

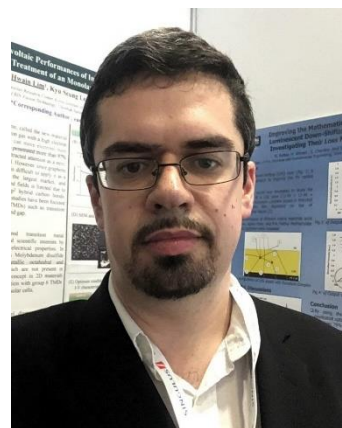
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Welcome from the Treasurer

Dear members,
Welcome to the Thin Films and Surfaces Group (TFSG) winter newsletter. I took up the position of Treasurer of the Group in 2021, having previously been Secretary from 2016.

I would like to welcome Matthijs Van Spronsen and Joshua Ellingford as new ordinary members of the committee, Steven Stanley for being re-elected as an ordinary member, and Hem-Raj Sharma for agreeing to be co-opted for another year. I would also like to thank Santanu Ray, Mhairi Rogan, Andrew Jardine, and George Darling, who left the committee in 2021, for their services. We will be holding elections by summer 2023 for additional ordinary members.



Our largest event last year was the [Nanoscience@Surfaces](#) Summer School, chaired by George Darling at the University of Liverpool in July 2022. The event was well received, and a report can be found later in this newsletter. Our largest event this year will be the [Interdisciplinary Surface Science Conference](#) (ISSC-24) to be held at Manchester Metropolitan University on 17-19 April. This will also include our Annual General Meeting (AGM). In addition, [Surface Science Day](#), which is our annual one-day event for PhD students, Postdocs, and early professionals, is going to be held on 9 June at the University of Chester. The TFSG also sponsors several other conferences and meetings throughout the year – please see “Upcoming events” below.

We are continuing to receive excellent nominations for the Woodruff Thesis Prize, which is a prize of £250 that we award for the best PhD thesis completed by a student in the stated year. I would like to congratulate Dr Alan Bowman of University of Cambridge for “Materials, methods and concepts for 21st-century solar cells”, which won the 2021 prize. Nominations are now open for the 2022 Woodruff Thesis Prize. The application form can be found on the [TFSG website](#) and submitted to our Group chair, Karen Syres (ksyres@uclan.ac.uk), at any time before the closing date of **30th April 2023**.

Please do get in touch with us if you have suggestions, would like to contribute an article to the newsletter, or otherwise get involved with the Group. We are especially interested in help to run a thin films event.

All the best for 2023 ahead!

Dr Kieran Cheetham

TFSG Treasurer, Science and Technology Facilities Council

TSFG Student and Early Career Bursaries

The Institute of Physics provides financial support to research students and early-career professionals to attend international meetings and major national meetings.

Research Student Conference Fund (RSCF) bursaries* are available to PhD students who are a member of the Institute and of an appropriate Institute group. Students may apply for up to **£300** during the course of their PhD and may apply more than once, for example they may request the full amount or decide to request a smaller amount and then apply for funding again for another conference at a later stage.

Note that grants will normally cover only part of the expenses incurred in attending a conference and are intended to supplement grants from other sources. All recipients are asked to produce a report on return from their conference before receiving payment. For details and application form please look at.

- **Research student conference fund:** <https://www.iop.org/research-student-conference-fund>
- **Early-career researchers fund:** <https://www.iop.org/about/support-grants/early-career-researchers-fund>

* Please note that bursaries are not available for meetings organised by the Institute of Physics including those organised by IOP groups.

UPCOMING EVENTS in 2023

- Apr 17-19: [Interdisciplinary Surface Science Conference](#), Manchester
- Jun 9: [Surface Science Day 5](#), Chester
- Jun 13-14: [Vacuum Symposium](#), Daresbury
- Jun 17-19: [UK Colloids](#), Liverpool
- Jun 28-30: [Condensed Matter and Quantum Materials](#), Birmingham
- Jul 25-27: [Peptide self-assembly](#), Manchester
- Aug 14-25: [Physics by the lake](#), Stirling

Call for research highlights and new TFSG Twitter account

We are keen to highlight significant achievements and profile research in Surface Science within the UK to demonstrate the vibrancy of our field. If you have a research highlight story or achievement to share or would like your research group profiled in the newsletter, please contact our Editor, Theodoros Papadopoulos t.papadopoulos@chester.ac.uk.

