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Message from the Editor

Welcome to the 2020 Institute of Physics Materials and Characterisation Group Newsletter. In this edition you will find reports from the conferences we ran and supported during the past year. We sponsored many travel awards and the details of members' experiences of the meetings they attended are contained herein. Since we have a large and diverse membership, we would like to hear from you if there are any items or information you would like to see included in the newsletter.

I would like to thank Alison Crossley for all her efforts in collating the information needed to put this newsletter together. We hope you enjoy reading it, and please get in touch if there is anything the group can do, the contact details can be found on the back page.

This newsletter is also available on the web and in larger print sizes: see <http://mc.iop.org>

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Materials and Characterisation Group Committee

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Lecturer in Physics of Functional Materials, University of Lancaster

Dr Ben Spencer
Senior Researcher, University of Manchester

Dr Andrew Stannard
Post-doctoral Researcher, King's College London

Chair's report

Dear M&C group members,

Given the issues we all currently face, I hope that this newsletter finds you well. For our group, 2019 was another very productive year. We organised and co-sponsored a number of excellent events tailored to our group specialties; we welcomed two new members to the committee (Ben Spencer and Andrew Stannard); we again supported many of our members' applications for travel bursaries (student and early career researchers); and finally capped the year off with our annual Christmas lecture entitled "*Ripples of Gravity, Flashes of Light: the Dawn of Multi-Messenger Astrophysics*" presented by Prof. Martin Hendry from the University of Glasgow.

Throughout 2019, the committee were also working hard to prepare for 2020, whereby we put into place numerous sponsored and group-led events and awards. Unfortunately, due to the current situation, these "best laid plans" have had to be put on hold. However, once some form of normality returns, we will try to resurrect our plans for the latter part of the year or postpone events until 2021. Therefore, the team effort I am pleased to say, will certainly not go to waste, and our events can once again be something for you all to look forward to. I recommend that you continue to monitor the latest news from the IOP and our [group webpage](#) and [event calendar](#). In the following pages we have included some highlights of the M&C group activities from 2019 for us all to enjoy and I thank Tom Hase for putting our newsletter together.

One final note; this year ends my term as group Chair (and Alison's as group secretary). I would especially like to thank Alison for all her support and hard work over this time, without which my role as Chair would certainly not have been as enjoyable. Looking back, I am pleased to note that the group membership has grown from less than 900 to 1180. We have established many new initiatives and events, with some now becoming permanent fixtures in our calendar, especially the well-received and attended Christmas lectures. We have seen an increase in applications for financial bursaries to support conference and workshop attendance for our members and to aid their professional development. I would finally like to add my sincere appreciation of the hard work from my fellow (volunteer) committee members, past and present, which has resulted in the excellent programme of events and high level of support that the M&C group members receive today.

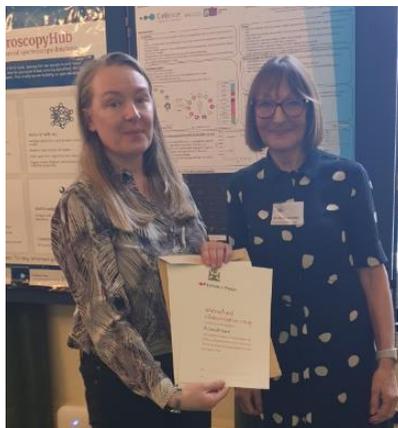
Best wishes for 2020,

Richard (Chair M&C group) [Email: Richard.Morris@imec.be](mailto:Richard.Morris@imec.be)

Materials Physics Group Awards

It is with great pleasure that we announce one current and one recently departed committee member have received **recognition awards**. Congratulations to you both.

In 2019, Sarah Fearn, a long standing and very pro-active member of the M&C committee, stepped down. Sarah served on the committee for approximately 10 years as both an ordinary member but also as the group treasurer. She was instrumental in organising and running several events on behalf of the committee. Although disappointing to lose such a valued team member, we unanimously voted to celebrate her time and contribution by awarding Sarah with a certificate in recognition of her services to the IOP and committee. The certificate was presented to Sarah at UKSAF 2020 by Alison (Committee secretary).



Alison Crossley presents **Sarah Fearn** (left) with the **IOP Materials and Characterisation Certificate**.



David Scurr, UKSAF Chairman, presents **Alison Crossley** (left) with the **2020 Rivière prize**.

In addition, we are delighted that **Alison Crossley**, our current group secretary, who was attending UKSAF 2020 to give an invited talk entitled "*Surface Analytical Considerations for Environmental Exposure Assessment for Nanotechnology Applications*", also received an award. Alison received the prestigious 2020 **Rivière prize** which is awarded to researchers whose work has had a major impact on other researchers in the field of surface analysis. Alison has made a significant contribution throughout her career, publishing over 100 articles, been a great supporter of the UKSAF community,

and has consistently encouraged and fostered young researchers in the field of surface analysis.

