approaches to studies of challenging membrane protein complexes.

2. Molecular mechanisms by high resolution cryo electron microscopy: Recent advances in cryoEM allowed the deciphering of complex mechanisms performed by large protein complexes. Examples of this new trend can be seen in top journals every week.

Chair: Poul Nissen (Aarhus University, DK)

Invited Speakers: Cristina Paulino (University of Groningen, NL) & Henriette Autzen (Aarhus University, DK) & Alexander Hahn (Max Planck Institute of Biophysics, DE)

LSA.12: Application of EM in Health Industry

The session will describe the current efforts in the health industry to improve process development and product characterization using EM based technologies. The recent technological developments in EM have highlighted this technology as for consequence a great interest of the health industry. This technology that was mainly present in public laboratories is more and more present in-house in the industry. The recent technological developments opened the door to new possibilities in this field, as protein targets that have been forbidden for drug design due to lack of crystal structures may now become amenable for drug design but also epitope mapping for vaccine. Besides showing the current efforts in the area of 3D, the session will address also all the possible applications of EM in health industry, the possible problems in the application of this new approach to drug design or vaccine development.

Co-Chairs: Frederic Ronzon (Sanofi Pasteur, FR) & Guillermo Montoya (University of Copenhagen, DK)

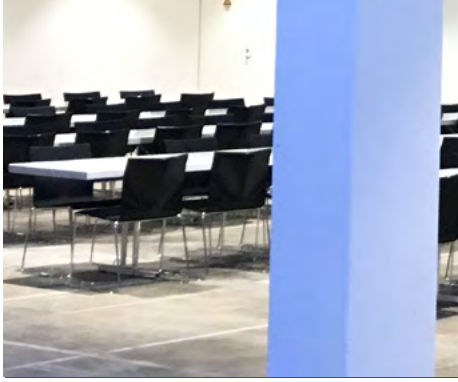
Invited Speakers: TBA

Life Sciences: Tools and Techniques (LST)

LST.1: Innovations and Developments to Deliver Improvements to Resolution, Application and/or Workflow in Cryo Electron Microscopy

Sessions specifically targeted at innovations in cryo electron microscopes and the supporting instrumentation which is critical to the delivery of high resolution cryo electron microscopy. The power of single particle techniques and cryo tomography has driven a resolution revolution in electron microscopy. However, these instruments are dependent on sample preparation and the quality of these samples. Poor sample quality, lack of reproducibility and a high skill barrier to the use of supporting technologies is often limiting the potential of the cryo electron microscope. New innovations in preparing TEM grids for cryo electron microscopy, cryo focused ion beam lamella production, cryo lamella lift out, integration of electrical stimulation into the high-pressure freezer, cryo CLEM are just a few examples of these tools. The cryo electron microscope is also evolving with new detectors, STEM imaging and automatic data collection.

Chair: Roland Fleck (King's College London, UK)



Conference Sessions (continued)

Invited Speakers: Dave Bhella (University of Glasgow, UK) & Sharron Wolf (Weizmann Institute of Science, IL)

LST.2: Recent Advances in Cellular Cryo-Electron Tomography

In recent years, cryo-EM has become an important technique to analyze the structure of molecules. Similarly, important will be the implementation of these structures in the cellular context. In order to study cells in their native environment cryo-electron tomography (cryo-ET) is the method of choice. In cryo-EM, the sample remains in a close-to-native state by rapid freezing of the EM grid, which turns water in the sample into amorphous ice unlike in conventional EM where the sample is dehydrated and stained with heavy metals leading to artifacts. Cells can be grown on EM grids or the sample i.e. cell organelles, bacteria, viruses, can directly be added to the EM grid. Furthermore, with the addition of fluorescent markers samples can be imaged at a cryo-fluorescence microscope. The combination of these techniques, referred to as cryo-light and electron microscopy (CLEM), allows for the localization of cellular structures, which can then be pinpointed with high structural resolution by cryo-ET. In this session, we will introduce methodological advances and strategies that can be employed to cope with e.g. thick cells or a crowded cellular environment. Methods such as cryo-FIBSEM to thin thick specimen, cryo-FIB-lift-out, and Cryo-fluorescence microscopy have become invaluable tools prior to studying the specimen by cryo-ET.