Research highlights, achievements, upcoming events, and any updates in the field are also welcomed to be posted on our new Twitter account [@IOPTFSG](#). So please do get in touch and follow us!

2022 David Tabor medal and prize

[Prof Jonathan Coleman](#), School of Physics, Trinity College Dublin, has won the [2022 David Tabor medal and prize](#) for ground-breaking research into developing the liquid phase exfoliation process, a scalable method for converting layered materials into two-dimensional nanosheets in large quantities.

The 2023 IOP Awards are now open for nominations. If you or someone you know is doing brilliant work in surface or nanoscale physics, please submit your nomination at <http://iop.org/awards>.



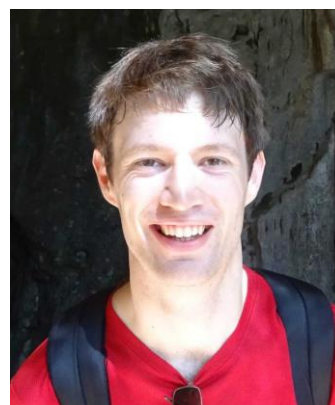
Prof Jonathan Coleman, Trinity College Dublin.

Woodruff thesis prize 2021

We received excellent nominations for the Woodruff Thesis Prize 2021. This is a prize of £250 that we award for the best PhD thesis completed by a student member of the group in the stated year. We would like to thank all the students and their supervisors who submitted nominations. The committee were impressed by the quality of the theses submitted.

After a very tough decision, the committee awarded the prize to Dr Alan Bowman, University of Cambridge. His thesis title “Materials, methods and concepts for 21st-century solar cells”, combined work in charge recombination in halide perovskite thin films, photon recycling, and coupling to singlet fission materials, towards fabrication of high-efficiency perovskite solar cells. His work was supervised by Prof Sam Stranks, University of Cambridge.

As the winner of the prize, Alan will also present his work at our next Interdisciplinary Surface Science Conference (ISSC-24). The ISSC conference is held every 2 years and our next conference is planned on April 17-19th 2023 (see upcoming events).



Dr Alan Bowman, winner of the 2021 Woodruff thesis prize.

Woodruff thesis prize 2022: Call for Nominations!

Nominations for the Woodruff Thesis Prize are now open, with a closing date of **30th April 2023**. The Woodruff prize is awarded annually for the best PhD thesis completed by a student member of the TFSG group. The value of the prize is £250 and is established to encourage and recognise high quality research and scientific writing in the field of thin films and surfaces.

The application form and further information is available online on the following IOP link:

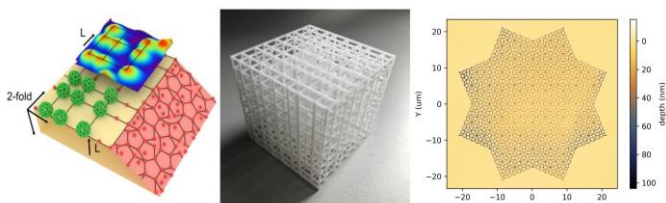
<https://www.iop.org/physics-community/special-interest-groups/thin-films-surfaces-group/woodruff-thesis-prize>

Nanoscience@Surfaces poster prize

Congratulations to Liam Chandler for being the poster winner in our Nanoscience@Surfaces summer school, hosted at Liverpool. Liam was awarded the prize of £100 for his work entitled “Multiscale quasiperiodic architectures and characterisation of their physical properties”. His work is undertaken at the SSRC and MIF at the University of Liverpool, in collaboration with Dr. Liam O’Brien, and Prof. Ron Lifshitz. EPSRC and UoL DTA schemes are acknowledged for financial support.



Poster winner Liam Chandler, and Karen Syres, TFSG Chair, during the poster award.



Left: A model of C60 molecules on the 2-fold surface of Al-Pd-Mn with a Fibonacci square grid tiling on top. The wedge-shaped cutaway shows the relation to the five-fold facets, on which is superimposed a Penrose tiling. Middle: a 3D printed Fibonacci grid. Right: An 8-fold tiling fabricated with nanolithography.