Both Ends of the Spectrum – UKSAF 40th Anniversary Meeting, 10th and 11th July 2019

Report by Alison Crossley (Oxford)

This special event took place over two days in celebration of 40 years of UK Surface Analysis Forum. It was held at the University of Nottingham on the 10th and 11th July with a celebratory conference dinner at Wollaton Hall.

In 1979 the UK ESCA user group was founded by Professor John Rivière at Harwell and the SIMS user forum held their first meeting the same year. With many interests in common they later merged to form the UK Surface Analysis forum (UKSAF) which holds meetings every six months. The 40th anniversary meeting reviewed old knowledge and looked ahead to new developments.

The delegates were welcomed by the home team of **David Scurr**, UKSAF Chairman, **Andrei Khlobystov**, NMRC, University of Nottingham and **Morgan Alexander**, School of Pharmacy, University of Nottingham. **Dave Sykes** of Loughborough Surface Analysis, UK and a previous chair of UKSAF kicked off the scientific part of the programme. Dave's talk was appropriately entitled "*Four Decades of Boron in Silicon: a personal journey through dynamic SIMS from the 1980s to the present day*". The next speaker was **Jim Castle** from the University of Surrey, UK who discussed "*The Auger parameter at 45 – a pragmatic tool with a deeper meaning*". Having been involved in the early days of use of the Auger Parameter to determine chemical state information Jim has continued to investigate the link between such measurements and polarizability and the potential usefulness in measuring the refractive index of powders. Jim also reminded the audience of how the ECASIA (European Conference on Applications of Surface and Interface) began, first with a joint meeting of the UK and Dutch ESCA User Groups held at the newly opened Center Parcs in Erperheide, Belgium in 1982 and the following year, joined by the Germans, at Flevoland in Holland.



Delegates at the UK and Dutch ESCA user groups attend their first joint meeting at Center Parcs in Belgium (can you spot our current IOP M&C group secretary in this photo?)

Moving firmly back to the present-day **Wendy Flavell** from Manchester University described Hard X-ray Photoelectron Spectroscopy at the Henry Royce Institute, Manchester. Her talk “*Non-destructive depth profiling of functional materials - towards rapid lab-based HAXPES*” described progress with this technique away from the synchrotron. Access to HAXPES and other instruments at Harwell XPS, the UK National facility for X-ray Photoelectron Spectroscopy was also outlined. Recent advances in SIMS were described by **Rasmus Havelund** (National Physical Laboratory, UK) in a talk on “*Depth profiling of organic electronic devices using the 3D OrbiSIMS*”. Rasmus was awarded the 2019 Vickerman Prize. Modern day application of XPS included the study of energy-related surfaces under ambient conditions (**James O’Shea**, Nottingham University). SIMS examples included imaging hydrogen (deuterium) at microstructurally relevant scales in steel, nickel and zirconium alloys (**Katie Moore**, Manchester University) and characterisation of biological materials by imaging SIMS (**John Fletcher**, University of Gothenburg, Sweden)

The second day of the meeting again commenced with an overview of 40 years of Surface Chemistry given by **Albert Carley** from Cardiff University and moved to the current day with a talk by **Marcus Rohnke** (University of Giessen, Germany)

on “*Novel Insights into Next Generation Battery Materials by ToF-SIMS and XPS*”. The Vendor sponsors were given an opportunity to showcase their latest developments. These included Hiden Analytical Ltd, Ionoptika Ltd, S A I Ltd, Scienta Omicron GmbH, SPECS Surface Nano Analysis GmbH, IONTOF GmbH, Scanwel Ltd, Loughborough Surface Analysis Ltd, Kratos Analytical Ltd & Thermo Fisher Scientific. Young Surface Analyst of the Year Competition 2019 entrants were also invited to give short presentations of their work. Game changers in the mass spectrometry toolbox were described by **Rian Griffiths** (Nottingham University) and **Arnaud Delcorte** from the University of Leuven, Belgium described the application of large argon clusters: from SIMS to nanomechanics and soft molecular transfer. The 2019 Rivière Prize was awarded to **Peter Cumpson** (Newcastle University & UNSW Sydney).

This lively, well attended and well sponsored meeting, together with the quality of the talks demonstrated the vibrancy of surface analysis in the UK even after 40 years. The next meeting will be held at Imperial College on 8th January 2020.