Co-Chairs: Julika Radecke (Diamond Light Source, UK) & Benoit Zuber (University of Bern, CH)

Invited Speakers: Miroslava Schaffer (Max Planck Institute of Biochemistry, DE) & Kay Grünewald (Centre for structural Systems Biology, Hamburg, DE)

LST.3: Advances in Image Processing in Biological Electron Microscopy

Data collected using current and next generation electron microscopes is increasing in size and complexity. Managing, processing and analysing such data is a critical frontier to realising the scientific value of the raw data. Techniques such as; tomography (in the TEM, cryo TEM, array tomography and multibeam SEM), focused ion beam and serial block face volume imaging and single particle cryo EM approaches seeking high resolution single particle classification and reconstruction as well as sub tomographic averaging are dependent on computational solutions to data analysis. These challenges are becoming more and more evident when dealing not only with seeking higher resolutions, but also whist tackling fundamental problems related to data size and complexity. This session will address advances in data processing; application of machine learning/ artificial intelligence in EM data and strategies to tackle fundamental problems related to conformational variability and functional diversity in macromolecular complexes.

Chair: Roland Fleck (CUI, King's College London, UK)

Invited Speakers: Muyuan Chen (Baylor College of Medicine, Houston, Texas, US) & Marin van Heel (Imperial College London, UK)

LST.4: Volume Scanning Electron Microscopy in Life Sciences

Volume SEM is a family of imaging techniques that enable automated acquisition of series of cross-sections through a specimen. They include focused ion beam SEM (FIB-SEM), serial block face SEM (SBEM) and array tomography (AT). Aiming at imaging large volumes, they impressively bridge scales from tissues morphology to subcellular architecture. Successful applications of volume SEM depend on addressing multiple technical challenges, including sample preparation, hardware and software development, and robust image analysis which will be the main focus of this symposium.

Co-Chairs: Nicole Schieber (EMBL Heidelberg, DE) & Ilya Belevich (University of Helsinki, FI)

Invited Speakers: Winfried Denk (Max Planck Institute of Neurobiology, DE) & Christel Genoud (Friedrich Miescher Institute for Biomedical Research, DE)

LST.5: Correlative Microscopy Across the Scales

Combining different imaging modalities can generate more or better data than by utilising each modality as stand alone. The combination of light microscopy with TEM is well established (generally referred to as CLEM). Other modalities are however more and more integrated in correlative workflows. This can be in completely cryo mode to visualise molecular details but also using large scale imaging techniques such as light sheet, X-ray and Volume SEM to study intercellular relationships.

Co-Chairs: Yannick Schwab (EMBL, Heidelberg, DE) & Paul Verkade (University of Bristol, UK)

Invited Speakers: Christian Tischer (EMBL, Heidelberg, DE), Louise Jensen (EPFL, CH), Gleb Shtengel (Howard Hughes Medical Institute, US), & Catherine Maclachlan (Francis Crick Institute, UK)

LST.6: Synergy Between X-Ray and Electron/Light Microscopy

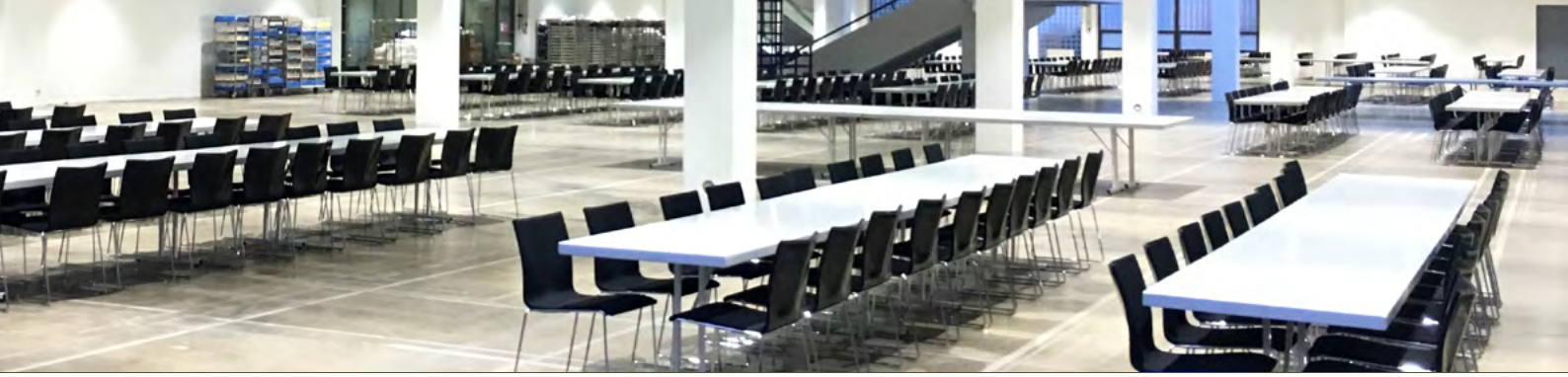
Microscopy techniques based on photon, electrons and X-ray photons have been used to observe inside matter for decades. Thanks to the technology advances in these few years, allow a huge progress in spatial resolution, sensitivity, to composition and physical properties. In the past of the last decade, the synergy of the high-resolution tomography and the chemical information from electron microscopy; the imaging with extreme sensitivity of chemical composition from X-ray microscopy and optic microscopy are the most outstanding modern imaging techniques to understand the complexity of life science.