Report on Nanosciences@Surfaces Summer School

The [Nanoscience@Surfaces summer school](#) took place on the 25-28th of July 2022 at the University of Liverpool. A bit ill-fated, this was originally scheduled for 2020, and even in 2022 proved organizationally challenging as COVID restrictions wound down. The organizers are deeply indebted to the Institute of Physics for assistance and the excellent line-up of speakers who provided their services at short-notice. We were absent only two speakers to train strikes (a bit more ill-fate) and a small number of attendees to COVID.

An exciting programme was delivered, book-ended by a perspective on the developments in surface engineering for biological applications by Ras Raval, and an introduction to Surface Science in application to Astrophysics and Astrochemistry by Martin McCoustra. Fundamental techniques were introduced by Philip Moriarty, who discussed the basics of Scanning Probe Microscopy and the dangers of over-interpreting results, Georg Held talked on Photoelectron and X-ray absorption spectroscopy, Chris Nicklin gave a broad introduction to Surface Science techniques at the Diamond Light Source. Andrew Jardine introduced the use of neutral atoms to probe surfaces and Rob Lindsay discussed quantitative structure determination of oxide surfaces. We also had talks on specific applications such as the surface properties of magnetic materials (Andrew Pratt), the structure and reactivity of water at metal surfaces (Andrew Hodgson), and single molecule electronics (Richard Nichols). Neil Curson introduced the use of surface modification by scanning probes and Early Career Physicist Peiyu Chen gave an excellent illustration of the use of STM to study and characterize metallic nanocrystals. Theory was covered by Matthew Dyer (DFT) and Dave Willock (theory of reactions at surfaces) and Ron Lifshitz gave an elegant talk on the fundamental description of a crystal, introducing quasi-crystals.

The talks were accompanied by hands-on workshops on SPM analysis (Joe Smerdon) and XPS analysis (Ben Spencer), with a new workshop on computational techniques by Theodoros Papadopoulos and Dave Willock, and a careers workshop organised by Kieran Cheetham with representatives from industry.

Dr George Darling
University of Liverpool

Report on CMD29, Optoelectronics for Energy Applications colloquium

The Condensed Matter Division of the European Physical Society held their general conference in Manchester this year (CMD29) with local support from the Institute of Physics. Originally scheduled for 2021, CMD29 was postponed due to the pandemic and eventually held as a hybrid meeting, though in fact it was generally attended in-person by over 650 delegates. The conference opened with a talk from local Nobel laureate Andre Geim, and covered a full range of condensed matter research topics such as low-dimensional systems, soft matter, quantum computing, and biophysics.

The Thin Films and Surfaces Group was represented on the CMD29 Organizing Committee by Sebastian Wood, and we also organised a 2-day mini-colloquium on "[Multi-modal characterisation of thin](#)

[film optoelectronics for energy applications](#)". This included invited and contributed talks on photovoltaics, electrochemical systems, and spintronics as well as interdisciplinary contributions on advances in multi-modal measurements. The Royce Institute generously sponsored an evening reception for our attendees, which was a great opportunity to see their new building and find out how we can access their state-of-the-art material characterisation facilities.

Dr Sebastian Wood
National Physical Laboratory



CMD29 Colloquium on multi-modal characterisation of thin-film optoelectronics for energy applications

Report on CMD29: Physics in 2D Nanoarchitectonics colloquium

The "[Physics in 2D Nanoarchitectonics](#)" colloquium, co-sponsored by the TFSG, was held on 21-22 Aug. 2022 within the CMD29 Conference, the 29th edition of the biennial international scientific meetings coordinated by the Condensed Matter Division (CMD) of the European Physical Society and the Institute of Physics.

The colloquium focussed on the emerging physics of functional 2D nanoarchitectures, covering both theoretical and experimental aspects, and spanning the synthesis of novel systems alongside characterisation of their structural, electrical, optical, thermal, and mechanical properties. An important aim of the colloquium was to bring research leaders in the field together with early career researchers in order to facilitate discussion about the latest advances and to stimulate the generation of new ideas in the highly active field of nano-architected 2D materials.