NuFOR – Nuclear Forensics, 10th and 11th July 2019

Nuclear Forensics directly supports the national nuclear security and is reliant upon access to expertise from right across the nuclear industry, academia and beyond and this meeting allowed many people from a diverse range of disciplines to share their ideas to support this exciting and important scientific field. The objectives for NuFor were to:

- Showcase research and new advances across academia and industry
- Discuss the technical challenges in the field
- Demonstrate the applications of fundamental science in Nuclear Forensics
- Enhance the UK skill base and career pathways in Nuclear Forensics
- Provide a networking opportunity for technical specialists across different disciplines



Over 80 people attended the inaugural NuFor conference at the University of Bristol in July, Spanning two days, the meeting allowed for networking, technical talks and keynotes delivered by prominent expert speakers from the IAEA, Metropolitan Police, US DOE, UK MOD and AWE.

David Smith, Nuclear Security Coordinator (Forensics) at the International Atomic Energy Agency and a NuFor 2019 Keynote speaker, remarked following the conference that *“...NuFor is now recognized by all who participated as such a strong addition to the technical exchange within international nuclear forensics calendar going forward... and we all are in a most enviable position with NuFor. It was just fabulous to listen, learn and interact with the extraordinary young researchers and their new ideas in nuclear forensics.”* Other feedback from participants has been equally kind, and the NuFor Organising Committee would like to thank delegates, session chairs, trade exhibitors, the University of Bristol and South West Nuclear Hub, as well as the Institute of Physics for all participating in making NuFor 2019 such a success. Further details of the meeting can be found in a [PhysicsWorld](#) article. A follow-up meeting is already in hand and will be hosted at the Institute of Physics, London, during October 2021.

Physics-based Contributions to New Medical Techniques (PCMT), 27th November 2019

Report by John Colligon (Huddersfield)

This [one-day meeting](#) was proposed by Professor John Colligon of the Ion and Plasma Surface Interactions Group in view of the rapid development and announcement of new medical methods during the last 12 months. The aim was to bring Medical experts, who develop these new procedures, and Physicists, who develop improved analysis methods, together to discuss these methods and to identify areas where more progress is needed.

At the start other IOP Groups were consulted and invited to support this meeting. By April 2019 we had support of seven IOP groups willing to help with speaker suggestions and advertisement of the event: (Ion and Plasma-Surface Interactions, Vacuum, Medical Physics, Particle Accelerators and Beams, High Energy Particle Physics, Materials and Characterisation, and Thin Films and Surfaces). Unfortunately, the Medical Physics group later found they were not able to support our meeting on 27th November. Nevertheless, members of other groups were helpful and identified possible speakers and the programme, shown below, proved to be very successful. IOP Conferences (Claire Garner and colleagues) did a great job with the meeting administration, and I would like to thank them for their valuable guidance. They advise me that the attendance was good for a one-day event. I was able to attract two exhibitors who took display stands (University of Surrey promoting a new European network of available ion beam facilities called "Radiate" (contact Roger Webb, Surrey) and Cosylab, with a base in Slovenia, which makes control modules that can be adapted to operate Proton beam Therapy systems and other Medical Devices.

I decided to hold a discussion session at 9.15 to give some background to recent activity in this field. Some interesting developments are a report on MRI showing that, in certain cases, a lower magnetic field will give a sharper image because high fields distort the display system (reported by **A.E. Campbell-Washburn** et al. in a paper "*Opportunities in interventional and diagnostic imaging by using high-performance low-field-strength MRI*". Radiological Society of North America, 2019)

Significant progress has recently been made in brain imaging where the brain pattern in a patient intending to speak or to move an arm can be converted via a special algorithm with information from tests on volunteers who can speak and move. An example of the speech programme has been reported by **Professor Chang**, dept of neurosurgery, University College, San Francisco. Early evidence of the onset of future health problems can be obtained by wearing patches on the body which are manufactured using a roll-to-roll process. These patches absorb the natural perspiration of the body which includes early evidence of future problems ("*Real-time measurements of sweat rate and electrolytes and metabolites in sweat*" **Bizen Maskey**, Sunchon National University). Bacteria in the gut are pulled into helical channels by an osmotic 'pump' in the pill and collected in microfluidic channels. (Courtesy: Nano Lab, Tufts University). An international team of researchers has designed a 3D-printed pill that combines an osmotic sampler with microfluidic channels that can profile bacterial species inhabiting the gut (microbiome). This could have important implications for conditions that affect and are affected by the intestinal microbiome (Advanced Intelligent Systems DOI: 10.1002/aisy.201900053). The role of the gut microbiome in aiding or protecting us from certain diseases is now under the spotlight. Recently, a potential link with the development of Alzheimer's disease has been highlighted, leading to a focus on the development of technologies that could sample the microbiome constitution in vivo. Unfortunately, the early tablets were not able to profile microbiome throughout the whole gut but a new pill, designed by a team led by **Sameer Sonkusale** from Tufts University, remedies this.