Co-Chairs: Meriem Er-Rafik (Technical University of Denmark, DK) & Sylvain Bohic (European Synchrotron Radiation Facility, FR)

Invited Speakers: José Javier Conesa (ALBA Synchrotron Light Source, Barcelona, ES) & Carolyn Larabell (University of California, San Francisco, US)

LST.7: Super-resolution Microscopy

Super-resolution imaging, which enables the imaging of samples at resolutions greater than 200nm using light microscopy approaches, is a rapidly developing field. This session will cover novel developments in super-resolution imaging, including those that enable



super-resolution imaging in live cells, such as MINFLUX, a development of STED microscopy, and rapid single molecule imaging approaches.

Chair: Michelle Peckham (University of Leeds, UK)

Invited Speaker: Ilaria Testa (Science for Life Laboratory, SE)

LST.8: Brillouin Light Scattering Spectroscopy for Life Science Research

Brillouin light scattering microscopy is an emerging technique in the life sciences which allows for the contactless spatial and temporal mapping of the mechanical properties (high-frequency elastic modulus) with near diffraction limited optical resolution. Recent improvements in instrument design have made it conducive to also studying live biological samples opening the door to a host of potential applications for studying the role of mechanical properties in various biological processes and medical conditions. The scope of this session will include: latest advances in the technology/instrumentation, progress in our understanding and interpretation of measured parameters, applications for studying diverse biological systems on the sub cellular and tissue level, as well as variations on the technique and correlative studies.

Chair: Kareem Elsayad (Vienna BioCenter. AT)

Invited Speakers: Francesca Palombo (University of Exeter, UK) & Giuliano Scarcelli (University of Maryland, US)

LST.9: Multiphoton Imaging in Highly Scattering Tissue

The use of multiphoton imaging is limited by the optical properties of the tissue. Brain tissue shows relatively low scattering, whereas most other tissues (e.g., peripheral nerves and kidneys) are highly scattering. This symposium will focus on the presentation of state-of-the-art studies applying multiphoton imaging in highly scattering tissues as well as studies of technical developments to overcome the limitations in scattering tissues.

Co-Chairs: Ina Schiessl (Aarhus University, DK) & Sebastian Frische (Aarhus University, DK)

Invited Speakers: Vasilis Ntziachristos (Technische Universität München, DE) & Andrew Hall (University of Zürich, CH)

LST.10: Lightsheet Illumination/ Detection Strategies to Yield Higher Speed, Higher Resolution and Higher Throughput in Bioimaging

Orthogonal illumination with lightsheets (e.g. SPIM) is widely accepted to be a highly versatile approach for long term imaging of fluorescent samples. The illumination confinement to the image plane, and the very high fluorescence efficiency through wide field detection enable to capture the highest number of images while preserving samples viability. In the recent years, lightsheet engineering and detection strategies have unleashed unprecedented performance to strengthen the three fundamental pilars that are transforming Live fluorescence imaging into a primary tool for scientific discovery in Life science: High and isotropic resolution, high speed and high throughput.

Co-Chairs: Julien Colombelli (Institute for Research in Biomedicine - Barcelona, ES) & Corinne Lorenzo (Institute for Advanced Technology in Life Science (ITAV), FR)

Invited Speakers: Elisabeth Hillmann (Columbia University, US), Reto Fiolka (UTsouthwestern, US), Alexandra Fragola (Sorbonne Université, FR) & Jean-Baptiste Sibarita (Interdisciplinary Institute for Neuroscience Bordeaux, FR)

Physical Sciences: Applications (PSA)

PSA.1: 1D and 2D Materials

From rapid optical microscopic identification of atomically thin materials through to the extreme temporal and spatial resolutions of the latest in-situ transmission electron microscopes, microscopy has been fundamental to the discovery and investigation of these low dimensional structures. In this session we will learn about the latest innovative applications of the imaging and spectroscopic techniques that drive progress in the field, including: white light imaging, Raman spectroscopy, scanning probe and probe tip-coupled optical techniques, and scanning and transmission electron microscopies. We also hope to learn about the latest advances in bridging microscopy and fabrication, including electron beam lithographies, direct write techniques, scanned probe lithography, and other areas, both visualising and controlling the structure of matter at the finest scales.

