

At the interdisciplinary heart of the matter: The RMS Engineering and Physical Sciences Committee

Roland Kröger, EPS Committee Chair

The versatility of advanced microscopy and spectroscopy is demonstrated by the wide range of applications that span across the Materials Science/Life Science boundary. It underpins the push for high-resolution correlative, three-dimensional and time resolved characterisation of organic and inorganic as well as composite materials that play key roles in the development e.g. of new drugs and medical treatments as well as environmentally friendly and energetically efficient alternatives to current material systems and the cultural heritage. This addresses some of the most urgent topics of our society such as sustainable health care and climate change and provides important contributions to the protection of cultural artifacts.

The Engineering and Physical Sciences Section embodies the broad and interdisciplinary engineering and physical science community, that uses advanced microscopy - and complementary spectroscopy-based techniques to address hot topics including Energy and Energy storage, Biomaterials, Structural/ Geological materials, Advanced 3D manufacturing, Photonic Materials, Electronic Devices, and Surface Engineering. We have a diverse range of expertise represented by our committee members including Materials Science and Engineering, Bioengineering, Physics, Chemistry, Geology and Archaeology. Our committee has a strong linkage to industrial partners by including company representatives from Health Care, Chemical Technologies and Electron Microscopy (e.g. previously Smith and Nephew, Johnson Matthey and Hitachi and currently Carl Zeiss and Sandberg LLP). Our diversity is reflected

in the engagement of our members in RMS events such as conference sessions, workshops, seminars and training activities. We regard state-of-the-art microscopy and spectroscopy as key tools to address exciting interdisciplinary questions, which is reflected in numerous events including various sessions at the MMC conference series, workshops on focused ion beam and X-ray based tools, a recent event on Microscopy and Microanalysis in Geological and Archaeological Sciences (<https://www.rms.org.uk/rms-event-calendar/2021-events/microscopy-microanalysis-geological-archaeological.html>) and our involvement in the RMS International Microscopy Lecture Series (<https://www.rms.org.uk/network-collaborate/the-international-microscopy-lecture-series.html>). The overwhelming participation of UK-based and international researchers in our events make research activities in our field visible beyond the

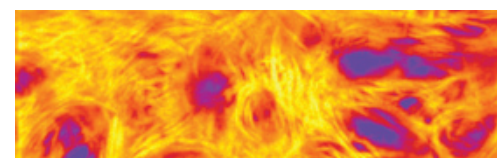
membership of the RMS promoting microscopy and spectroscopy-based science. Our members engage in outreach activities e.g. by offering microscopy kits to schools and introducing pupils to stimulating ways of exploring the microscopical world (<https://www.rms.org.uk/network-collaborate/science-sections/outreach.html>). Via this direct interaction with the youngest members of our society we aim to shape engineering and physical science of the future and encourage particularly girls and members of ethnic minorities to choose this exhilarating research field to achieve increased representation. With this scope our committee is well-placed within the RMS community and reaches out to other committees for co-organisation of interdisciplinary events within the framework of the RMS and beyond.

EPS Committee Members

Professor Roland Kröger
(Section Chair)



Roland is a Professor at the Department of Physics at the University of York concentrating on Nano- and Biomaterials using electron microscopy as well as various spectroscopy tools including Raman microscopy and X-ray techniques. He obtained his PhD from the University of Hamburg/Germany and the Fraunhofer Institute for Surface Science and Technology in Braunschweig/Germany. Roland has since built a large expertise in Materials Physics and Materials Science covering diamond thin films, metal/semiconductor nanostructures, nitride based light-emitting devices, metal nanoparticles for biomedical applications and biominerals using focused ion beam as a key method for sample preparation and analysis. Besides his



Bone Nanostructure: Organisation of human bone nanocrystals imaged by scanning transmission electron microscopy.

interest in multi-lengthscale material characterization in 3D he is particularly focussing on *in situ* techniques to study mineralisation processes in liquid environments.

Dr Anna Baldycheva
(Section Deputy Chair)



Anna is an Assistant Professor in 2D Optoelectronic materials in Engineering at the University of Exeter. Dr. Baldycheva's research group works in the areas of 2D Materials, Si Photonics and Microfluidics. The research interests span from the development of new 2D material based layered and liquid crystal nanocomposites to the engineering of integrated 2D material-Si hybrid electronic-photonic devices for application in communications, energy harvesting, and bio-chemical sensing. Since 2010, Dr. Baldycheva authored and co-authored over 50 peer-reviewed papers and conference proceedings.