Speakers and delegates have all indicated that they found this meeting very useful and informative and suggested that they would support a second similar event, perhaps in two years' time. On the train home I began to wonder how surgeons control the depth of protons used in "Proton Beam Therapy". They can certainly perform a low dose test-run at the start where protons are bombarding cancerous tissue and they do know the initial depth from subsequent analysis. However, very quickly, they are bombarding damaged material which is body tissue plus implanted protons. This means some of the incoming protons now hit protons and the range must become less. Will deeper parts of the tumour survive because they receive a lower total dose? Of course, subsequent MRI will check this, but it could mean a second radiation. Your views on LinkedIn may be interesting!

UKSAF 2020 Winter Meeting: Multi-Technique Analysis, 8th January 2020

Report by Alison Crossley (Oxford)

The UKSAF 2020 winter meeting was held at the impressive, grade II listed building, 170 Queen's Gate London on the 8th of January 2020. The meeting was organized by **Dr Sarah Fearn** of Imperial College London. Sarah was the former IOP Materials and Characterisation Group Treasurer and had served on our committee for many years. To mark her contribution to the Group I had the pleasure of presenting Sarah with a certificate from the group. Sarah is now the secretary of the UKSAF and we wish her well with that task.



The Grade II listed meeting venue



Alex Ramadan talking about perovskite photovoltaics

The scientific programme began with a talk by **Dr Jean-Paul Barnes**, Grenoble, France on *Multi-technique analysis for nano and opto-electronic applications*. This was followed by **Dr Alexandra Ramadan**, University of Oxford. Alex, returning to Imperial College where she had studied for her PhD, discussed *Lead halide perovskite photovoltaics: challenges and pitfalls with their surface analysis*. Results from the innovative cryogenic 3D OrbiSIMS method for imaging volatile lipids were shown by **Clare Newell**, NiCE-MSI, NPL. **Dr Mark Greiner**, Max Planck Institute for Chemical energy conversion introduced the Spectroscopy Hub, www.spectroscopyhub.com. This is a crowd-sourced open database for photoemission spectra. Further talks in the morning were given by **Dr Noel Smith**, Oregon Physics, USA on *Plasma focussed ion beams and materials analysis* and **Dr Alison Crossley**, University of Oxford on *Surface analytical considerations for environmental exposure assessment for nanotechnology applications*. After giving this talk, I was delighted to be presented with the 2020 Rivière Prize, especially as I was the first female recipient in the 30-year history of this prize. The award is formal recognition of long-term and wide-ranging significance of the recipient's contribution to surface analysis, the impact on other scientists' work and support for young researchers. The prize is named after John Rivière, the founding Chairman of the UKESCA Users Group, in recognition of his efforts in setting up the group and steering it to be the UK's main focus in applied surface science. I had the great honour of working with John Rivière for many years at Harwell, so this prize has great significance for me.

The afternoon commenced with a talk by another former IOP Materials and Characterisation committee member, **Graham Cooke** from Hiden Analytical this was followed by **Horatio Cox**, a PhD student at UCL describing his research in a talk entitled "*One thousand trillion reasons why silicon oxides (SiO_x) memristors*". The meeting was concluded by **Dr Ozden Celikbilek**, Imperial College, London discussing *Exploitation of surface characterisation techniques for the improvement of solid/gas interfaces of thin-film solid-oxide electrodes*.

As well as the scientific programme there was an impressive exhibition of equipment by companies who support UKSAF.

Christmas Evening Networking and Outreach Event London, 18th December 2019

“Ripples of Gravity, Flashes of Light: The Dawn of Multi-Messenger Astrophysics”

The Christmas Lecture was given by **Prof. Martin Hendry, Glasgow** who is also a senior member of the LIGO Scientific Collaboration (LSC), for which he chairs the LSC Education and Public Outreach. The hugely [entertaining talk](#) was attended by a diverse audience of over 40 people.



The speaker introduced himself, and the first ever direct detection of gravitational waves by the LIGO and Virgo Scientific Collaborations, from the collision of two massive black holes more than a billion light years away (Nobel prize 2017). The talk not only introduced the astrophysics, but also discussed in an accessible way were the extreme material challenges in building the laser interferometers needed to detect the gravitational waves which have an amplitude of only 10^{-20} m. New space based systems are currently being developed which hope to alleviate some of the noise issues. From the first report waves detected in 2016, upgraded and more sensitive systems are coming online with coordinated worldwide efforts now able to pinpoint the source of the waves using optical telescopes. The talk finished by noting that gravitational-wave themed clothing was also for [sale](#) if one is interested! Martin graciously answered many questions from the audience and chatted with the attendees afterwards over wine and mince pies.