Co-Chairs: Tim Booth (Technical University of Denmark, DK), Per Persson (University of Linköping, SE) & Sarah Haigh (University of Manchester, UK)

Invited Speakers: Valeria Nicolosi (Trinity College, Dublin, IE) & Juan Carlos Idrobo (Oak Ridge National Laboratory, US)

PSA.2: Metals and Alloys

The properties of metals and alloys are determined by their chemical, microstructural and crystallographic parameters, which can be precisely characterized by electron microscopy techniques. Recent advances in electron microscopy techniques have enabled the characterization of metals and alloys at higher spatial and chemical resolution, in three-dimensions (in terms of both imaging and orientation mapping), and under multiple stimuli (temperature, stress, electrical current etc.). Correlative electron microscopy and atom probe tomography is another new advance in the characterization of metals and alloys. All these advanced characterizations have led to breakthroughs in the fundamental understanding of structure-property relationships and in the development of advanced metallic materials with unprecedented properties. This symposium encompasses progresses in the development of the state of art techniques and their applications into the investigations of metals and alloys.

Co-Chairs: Xiaoxu Huang (Technical University of Denmark, DK), Oleg Mishin (Technical University of Denmark, DK)

Invited Speakers: Pat Trimby (Oxford Instruments, UK) & Daniel Caillard (CERMES – CNRS, FR)

PSA.3: Semiconductors and Devices

Microscopy techniques are currently heavily used in semiconductor research for applications in microelectronics, optoelectronics, memristors, photovoltaics, bioelectronics, quantum

Conference Sessions (continued)

computing and others. In particular electron microscopy is an indispensable technique for nanotechnology with major advances in aberration corrected electron microscopy becoming indispensable in understanding the properties of semiconductor nanostructures and their potential applications. This symposium invites contributions about microscopy methods as applied to the investigation of conventional and new semiconductor materials. This session will include in situ characterization of the growth and structure of nanoscale materials, such as nanowires, nanotubes, 2D semiconductor based materials, typically under environmentally relevant conditions, or probing their properties by in-situ characterization of the response of nanomaterials to external stimuli such has heat, light, mechanical stress.

Co-Chairs: Elisabetta Fiordaliso (Technical University of Denmark, DK), Kimberly Dick Thelander (Lund University, SE) & Federico Panciera (CNRS, FR)

Invited Speakers: Kerstin Volz (Philipps-Universität Marburg, DE) & Martien den Hertog (CNRS, FR)

PSA.4: Batteries and Materials for Energy Conversion

This session focusses on multimodal microscopy (In-situ/operando and 3D) with emphasis on dynamics in energy materials (for example electrodes, photovoltaics, electromechanical materials and thermoelectrics), functional materials and heterostructures. Weight is put on quantitative microstructure analyses as well as on simulations linking structural dynamics with material properties. The session covers experiments with electrons, photons and neutrons. To improve our understanding of the complex processes in batteries, all available microscopy and spectroscopy methods are used and the drive is to observe processes in real-time and realistic conditions. In this session, we will gather the many different methods to get the full faceted microscopic view of how to best possibly observe real and model battery systems. The methods primarily involve electron, X-ray and optical methods correlated with electrochemical or other in operando quantitative measurements.

Co-Chairs: Søren B. Simonsen (Technical University of Denmark, DK), Beata Layla Mehdi (University of Liverpool, UK), Poul Norby (Technical University of Denmark, DK) & Christian Kübel (Karlsruhe Institute of Technology, DE)

Invited Speakers: Jacob R. Bowen (Technical University of Denmark, DK) & Nigel Browning (University of Liverpool, UK)

PSA.5: Nanoparticles and Catalysts

With emphasis on nanoparticles and catalyst materials, this symposium will cover developments and applications of dynamic environmental, in situ and fast time resolved microscopies (including electron, probe and optical and 3D) in the chemical sciences. It will focus on the pivotal role of imaging and spectroscopy of dynamic processes to access previously invisible aspects of real world processes and complementing and extending examinations of static structures. Advances in high-speed recording and novel sample holder designs are advancing catalyst nanostructure analyses in gases and liquids; often combined with other controlled conditions of temperature, electrical and beam parameters in catalytic chemical reactions. The real time studies of catalysts in change inducing, or sometimes stabilising, environments lead to a new understanding as the basis for development of properties on the nanometre and atomic scale. They contribute to the full range of chemical sciences and technologies including for energy, in diverse applications of vital importance to industry, society, and the environment, but often inaccessible with conventional microscopies.