Dr Trevor Almeida



Trevor is a Lecturer in the Materials and Condensed Matter Physics Group at the University of Glasgow. He obtained his PhD in Material Science at the University of Nottingham, focusing on the transmission electron microscopy (TEM) of magnetic nanoparticles. His research evolved to investigate a range of nanomagnetic processes by combining *in-situ* TEM methods with Lorentz microscopy techniques. This took place during time spent at Imperial College London, Centre for Electron Nanoscopy (Denmark), Ernst-Ruska Centre (Germany), the University of Glasgow and CEA-LETI in Grenoble (France). Trevor's primary interests include the functional magnetism within 3D nanostructures, nanoelectronics, magnetotactic bacteria, meteorites, minerals, nanoparticles and thin films.

Mr Ian Belding



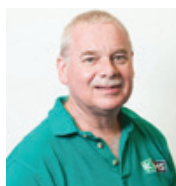
Ian is Regional Sales Manager at Carl Zeiss Ltd and Business Development Manager for Electron and X-ray Microscopy. Ian joined ZEISS in 2004 as an Electron Microscopy product specialist and has since worked in a variety of roles across the full spectrum of ZEISS microscopy products. Prior to that Ian gained a degree in Physics from Leeds University and worked in a range of industries working on analytical instrumentation.

Mr Paul Bennett-Hughes



Paul works for Sandberg LLP, based in Clapham, as a Senior Associate and is involved in construction materials related investigations, such as compositional analysis, staining issues, ASR/DEF assessments, fire-damage assessments and general condition analysis. As part of these investigations, Paul frequently conducts petrographic examinations of natural and man-made materials using optical and electron microscopy techniques. Paul is a European Geologist, Chartered Geologist and member of The Geological Society of London's Applied Petrography Group (APG).

Mr Owen Green



Owen has worked in the Earth Science Department at the University of Oxford since 1989. He initially, trained and worked in London Colleges as a Geological Technician and Curator of Geological Collections. He is currently a member of both the Engineering and Physical Sciences and Outreach Committees, and has been a co-convenor of the Geo-materials meeting (September 2014), and organised Outreach events on volcanos and mountain building. He has been a

member of the Learning Zone team at mmc and an occasional contributor to **infocus**. His research interests include sample preparation techniques, particularly those involving applications in light and scanning electron microscopy. He is currently undertaking a 2nd edition of A manual of Practical Laboratory and Field Techniques in Palaeobiology (2001, published by Kluwer, now Springer). Other micropalaeontological research includes a study of the last shallow marine carbonate-platform foraminifera of the Tethyan Ocean recorded in rocks from the NW Himalayas 50.5 million years ago as India crashed into Asia, Neoproterozoic agglutinated foraminifera from NW Europe (Avalonia and Baltica), and contextual studies on the world's oldest (3.5 billion years old) putative microfossils from Western Australia.

Dr Dan Haspel



Since the beginning of 2017 Dan has been a Technical Specialist in the Plymouth Electron Microscopy Centre at the University of Plymouth, primarily in charge of the FIB-SEM and is the lab's specialist for Materials and Engineering. Dan graduated with his PhD in 2018 from Loughborough University which looked at developing a dual-layer system for the mitigation of tin whisker growth. Prior to this, Dan obtained his MEng, also from Loughborough University, in Automotive Materials Engineering. Dan still studies tin whiskers but now with the addition of 3D analytics using FIB-SEM. Being within a central unit, he is heavily involved with a broad range of subject areas using FIB-SEM, creating and analysing 3D datasets. Dan is also highly interested in finding novel samples to use advance analytical techniques with, such as EBSD and TKD (transmission-EBSD) of teeth. More recently, Dan, along with other Plymouth EM colleagues, have been successfully using 3D printing to create bespoke sample holders for use in electron microscopes.

Professor Beverley Inkson



Beverley is Professor of Nanomaterials in The Dept of Materials Science and Engineering at The University of Sheffield, where she leads the NanoLAB Centre. Beverley joined the RMS as a PhD student in Electron Microscopy at Cambridge University, and served on the RMS_EM section_committee while a Royal Society University Research Fellow. She set up the UK NanoFIB network in 2001, and has run numerous Focused Ion Beam scientific meetings joint with the RMS. Beverley's research interests focus on the use of electron and ion microscopies to quantify the nanomechanical and functional properties of 3D nanomaterials, including developing novel in-situ SPM-TEM and tomographic characterisation methods.