As well as Martin's talk, Dr Borja Sorazu (Glasgow) and project student Matthew Wassell demonstrated a portable interactive *LIGO in your hands*. This scale model of Gravitational Wave detectors was a welcome addition to the event; helping explain the operation of the LIGO detectors.

IOP Conference Funds



Early Career Researchers Fund

Providing financial support to early career researchers to attend international meetings and visit international facilities.

Research Student Conference Fund

Providing financial support to research student members to attend international conferences and major national meetings.

Members can obtain funding, up to a value of £300 from the Materials and Characterisation Group to attend a meeting or conference. The eligibility criteria and application form are available at <http://www.iop.org/about/grants/>. As part of being awarded a bursary you must write a short report on your experience at the conference. Selected reports are published in this group newsletter over the next few pages.

Reports on Conferences by students and early career researchers supported by the group

Archer - International Conference on Composite Materials (ICCM22) *University of Manchester*

With thanks to the financial contribution from the Materials and Characterization Group of the Institute of Physics, I was able to attend the International Conference on Composite Materials, which took place from the 11th to 16th August 2019, in Melbourne, Australia.



11-16 AUGUST 2019
22nd International Conference
on Composite Materials

A highlight of the conference was the plenary lecture on future challenges for carbon fibre composites delivered by Professor Browyn Fox of Swinburne University, Australia. Some stand-out talks included: a talk on the in-situ monitoring of braided composite tubes by Neha Chandarana, University of Manchester, UK, and a talk on hybrid thermoset composites by Kanokporn Tangthana-umrung, University of Manchester, UK. Alongside the speakers, the exhibition of stands representing different companies were well picked and added a useful industrial element to the conference.

Presenting my own research on *the impact performance of interlayer toughened carbon fibre composites* was beneficial, not only improving my dissemination skills but also because of the valuable input and feedback I received from participants of the conferences, which I otherwise would not have been able to receive. As I was at a critical point in my PhD – the writing up stage – the insight I gained into the current research landscape in relation to advanced composites, as well as the critical comments from the audience, will all play a part in improving my PhD thesis, and my performance and confidence for my viva.

In my opinion the conference was a complete success, very well organised and with an interesting cross section of research topics across composite materials. In particular, the organisation of the poster session, with lightning talks, was an interesting format that worked well. The venue is also of note, the staff of the Melbourne Convention and Exhibition Centre were helpful and friendly, the addition of a speaker preparation room was also greatly appreciated. Overall, a brilliant conference experience.

Fayter - 50th annual conference of the British Association of Crystal Growth
University of Warwick

The 50th annual conference of the British Association of Crystal Growth (BACG) was organised between 9th and 11th July 2019 at the Rooms on Regent's Park in London. The IOP Materials and Characterisation Group kindly provided funding to attend this conference, which consisted of an exciting programme detailing the latest developments across a wide range of areas relating to crystals including, but not exclusive to; growth, polymorphism, modelling, crystal properties and bio-inspired crystallisation, allowing me to broaden my knowledge of the field and present my work. The conference consisted of keynote lectures, including a really interesting presentation on "*Joel Bernstein and polymorphism*" by Dr Aurora Cruz Cabeza (Manchester). Bernstein was a formidable scientist in the field of crystallography and offered much expertise to many of the BACG attendees as well as a great deal of fundamental knowledge on polymorphism, on which much of the more recent work presented at this conference was based. Another extremely interesting keynote speaker was Dr. Wim Noorduin, AMOLF, Netherlands, presenting "*Shaping up bio-inspired functional materials*". Noorduin presented work on new ways to steer nucleation and growth of mineralizing microstructures, this included amazing micrographs of 'crystal microgardens' they obtained.

In this conference I gave an oral presentation titled "*Characterisation of the Effects on Ice Morphology and Growth upon Addition of Ice active Compounds, a Biophysical Study*". My work introduced scientists to a different area, crystallisation of solid water. My work studies the field of synthetic macromolecular (polymer) mimics of antifreeze proteins by examining the effect of different compounds on ice crystal morphology and growth, molecularly as well as macroscopically, with the aim of elucidating mechanisms of action and enabling the production of more active, less toxic antifreezes. I explained how X-ray scattering and solid-state nuclear magnetic resonance (SSNMR) spectroscopy can be used to study ice growth and ice morphology thoroughly, and that understanding of the ice crystallisation process has significance in basic cryo-science and to help develop new materials for extreme low temperature applications. I answered questions and appreciated the opportunity to discuss my work with those who understand crystals but were from different areas of the field, not just cryo-science and ice, enabling me to examine my work from different points of view.