Co-Chairs: Pratibha Gai (University of York, UK), Jakob B. Wagner (Technical University of Denmark, DK), Marc Willinger (ETH Zurich, CH) & Juan José Calvino (University of Cádiz, ES)

Invited Speakers: Rolf Erni (EMPA, CH) & Karine Masenelli-Varlot (INSA, Lyon, FR)

PSA.6: Geological Materials and Bio-mineral systems

Using microscopy (including electron, probe and optical) in a Geological context can provide answers to topics ranging from the origin of life here on Earth, how to recover more oil from existing reservoirs, to decipher the processes for mineral nucleation and growth or to quantify how organic molecules interact with minerals. Recent improvements in several techniques including focused ion beam milling, electron backscatter diffraction, SEM, TEM and X-ray microanalysis and microscopy have opened up new possibilities for the characterisation of natural materials at a significantly higher level of detail. Furthermore, the recent years has seen an advance in biologic applications of the AFM and self assembly of organic compounds on different substrates or how bacteria interact with different surfaces are increasing being addressed. There has also been an increase in number of AFM derived techniques enabling a more comprehensive characterization of physical and chemical properties of surfaces. We welcome contributions on all aspects of microscopy (surface, bulk, and 3D) including imaging techniques, physical and chemical characterization and quantification of bond parameters. The common ground for the session is the use of a mineral substrate in some form and both purely inorganic systems and bio-mineral systems are of interest.

Co-Chairs: Tue Hassenkam (University of Copenhagen, DK), Trevor Almeida (University of Glasgow, UK), Carsten Gundlach (Technical University of Denmark, DK) & Henning Osholm Sørensen (Technical University of Denmark, DK)

Invited Speaker: Karina Sand (University of Copenhagen, DK)

PSA.7: Soft and Organic Materials in Liquid Phase

With the advent of sophisticated equipment to make possible in situ and in operando experiments in an electron microscope, this symposium will be dedicated to experiments encompassing soft and organic materials. The symposium will highlight the recent studies and challenges in using aqueous and non-aqueous solvents and the interactions of soft materials with the electron beam and how to mitigate or exploit these interactions. Upcoming applications towards energy research,

Jacob Schjørring & Simon Lau

biology, pharmaceuticals, mineralogy and electron beam dose related influences will be the main focus.

Co-Chairs: Rik Drummond-Brydson (University of Leeds, UK), Joe Patterson (University of California, Irvine, US), Helen Freeman (University of Leeds, UK) & Jennifer Cookman (University of Limerick, IE)

Invited Speaker: Patricia Abellan (SUPERSTEM, UK)

PSA.8: Microscopy in Industrial Applications

Industrial, institute and academic electron microscopy experts would be encouraged to present applications and developments of direct industrial relevance and highlight innovations based on understanding mechanisms down to the smallest scale. Areas would include energy, transport and electronics. The objective would be to encourage increased industrial use, particularly of advanced techniques, such as in-situ studies, and publicity mechanisms such as Transnational Access in the EU ESTEEM 3 project, in which the organizers are active, which can offer access to companies and SMEs to consortium facilities.

Co-Chairs: John Walmsley (University of Cambridge, UK), Randi Holmestad (Norwegian University of Science and Technology, NO), Lisa Lautrup (Scandvik Group, SE) & Dogan Ozkaya (Johnson Matthey, UK)

Invited Speaker: Alvaro Mayoral (University of Zaragoza, ES / ShanghaiTech University, CN)

PSA.9: Magnetic and Spintronic Materials

Magnetic, superconducting, ferroelectric and multiferroic functional materials for information technologies and smart structure applications are set to remain in the limelight, as judged by the ever-increasing number of research publications. The “non-structural disorder” in these materials manifests itself as highly mobile domains and domain walls. These are due to a local arrangement of magnetic, electric and/or local electronic properties. In this regard, recent technological innovations in electron microscopy, especially new aberration-correctors, high-speed cameras, pixelated detectors, high-energy resolution EELS and developments in imaging processing along with in-situ technologies, allow a quantum leap in fundamental understanding of the structure and properties of such materials. The symposium will also promote crosstalk at the intersections of frontiers in chemistry, physics, materials science and nanotechnology.