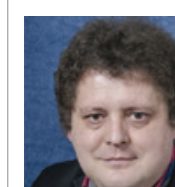
Ms Nyree Manoukian

Early Career Representative



Nyree studied archaeology for her undergraduate degree at University of Toronto, and subsequently moved to the UK for her MSc degree in technology and analysis of archaeological materials. She is currently a PhD student at the University of Oxford in archaeological science. Her research interests include the analysis of ceramics using scanning electron microscopy and polarised light microscopy, in order to reverse-engineer the production and use of such materials in the past. Her fieldwork activities focus on the Caucasus region. Research areas include raw materials acquisition, manufacturing techniques, firing regimen, and the use/function of archaeological pottery. Nyree is the EPS Early Career Representative and is keen on organising archaeological science workshops, which integrate various scientific fields explored within RMS.

Professor Igor Meglinski



Igor is a Professor in Biomedical Engineering & Biophotonics at the School of Engineering & Applied Science and School of Life & Health Sciences in Aston University (UK). He is a Chartered Physicist (CPhys), Chartered Engineer (CEng), Fellow of Institute of Physics, Senior Member of IEEE and Fellow of SPIE. His work is focused on the examination of interaction of photonic quantum vortexes with biological tissues, and their components, including cells, cell's organelles, collagen, etc. He is developing an advanced optical-microscopy biopsy, optical tweezers for cells diagnosis and quantitative polarization-based hyperspectral imaging technique for tissue characterization. His particular interest is an integrating of new developing technologies with currently available microsocopy systems.

Dr Duncan Muir



Duncan is the Senior Electron Microbeam Technician in the School of Earth and Ocean Sciences at Cardiff University. His work focuses primarily on scanning electron microscope imaging and microanalysis of geological samples. Duncan studied Geology and gained a PhD at the University of Bristol researching subduction zone volcanism and magma processes. Prior to his postdoctoral studies he worked in the applied fields of Mineral Exploration and Offshore Geotechnics gaining a broad experience of Geosciences.

Dr Fabio Nudelman



Fabio is a Senior Lecturer at the School of Chemistry, University of Edinburgh. Fabio obtained his PhD at the Weizmann institute of Science, Israel, and then

moved to the Eindhoven University of Technology, The Netherlands as a postdoc before joining the University of Edinburgh as a Chancellor's Fellow. Fabio's current research is in biomineralisation, investigating the formation and the structure of mineralized biological materials such as bone, teeth and shells. This is an exciting area at the interface between materials sciences, chemistry, crystal growth and biology. Cryo-electron microscopy techniques, including cryoTEM, cryoSEM and cryoFIB-SEM play a central role in Fabio's research, and in the last years he has also been interested in soft matter, electron crystallography and Ptychographic X-ray tomography as a 3D imaging technique.

Dr Julia Parker



Julia is an X-ray microscopist at Diamond Light Source, the UK's national synchrotron facility. Julia is responsible for the operation of the hard X-ray nanoprobe beamline, supporting nanoscale spectroscopy, diffraction and imaging experiments across the life and physical sciences. Julia joined Diamond in 2007 after completing her PhD at the University of Cambridge. Julia's current research interests lie in the area of biomineralisation, using synchrotron techniques to unveil details of the structure of calcium carbonates formed by organisms such as shells and studying the crystallisation and formation pathways of calcium carbonates.

Ms Jane Woolrich



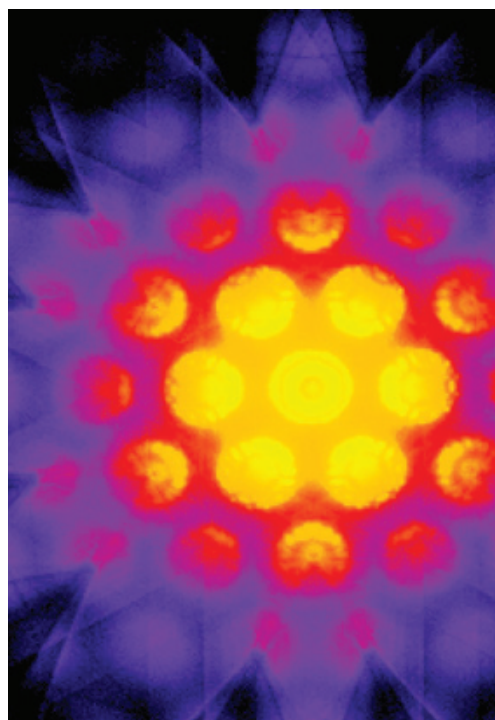
Jane is Materials Engineer and a senior member of the Service Investigation team for Civil Aerospace at Rolls-Royce plc. Her prime role involves the use of both optical and electron microscopy techniques for fractographic analysis, using both established techniques and applying new

modalities to further a deeper level of understanding. She is a Chartered Engineer and a Fellow of the Institute of Materials, Minerals and Mining. Having previously obtained a Masters in Gas Turbine Materials from Swansea University she is currently studying part-time for a PhD in single crystal materials at Cambridge University.