A particular highlight of the conference was Mark Holden's presentation "*The role of active sites in heterogeneous ice nucleation*". This year Holden won the Young Investigator Award from the Society, which inspired me, as he also researches heterogeneous ice nucleation and his hard work studying ice has been recognised and rewarded. There was also the 50th anniversary dinner at the Royal Society, which was excellent. Having the celebratory

dinner allowed everyone to network and I found it particularly beneficial for me to create links for future career opportunities and discuss my research further.

The conference was very successful. It was highly attended and there were researchers from throughout the field. It was helpful for me to have the chance to hear about crystal growth for a range of compounds as well as hear, in more depth, about the use of different analytical techniques such as X-ray photoelectron spectroscopy. I would recommend those who work in materials and crystallisation to attend future BACG conferences.

Richheimer - 21st International Scanning Probe Microscopy (ISPM) 2019
National Physical Laboratory and the University of Surrey



The 21st International Scanning Probe Microscopy (ISPM) meeting was held in Louvain-La-Neuve in Belgium 26-29th of May, focusing on technical development of scanning probe microscopy (SPM) as well as sample characterisation using SPM based techniques, covering fields such as material sciences, fundamental physics and life sciences. Overall, 140 participants from 18 different countries came together to share their findings in over 50 oral contributions and over 40 posters.

The conference was opened by the pro-rector for research of the hosting university UCLouvain, Jean-Cristophe Renaud, followed by the opening lecture on “*AFM and the art of touching molecules*” by Hermann Gaub from the LMU in Munich. His talk started with a historical background on the application of atomic force microscopy (AFM) to life sciences, followed by highlighting practical remarks relevant to the technique and broad overview on the current work performed by his group.

On the second day a total of 4 sessions with about 5 talks each were held, out of which I would like to highlight 3 talks that were of particular interest. Renato Zenobi from the ETH in Zurich gave a very didactic talk on the challenges in tip-enhanced Raman spectroscopy together with some examples of its applications. Georg Gramse from the JKU in Linz talked about a broadband technique of applying amplitude modulated electrical signals to the AFM probe in order to study the dipole dynamics of proteins and water. Babak Eslami from the Widener University, USA discussed a novel way of finding the most appropriate resonance peaks (for higher sensitivity) on bimodal AFM in low quality factor environments. After the 4th session, I presented a poster entitled “*Multi-parameter electrical scanning force microscopy studies of Van der Waals heterostructures via cluster*”

analysis”, where I suggested a novel procedure for indentifying a separation of different species on a scanned area. It is based on using complementary sample information provided by co-localised conductive atomic force microscopy and scanning Kelvin probe microscopy and subsequent clustering using a K-means algorithm. The procedure was well received with the most frequent question raised was the type of features it can be applied to and how I was intending to make it available for the broader SPM community.

The remaining days offered several interesting contributions towards the technical development of SPM, including the vertically oriented probe geometry for extremely high lateral force resolution by Mervyn Miles from the University of Bristol and the hedgehog type probes developed by Thijs Boehme at the KU Leuven in Belgium, enabling remarkably high resolution for electrical contact mode AFM measurements.

Overall, attending the conference was very beneficial. It was helpful to receive valuable feedback from experienced microscopists on my project. Their opinions will allow me to prioritise the parts of my work that received the most interest. As such I will not only pursue further development of my procedures technically but will also look at how to integrate it into existing post-processing software packages. The fact that practically all attendees stayed at the same venue, as well as the conference lunches and dinners offered several opportunities for me to engage with more senior scientists and discuss technical questions about challenges I am facing in my research. I was also able to discuss shared research interests and collaboration opportunities with other doctoral students. As such, I would like to express my gratitude to the conference organisers, David Alsteens and Yves Dufrêne, as well as the IOP Materials and Characterisation group for the financial support.

Wyatt - Display Week 2019 *University of Leeds*



The Society for Information Display hosts the annual [Display Week conference](#) in Silicon Valley, California. This offers a wide selection of display and related technology presentations by global experts, along with an exhibition enabling the audience to interact with the latest innovative products from leading companies. Topics at the symposium ranged from fast-switching liquid crystal displays (LCDs), to organic light emitting diode (OLEDs) materials, and emerging technologies such as micro light emitting diodes (LEDs), to specific new areas such as active contact lenses. Big names such as Google, Samsung and Apple frequently appeared, giving an insight into their current research interests, along with many universities involved in display related research. With seven parallel sessions, it was impossible to see everything, but this did not stop me from learning a lot!

I arrived in San Francisco on the Saturday and jumped straight into the Sunday Short Courses. These were 4-hour sessions aiming to give a thorough introduction to a variety of topics for those looking to expand their knowledge in a new area. I attended the *“Fundamentals of Virtual and Augmented Reality”* session, led by a team from the University of Stanford’s School of Electrical Engineering. A truly eye-opening introduction to a topic I knew little about, where they started by saying *“let’s show you how to build a VR display in just 4 hours”*. Following this I delved into the *“Fundamentals of MicroLEDs”*, led by Prof George Zhaojun Liu of the Southern University of Science and Technology. Again, all the information you need to begin understanding this emerging technology.