Co-Chairs: Maria Varela (Complutense University of Madrid, ES), Paulo Ferreira (The University of Texas at Austin, US) & Stephen Pennycook (National University of Singapore, SG)

Invited Speakers: Leopoldo Molina-Luna (TU Darmstadt, DE) & Magnus Nord (University of Antwerp, BE)

Physical Sciences: Tools and Techniques (PST)

PST.1: Phase Microscopy

Recent technological developments in the re-shaping of imaging waves (whether using apertures in real space or phase plates in reciprocal space) are enabling the latest generations of detectors to be used in powerful new ways. This session will cover new developments in phase-related imaging techniques across electron microscopy, x-ray imaging and allied techniques. Submissions relating to either the introduction of phase shifts in the imaging process (such as in holography and interferometry, or with vortex beams and new probe shapes) or the retrieval of phases from collected data (including ptychography, TIE, Lorentz microscopy and differential phase contrast etc.) are welcome.

Co-Chairs: Laura Clark (University of Glasgow, UK), Ben McMorran (University of Oregon, US) & Darius Pohl (Dresden University of Technology, DE)

Invited Speakers: Vincenzo Grillo (University of Modena, IT) & Benedikt Haas (Humboldt University of Berlin, DE)

PST.2: Microscopy for the Study of Quantum Effects and Nano-optics

In recent years, there has been a growing interest in material systems where quantum effects manifest themselves over a wide range of length scales (superconductors, topological insulators, nickelates...). Developments in material growth, spectroscopy and imaging have stimulated a new field of research that requires appropriate tools, techniques and models to be fully understood. This session aims to bring together experimentalists and theoreticians from a broad range of techniques not only using Electron Microscopy and Scanning Tunneling Microscopy but also ARPES and X-ray spectroscopy. Particular emphasis will be given on momentum resolved spectroscopy, tools and techniques for measuring the local polarization, and nano-optics.

Co-Chairs: Alan Maigne (The University of British Columbia, CA) & Doug Bonn (The University of British Columbia, CA)

Invited Speakers: Mathieu Kociak (University of Paris-Sud, FR)

PST.3: New Instrumentation

Recent technological breakthroughs for both imaging and spectroscopy using electrons, ions, photons and X-rays, have provided a fertile new ground for correlative analysis of materials’ structural, chemical and physical properties together with their functionalities at unprecedented spatial and spectral resolution. For this, state-of-the-art approaches to sample preparation, fabrication, and analytics that go beyond conventional methods need to be developed. This session will provide a forum to review and discuss recent scientific achievements at the forefront of new instrumentation development and the impact of these new instruments, where topical areas include: high-brightness sources, high-energy resolution monochromators, structured illumination, adaptive optics, novel aberration correctors, spectrometers, fast and collection-efficient detectors, as well as innovative focused ion-beam tools.

Co-Chairs: Peter van Aken (Max Planck Institute for Intelligent Systems, DE) & Quentin Ramasse (University of Leeds, UK)

Invited Speakers: Naoya Shibata (University of Tokyo, JP), Max Haider (Corrected Electron Optical Systems GmbH, DE) & Florent Houdellier (CNRS, FR)

Conference Sessions (continued)

PST.4: Spectroscopies in Electron, X-ray and Ion Microscopy

Hyperspectral imaging has become ubiquitous in a wide range of techniques to couple spatial and spectral information at the micro- down to atomic scale. This session aims at exploring the latest advances in spectroscopies, including hyperspectral data acquisition, processing, and analysis on hard and soft matter, by electron, ion, and x-ray microscopy. It covers the recent developments of data acquisition schemes, such as low dose, random scan, multi-signal, etc., using spectroscopies like EELS, EDX/WDX, IR, Raman, He-Ne, XAS (soft and hard x-rays). Studies with focus on hyperspectral data analysis and modelling, using e.g. inelastic channeling, atomistic calculations, machine learning algorithms, etc. are strongly encouraged, in addition to contributions involving the development of novel hyperspectroscopy methods.

Co-Chairs: Nestor Zaluzec (Argonne National Laboratory, US), Demie Kepaptsoglou (University of York, UK) & Matthieu Bugnet (French National Centre for Scientific Research, FR)

Invited Speakers: Ryosuke Senga (National Institute of Advanced Industrial Science and Technology, JP) & Gerald Kohleitner (University of Graz, AT)