Invited speakers Mads Brandbyge (DTU, Technical University of Denmark, Denmark), Nuria Aliaga (ICREA-ICMAB, Barcelona, Spain), Alexander Grüneis (University of Cologne, Germany) and Gabriela Borin Barin (EMPA, Switzerland) showcased highlights of their work

describing materials that can be created with precision methods such as "top-down" nanostructuring bulk 3D materials or "bottom-up" 2D nanoarchitectonics via on-surface synthesis. Both "top-down" and "bottom-up" approaches were shown to be progressing rapidly towards achieving novel nanostructures and devices.

Of particular note was the high-quality and interdisciplinarity of the talks, both invited and contributed. This clearly aroused the interest of the audience, with long and interesting question and answer sessions that stimulated new ideas and articulated new challenges in the highly active field of nanostructured 2D materials.

We are grateful for the sponsorship provided by the TFSG and the AECID (Agencia Española de Cooperación Internacional para el Desarrollo).

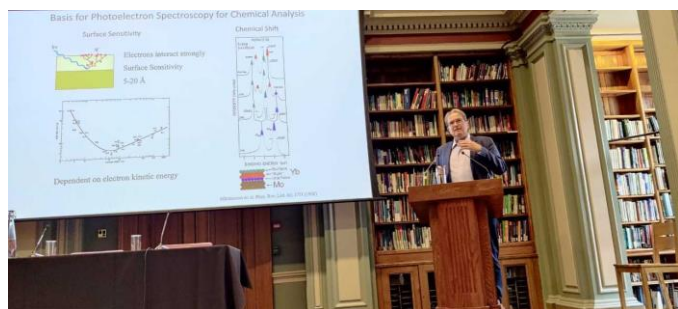
Dr Aran Garcia-Lekue, *DIPC, Ikerbasque*
Dr Aitor Mugarza, *ICN2, ICREA*
Dr César Moreno, *Universidad de Cantabria*
Dr Rasmita Raval, *University of Liverpool*

Report on Faraday Discussion: Photoelectron spectroscopy and the future of surface analysis

Whilst the [conference](#) title was deliberately broad in order to include a wide range of surface analysis themes, the meeting was very much dominated by photoelectron spectroscopy (PES). Nevertheless, the breadth of research that PES encompasses created a very dynamic meeting with a considerable diversity of topics. An excellent introductory lecture from Prof. Wendy Flavell captured the current excitement amongst the community about the advances occurring in the field particularly the shift of experimental techniques that were previously confined to synchrotrons into the laboratory, but at the same time the major advances of synchrotron photoelectron spectroscopy that are giving us access to ultra-fast time resolved processes and towards higher pressures systems and truly operando techniques. What she didn't cover in any depth (and was happy to admit so) are the significant advances theory is making towards simulating and interpreting photoelectron spectroscopy, a theme which emerged strongly from the papers that were presented at the meeting and in the discussion. The discussion at the meeting identified many significant synergies between the different sub-communities in PES and brought together people working in some of these areas for the first time. As always, the RSC team's organisation of the meeting was excellent and holding the meeting in-person at Burlington house with its usual very high standard of catering and organisation was a pleasure. The organising committee is grateful for the support of the TFSG. It's worth noting too, that the three online

presentations worked extremely well; indeed, during the discussion, the online presenters seemed to be as available to the other delegates as those presenters actually on the stage. Overall, a very good conference and experience.

Dr Philip Davies
University of Cardiff



Concluding Remarks Lecture by Anders Nilsson, Stockholm University, at the Faraday discussion on Photoelectron spectroscopy and the future of surface analysis.

Report on Vacuum Symposium

After a 2-year break due to Covid, the [11th Vacuum Symposium](#) was held on 12-13th of July 2022 at Daresbury Laboratory, Warrington, UK. The response to an in-person meeting exceeded expectations, and despite some Covid no-shows on the day, 141 people attended the event.

Vacuum Symposium is an annual event that aims to educate and inform in all aspects of vacuum across the many and varied applications. VS attracts a wide variety of academia and industry and promotes a great willingness to share knowledge, ideas, and experiences amongst the participants.

The low-cost Vacuum Training courses put in by VS proved once again to be very popular. Few people working with vacuum have received any formal training and the courses, ranging from introductory to specialist, provide knowledge that can be taken back to the workplace. Our Trainers have a vast amount of experience and know-how, which according to the comments received from delegates, is passionately delivered, and sometimes reveals a prior misunderstanding of vacuum principles.