Day 2 continued in a similar fashion, with a selection of 90-minute seminars on the hottest display technologies – faster paced, and equally stimulating. Here I went to the *“Display and Emerging Technologies Market Forecast”*, where Jennifer Colegrove, CEO of Touch Display Research attempted to predict the next 10 years for the display industry. Sessions also included quantum-dot displays, high-dynamic range (HDR) and its underlying physics, flexible display trends and challenges, and automotive displays. All engaging and informative.

Following the short courses and seminars was the main event, a four-day symposium and exhibition featuring over 70 technical sessions consisting of over 400 oral and poster presentations. Here I presented my poster on ferroelectric liquid crystals for fast-switching and shock-stable applications, which received a lot of interest from liquid crystal experts from various industries. This experience was hugely beneficial, as I got asked some challenging questions that I could not easily answer regarding my work and which will lead to further research. During the symposium there was a job fair and young engineer’s spotlight which provided a forum for young engineers and students just starting their professional careers to network and share experiences with SID members of all career levels. The job fair featured interviews with potential employers looking to recruit young engineers and students, represented by companies such as Apple, E-ink and LG, as well as smaller start up’s such as ClearInk. A truly unique and worthwhile event to attend for someone thinking about a career in display research. Although it is worth noting that most of the opportunities require moving to the USA!

Overall, the conference was better than I had anticipated, and I was expecting great things through stories of those that had been before. It was truly a spectacular experience. You must go to believe it. San Francisco is quite nice too – although you will have to spend some extra time in the USA to explore, as the conference leaves no time for sightseeing. I would strongly urge students or young researchers at any stage in display related technology research to attend this conference.

News in Brief

PVSAT 16 conference: Yusuf Chanchangi

A postgraduate student in the renewable energy group at the University of Exeter was awarded a prize for his poster presenting his work on “*Effect of dust formation on the PV module’s performance in Nigeria: A preliminary study*”.

RAMS 2019:

Ultrafast Spectroscopy: Watching electrons dynamics “live”

Adrien Chauvet, University of Sheffield.



Adrien Chauvet receiving his prize for his work

My job is to look at energy and electron transfers. Whether it is in solid-state materials, molecules or even large protein complexes, I am interested in understanding how their electronic and nuclear structure governs their overall properties. The goal is to understand the fundamental characteristics of the material in order to either control its behaviour or help develop new ones that are fit for purpose.

The challenge is to track the “real time” motions of electrons, nuclei, and energy transfers. The trick is to use light. Indeed, light is faster than any electron or nucleus’ motion, and we use it to take picture of these atoms. Certainly, individual electron and nucleus are too small to be seen with light. Fortunately, while looking at an ensemble, every material in its specific electronic state has a unique spectral signature. In other words, it will “look”

different and behave differently whether it is a monolayer, in bulk, oxidized, reduced, etc. The idea is then to use high power lasers to take “pictures” of the materials at a particular instant after poking them with another light. Taking many pictures at different time delays enable us to create sort of a stop-motion movie of the material, which can then be analysed.

While this technique, called ultrafast transient spectroscopy, is a standard in molecular biology and chemistry, it is only sporadically used in material science or engineering. However, in fields of research where photo-voltaic or catalysts are developed, such ultrafast characterisation can have a tremendous impact as it can help control and tune the materials.

For example, in the presentation I gave, I showed how my group recently characterised the electronic properties of thin-film metal oxides that exhibit antibacterial properties. For this study, we used our equipment to produce ultrashort laser pulses that mimic sun light to trigger charge separations. We were then able to follow the different charge dynamics that ultimately lead to the generation of reactive oxygen species and to the death of bacteria. With this spectroscopic technique, we are able to harvest information such as the charge separation efficiency, electron dynamics, excited state's band gap energy and even material deformation upon photo-excitation; all of which are key to understanding, controlling and enhancing the catalytic processes.

It is with this objective in mind that I joined RAMS 2019. The goal was to offer an expertise, that of ultrafast characterisation, which can be useful across disciplines. The goal was to trigger interests, initiate discussions and build-up new collaborations. I am thus grateful for the organisers who gave me the opportunity to present my work and valued it enough to grant me the prize. Finally, if you are interested in such project, feel free to contact me.

@IOP_M+C <https://twitter.com/IOPMC1>



The Materials and Characterisation Group Twitter Communication goes live! Please use this twitter @IOP_M+C to communicate your materials news with other members of the group and the wider world.

For example, have you just published some amazing work that you would like your fellow group members to see? Or is there a relevant event that we would all be interested in? Watch this space for further news from the Committee.