PST.5: Diffraction Techniques and Structural Analysis

Structural analysis and nanoscale crystallography using electron diffraction and related methods has undergone a renaissance in recent years. There have been a series of major developments in recent years that have transformed the field, including: the advent of remarkably sensitive, almost noise-free, cameras and detectors; the introduction of automated data collection and big data processing (e.g. machine learning); and the availability of dedicated software that enables robust and reliable structure determination from electron data. This has led to an explosion of interest across a wide range of materials and life sciences in using these techniques to (i) solve crystal structures not amenable to more conventional x-ray diffraction and (ii) to use the high spatial resolution of the microscopes to reveal hitherto unseen micro- and nano-structure using 4D scanning methods, acquiring diffraction patterns at every real space probe position. This session highlights the progress made in this area using both scanning electron microscopy (with techniques such as EBSD (2D and 3D), ECCI, TKD and (scanning) transmission electron microscopy such as 4D-STEM, SED, SPED, PED, CBED, SCBED, HRTEM, time-resolved diffraction and ptychography. We would also encourage submission of papers from complementary fields such as atom probe tomography and scanning transmission x-ray microscopy.

Co-Chairs: Randi Holmestad (Norwegian University of Science and Technology, NO), Xiaodong Zou (University of Stockholm, SE) & Paul Midgley (University of Cambridge, UK)

Invited Speaker: TBA

PST.6: *In Situ* and *In Operando* Microscopy

In order to understand dynamic processes in functional materials they have to be studied under relevant environmental conditions and driving forces. Significant developments in instrumentation has brought various stimuli (e.g. temperature, electric/magnetic fields, light, mechanic probes) and environments (e.g., liquids, gases) most successfully in TEM with high precision and controllability. On the other hand, SEMs with their large space available, stronger interaction at lowered electron energies and steady improvements in resolution promise high potential for dynamic studies as well. When coupled to efficient detection with novel experimental designs or new detectors, unprecedented details of dynamic processes in materials can be studied using imaging, diffraction and spectroscopy techniques. When tackling problems in beam sensitive materials, smart dose budgets, or correlative, complementary techniques using other probes have to be applied. In this symposium, we aim to highlight novel approaches to in situ and in operando microscopy, illustrated with applications in materials science. We welcome contributions on instrumental developments or novel use of existing equipment that can provide new insights into the dynamics of materials, including (but not limited to) nucleation and growth, phase transformations, surface and catalytic processes, functional properties, dynamics of defects, and degradation processes.

Co-Chairs: Erdmann Spiecker (Friedrich - Alexander University of Erlangen, DE), Kristian Mølhave (Technical University of Denmark, DK) & Thomas Hansen (Technical University of Denmark, DK)

Invited Speakers: Marc Willinger (University of Zürich, CH), Raymond Unicic (Oak Ridge National Laboratory, US) & Kunal Mukherjee (University of California, Santa Barbara, US)

PST.7: Fast and Ultrafast Dynamics using Transmission Electron Microscopy

This session will focus on advances in the study of fast and ultrafast chemical and materials dynamics (structural, electronic, magnetic) with transmission electron microscopy instrumentation and methods. Abstracts are encouraged in (but not limited to) the following areas:

- Techniques and instrumentation for high frame rate imaging and the science they enable.
- Method and instrument development for increasing spatial, temporal, and energy resolutions in ultrafast transmission electron microscopes (UTEMs), both in stroboscopic and single-shot modes.
- Pulse compression methods and schemes, including those for generating attosecond electron packets in the stroboscopic mode and sub-nanosecond packets in the single shot mode.
- Laser technology/architecture and other means for generating discrete electron packets (e.g., RF cavities) that expand UTEM capabilities and the application space.
- UTEM-compatible cathode developments; including those based on swept beams, field emission, Schottky-type, and thermionic electron guns.
- Discoveries, new physical insights, and paradigm tests that have occurred because of, and have been enabled by, UTEM developments and advancements.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In addition to communicating technology developments and the new scientific advances resulting from UTEM experiments, a goal of this symposium is to stimulate discussions on future directions of fast and ultrafast TEM and to foster the formation of new collaborations and new ideas within the community.

Co-Chairs: Ilke Arslan (Argonne National Laboratory, US), David Flannigan (University of Minnesota, US) & Fabrizio Carbone (EPFL, CH)

Invited Speakers: Oh-Hoon Kwon (Ulsan National Institute of Science and Technology, KR), Yimei Zhu (Brookhaven National Laboratory, US), Pietro Musumeci (University of California, Los Angeles, US) & Daniel Masiel (Integrated Dynamic Electron Solutions, US)

PST.8: Scanning Probe Microscopy: Imaging and Beyond

This session will focus on the last cutting-edge developments of scanning probe microscopies for the characterisation of materials, from soft biological and polymeric materials to hard inorganic materials. Beyond surface imaging, the session will highlight the abilities of SPM to characterise the surface properties of materials with a particular focus on the nanomechanical property characterisation with various AFM-based techniques and on the functional properties such as electronic, magnetic, piezoelectric properties with techniques such as EFM, KPFM, MFM, PFM, ...