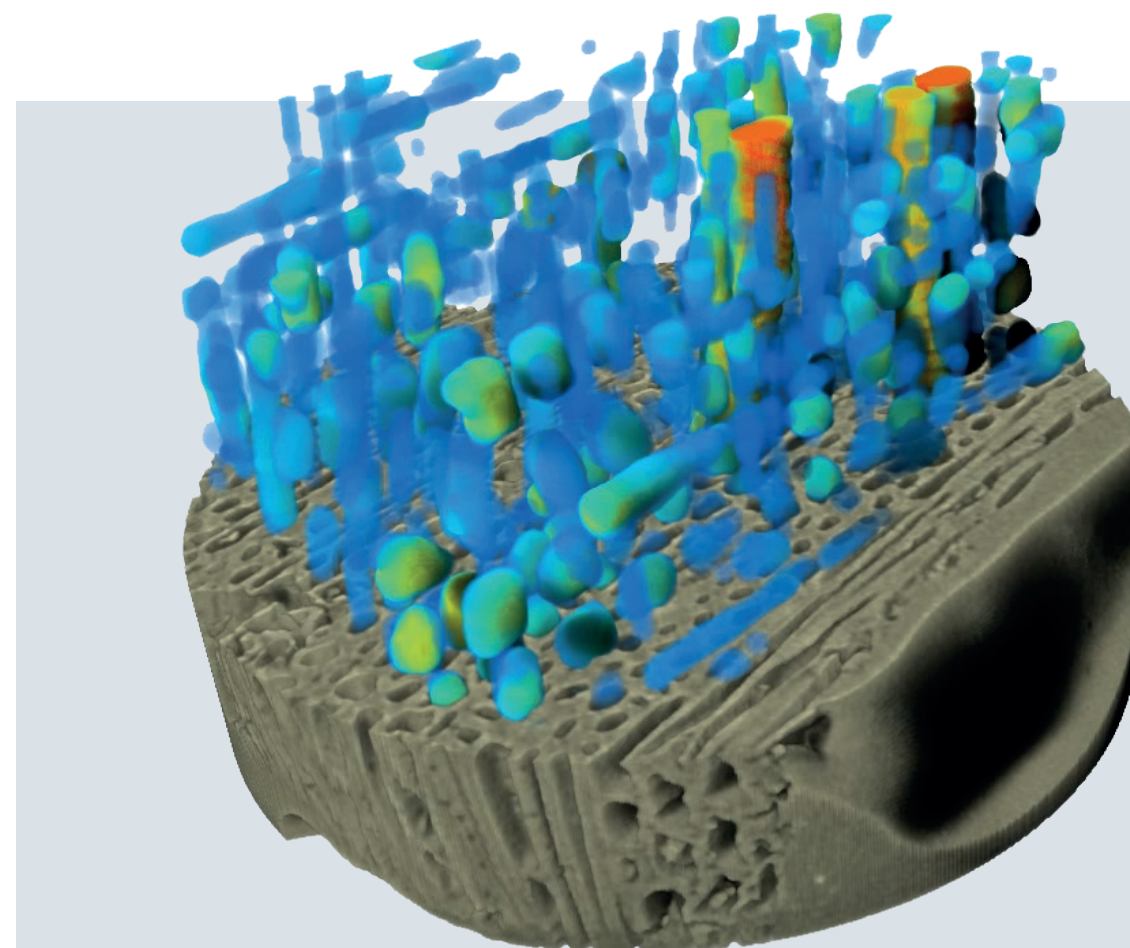
Ms Xiangli Zhong



Xiangli is a Senior Experimental Officer in the School of Materials, University of Manchester. Xiangli obtained her BEng in Metrology Instrumentation and MEng in Materials Science and Engineering. She has registered her PhD since 2006 in National University of Singapore. Xiangli has extensive experience and rich knowledge on electron microscopies, ion microscopies and sample preparation techniques. Her current research interest is on minimising focused ion beam (FIB) induced damages and FIB technical development on various types of materials.



Convergent transmission electron diffraction pattern of Si(111).



Wood sample scanned at 280 nm voxel size - vessels are color-coded to thickness.

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