Something to look forward to

Lab Innovations 2020 (Alison Crossley)

[Lab Innovations](#) returns to the NEC, Birmingham on the 4th and 5th November 2020 with a bigger floor space than ever before. Leading suppliers and industry players will launch their latest products and showcase ground-breaking innovations to the UK's largest gathering of lab professionals. At the show, visitors will be able to discover sustainable lab initiatives, secure the latest tech, join exciting free conferences to earn CPD points and explore new ways of future-proofing their labs. Supported by some of the UK's top science institutions, it is a key event for powering the business of science. Anton Paar, Cole-Parmer, CEM Microwave Technology, Bruker, IKA, NOVACYT, Eppendorf UK, Huber UK, VWS UK, Julabo, Sartorius, and SLS are among the big industry players participating for 2020. Joining them will be many exciting newcomers including Mettler Toledo, Edwards Vacuum, TMQA and BMM Weston.

With sustainability high on the UK agenda and an increased demand for practical advice and solutions in this area, the Sustainable Lab will return. The dedicated area boasts a functioning laboratory on the show floor showcasing sustainable lab equipment with hourly guided tours. The tours give visitors expert advice on sustainability with evidence and research from 11 major case studies undertaken in leading universities in the field. The dedicated zone demonstrates how visitors can make improvements to their lab by adhering to sustainable best practice.



Helen Arney physicist, presenter, stand-up comedian, and musician entertains and informs delegates at Lab Innovations 2019.

Committee Blog: Dr. Richard Morris

I have now had the pleasure to serve on the M&C committee for the best part of 10 years. Having joined as an ordinary member, I became group secretary and most recently Chair. My election to the committee is also an interesting story. Following an M&C event where I had given a presentation, the M&C group held their AGM directly afterwards. As I waited at the back of the room for a friend who was on the committee, I heard “I would like to recommend Richard for the committee” and another voice (of someone I did not know at the time) seconded it. The rest is history, as they say. Aside from holding numerous roles, I have also initiated and participated in many other group activities, with the “cultural heritage meets science” events held at the Mary Rose certainly up there as a highlight for me.

For my day job, I am a researcher at IMEC in Belgium, an international research & development and innovation hub, active in the fields of nanoelectronics and digital technologies. I am based in the Materials Components Analysis (MCA) department where my research focus is on atom probe tomography (APT) and secondary ion mass spectrometry (SIMS). I moved to IMEC in 2015 from the University of Warwick, UK, having secured an EU Marie Curie Independent Research Fellowship. Following a successful completion of this Fellowship I became a permanent member of staff.

In my spare time I enjoy reading, cycling and traveling. Being based in mainland Europe has certainly made traveling around Europe easier (before the lockdown, I should note). I am now hoping that the next challenge we face, Brexit, will not derail my European adventure early (either professionally or personally).

On a final note, what I have noticed since working in mainland Europe is that the IOP has little to no presence or recognition outside of the UK. I wonder if there is scope for the IOP to explore changing this in some way?

If you have thoughts on this, or anything else, I would be very happy to hear from you, or you can send your comments to the group.



Forthcoming Conferences supported by the IOP Materials and Characterisation Group

Please note that the dates and times are subject to change due to ongoing COVID-19 restrictions.

The 16th Photovoltaic Science, Applications and Technology (PVSAT) Conference

POSTPONED – provisionally week of 14th September, University of Salford

<http://www.pvsat.org.uk>

UKSAF Summer 2020 Meeting – New technologies and advancements in Surface Analysis

Henry Royce Institute Hub, Manchester, 8th & 9th July 2020

POSTPONED – July 2021

NEW: UKSAF Online Summer Meeting 2020

University of Nottingham (Online) 8th July 2020

UKSAF will run a scaled down summer meeting on-line via Microsoft teams which will be free to attend. Please register for the on-line meeting here:

https://www.uksaf.net/?page_id=228

IOP Materials and Characterisation Group Christmas Lecture

IOP Headquarters, 16th December 2020 t.b.c.

<https://events.iop.org/materials-and-characterisation-christmas-lecture>

EPS-CMD 29: European Physical Society Condensed Matter Division

Manchester, 23rd-28th August 2021

NuFor2 – Nuclear Forensics

Institute of Physics, London 13th-14th October 2021

<http://nufor.iopconfs.org/home>

This technical conference will bring together experts from academia, industry, and government to share developments in the field of Nuclear Forensics for a wider audience as well as promoting the exchange of information and good practice between those already involved in nuclear forensics and other specialists who could provide wider value to the Nuclear Forensics community.

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Group Web Links

IOP Website

Our Group website address <http://mc.iop.org> is where you will find up to date information on the activities of the group including registration details for the conferences we sponsor and organise.