The Vacuum Symposium meeting is also an opportunity to present the Harry Leck Memorial Medal for distinguished contributions in vacuum science and applications. The 2022 winner was Dr Andrew Chew of Atlas Copco seen below receiving the award from Robin Hathaway (R), Chairman of the Vacuum Symposium committee.



The free to attend Technical Meeting at VS11 included presentations on a range of vacuum topics such as pump technology, contamination and particulate control, and safety in design and operation of vacuum systems. Speakers from industry gave talks on process control and challenging tasks within a vacuum environment.

Outside the meeting rooms was a large marquee (perfect for the hot July weather) for the Vacuum & Technology Exhibition with table-top displays from over 40 companies. The free buffet lunch in the marquee provided a great opportunity to network and talk to the exhibitors. The Marquee also housed the VS Poster Session with the prize being awarded to Chris Benjamin, University of Warwick, who with colleagues, presented 'Photocathode Performance Characterisation of Ultra-thin MgO Films on Polycrystalline Copper'.



Date for your diary: the 12th Vacuum Symposium will be held at Daresbury Laboratory on 13-14th June 2023. In addition to all the above the IOP Vacuum Group will be organising a meeting on 'Vacuum in Medical Applications'.

Dr Steve Shannon
SS Scientific Ltd

Report on Condensed Matter & Quantum Materials

The [CMQM 2022](#) conference organised at the University of Bath in 20-22nd June 2022 has brought together the condensed matter community in the UK and has featured high profile speakers from around the world. The conference developed in three days with three parallel sessions and more than 130 participants. It has been one of the first in person live events after the pandemic and gathered a lot of interest especially from young and early career scientists. Together with the oral sessions around the themes of quantum matter, 2D-materials, theory, magnetism and superconductivity, the meeting also offered a well-attended poster session, an exhibition with seven partners and a social dinner. The whole event was hosted on the university campus giving plenty of opportunities for networking and exchange of ideas among the participants. This helped to establish the CMQM series of conferences as one of the primary events in condensed matter physics in the UK.

Dr Enrico Da Como
University of Bath

Report on Plasma, Surfaces and Thin Films

After a COVID-related absence of a few years, the [Plasma, Surface and Thin Films](#) meeting was back on 9 June 2022. Organised by the Ion and Plasma Surface Interactions, Thin Films and Surfaces and Vacuum groups, this was a 1-day event at the IoP headquarters in London. For many of us, this meeting was the first opportunity to see colleagues again in person and talk about some exciting science.

The programme had 3 themed sessions with an invited speaker and a contributed talk as well as a poster session during lunch. As always, there was a nice mix of university and industrial contributions. The first session was on Ion Implementation with an invited talk by Mateus Masteghin of University of Surrey on “Strain Control in Suspended Thin Films via Ion Implantation: Towards Direct Bandgap group-IV Semiconductors”. He showed work investigating the intentional use of strain to control film material properties.

Then there was a dedicated session on the emerging topic of the Application of Clusters and Heavy Ions. Naoko Sano from IonOptika Ltd. gave an invited presentation on “A Practical Guide for Choosing the Best Gas Cluster Ion Beam for SIMS Application”, highlighting their experience on producing high-quality, reliable gas clusters for analysis.

After lunch, the last session was a session on Technology applications for quantum and solar. Ella Schneider of the Surrey Ion Beam Centre gave a presentation on “The Use of Ion Beams for Quantum Applications”. The talk covered many of the potential as well as some of the material challenges for quantum applications and how our research field can contribute to overcoming these.

During the lunch break, we enjoyed our lunch while talking to the presenters of posters. Topics ranged from laser ablation to thin film deposition and ion beam sputtering. The annual IPSI poster prize was won by Joshua Ellingford from Plasma Quest Ltd for his poster on “A new plasma source design enabling co-sputter and large area applications of HiTUS (High Target Utilisation Sputtering) and derivative technologies”, as shown in photo.

Overall, it was a relatively small but very successful event, hopefully marking the return to an annual and in-person event. Many thanks to Hayley Brown and Roger Webb for the excellent organisation. Finally, I hope to see you all again next year.