Co-Chairs: Philippe Leclere (University of Mons, BE) & Bernard Nysten (Université Catholique de Louvain, BE)

Invited Speakers: Thierry Melin (University of Lille, FR) & Danielle Passeri (University of Rome, IT)

Data Handling and Analysis (DHA)

DHA.1: Machine Learning for Analysis and Interpretation of Microscopy Imaging Data

Machine learning methods such as deep learning have revolutionized applications in image analysis and understanding during the last decade. The developments have also impacted microscopy image analysis and processing where the most successful methods in object segmentation and detection, image reconstruction, classification and denoising are nowadays taking advantage of machine learning techniques. With the aid of open datasets, machine learning solutions continues to develop towards easy-to-use platforms that include pre-trained models for various applications whereas research challenges focuses on unsupervised and weakly supervised learning.

This session presents the latest advancements in methods and software utilizing machine learning applied broadly in different microscopy modalities e.g. light, electron and X-ray microscopy and digital pathology. We also invite studies describing open datasets to be presented in this session. In addition, the session hosts discussion on the challenges as well as future perspectives that the machine learning currently holds.

Co-Chairs: Lassi Paavolainen (University of Helsinki, FI) & Riku Turkki (SciLifeLab & Karolinkska Instituet, SE)

Invited Speakers: Anna Kreshuk (EMBL Heidelberg, DE), Ivo F. Sbalzarini (Max Planck Institute of Molecular Cell Biology and Genetics, DE), Peter Hovarth (Hungarian Academy of Sciences, HU) & Geert Litjens (Radbound University Medical Center, NL)

DHA.2: Advances in 3-Dimensional Image Reconstruction

The session will cover the quantitative analysis of X-ray and electron based 3D microscopy data. Electron and X-ray 3D microscopy is widely used in material science and is an emerging field with great potential in bioimaging. With the possibility of imaging 3D structures at high spatial or temporal resolution both ex and in vivo allows structural quantification that has many applications in bioimaging. In situ 3D imaging within materials science and 3D imaging of the interface between biology and materials science often requires imaging at different length scales. The full potential of electron and X-ray 3D microscopy can only be utilized having automated analysis methods and subsequent modeling tools. This session will focus on recent developments within X-ray 3D microscopy for both laboratory and large-scale synchrotron facilities as well as applications of 3D imaging techniques by electron sources. Both destructive (slice and view) and non-destructive 3D imaging applications will be discussed.

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Co-Chairs: Sara Bals (Univerity of Antwerp, BE) & Anders Dahl (Technical University of Denmark, DK)

Invited Speakers: Joost Batenburg (Leiden University, NL) & Ute Kolb (University of Mainz, DE)

DHA.3: Machine Assisted Acquisition and Analysis of Microscopy Data

Cutting-edge microscopy does not only require state-of-the-art instruments and detectors but also innovative approaches and programs for machine-assisted collection and analysis of data. Recent advances in instrumentation and computing capabilities enable the application of machine learning for the processing of microscopy datasets during and after acquisition. Furthermore, the development of sustainable, open-source and user-friendly software is of paramount importance to make these algorithms and workflows available widely in the scientific community and to promote reproducible research. This symposium will feature recent progress in data acquisition scheme, processing workflow, algorithm and software in microscopy with a focus on, but not limited to, open-source software and machine learning.

Co-Chairs: Daniel Baum (Zuse Institute Berlin, DE) & Lewys Jones (Trinity College, Dublin, IE)

Invited Speakers: Loïc Royer (Chan Zuckerberg Biohub, US) & Zineb Saghi (French Alternative Energies and Atomic Energy Commission, FR)

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EUROPEAN MICROSCOPY CONGRESS 2020

23 - 28 August 2020, Copenhagen, Denmark

Key Dates

15

1 March 2020 - Abstract Submission deadline

1 June 2020 - Scientific Imaging Competition deadline

15 June 2020 - Late Breaking Poster deadline

6 July 2020 - Early Bird Registration deadline

Key Information

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The European Microscopy Congress 2020 will be held at The Bella Center, Copenhagen, Denmark from 23 - 28 August 2020.

Keep up to date with all the developments in the run up to the event by signing up to receive our e-newsletter on the website

www.emc2020.eu

Professional Congress Organiser

The European Microscopy Congress 2020 is being hosted by SCANDEM. The appointed PCO is the UK's Royal Microscopical Society.

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