Dr Erik Wagenaars
University of York



Joshua Ellingford from Plasma Quest Ltd receiving the annual IPSI poster prize.

Report on the Workshop on Scattering of Atoms and Molecules from Surfaces

The 5th International [Workshop on Scattering of Atoms and Molecules from Surfaces](#) (SAMS5) was held from the 12-15th September 2022 at Gonville and Caius College, Cambridge, with support from the IOP Thin Films and Surface Group. The goal of the event was to bring together both experimental and theoretical scientists working in the field of atom and molecule surface

scattering, to consider the unsolved and challenging problems in the field that need to be addressed in the near future. The event consisted of a mixture of invited talks, contributed talks, panel discussions and posters. The meeting attracted almost 50 participants, primarily from around the UK and Europe, but also from as far afield as Tokyo. The talks brought together a range of topics, including experimental atom-scattering and atom-microscopy, surface processes including reactivity, electronic transitions, surface phonon dynamics and many related theoretical methods. The talks stimulated lots of lively discussion, especially during the panel sessions, which focussed on modelling methods to support the field and on taking a forward look to the future. The meeting culminated in a very enjoyable conference dinner in the Fellows Dining Room at Gonville & Caius college, where Bill Allison was awarded the inaugural SAMS Lifetime Achievement award. We are now looking forward to the next SAMS meeting, which will be held in 2025, in Ulm, Germany.

Prof Andrew Jardine
University of Cambridge

Researcher Profile

As an undergraduate in Engineering Physics, I was fortunate to undertake an industrially led final year project with my 3rd year placement company to develop a Hydrogen barrier- this was my first practical with thin film coatings and despite efforts to leave the discipline remains the focus of my career since that time in 2004.



Following a challenging but rewarding final year project I was offered the opportunity to continue within the field of practical surface coatings for a PhD in structural magnetoresistance coatings at Loughborough University. The area of research was to develop and

test a theoretical magnetoresistive structure which would far exceed current technologies, unfortunately it soon became apparent that the material properties in order to achieve even minimal magnetoresistive properties was not possible with any current techniques. This was an important lesson, fortunately learnt early in my career that the material properties of thin films can be significantly different to those produced in bulk and the crystal structures achievable in bulk cannot always be replicated in thin film structures.

It was at this point that my PhD hung by a thread but during structural analysis with SEM and FIB it was discovered that the techniques I had employed in an attempt to achieve specific crystal structures gave rise to very high aspect ratio nanowires grown directly from magnetron sputtering, far in excess of any current model or growth theory. It soon became apparent that we had discovered not only a new method for producing single crystal, very high aspect ratio nanowires but also a new model for film growth in extreme deposition parameters. The second lesson early in my career to show that thin films is still a developing area and to this day the nature of thin film growth and processes continue to surprise me.

After my PhD I was keen to continue in the field of thin film coatings, particularly around material and process parameters but I was keen to do this within an industrial setting, firstly to see the impact of my research but also due to the significant pace at which research and developing is undertaken.

During my career I have worked with industrial sputter coating systems with chamber sizes from 10L to 3500L, with processes from Magnetron Sputtering, Arc, ebeam, ALD, CVD, PECVD and many hybrid or intermediate versions of these. Applications include optics for defence, solid lubricants for space craft, electrochromics, photovoltaics, decorative applications for automotive and ophthalmics as well as coatings for the LCD, aerospace and semiconductor industry. In support of these technologies and processes I have installed, supported and consulted on processes and equipment from the US to Australia and many places in between.

My current role is CEO of Light Coatings Ltd, consulting for coating technologies globally in addition to our own inhouse coating and analysis facilities supporting research, development and prototyping of thin film related products. This allows me to provide solutions with direct impact to customers, undertaking development to solve immediate challenges and supporting companies new to thin film coatings. The most rewarding aspect of this role is to bring understanding of surfaces and thin film coatings to a wide audience, in some circumstance supporting customers to establish new production lines and facilities starting with no experience.

I work continuously to break down the perception of 'a dark art' related to the growth of thin film coatings to bring the technology to a much wider application.

Dr Steven Stanley
CEO – Light Coatings Ltd, Warrington, UK

Facilities relevant to TFSG

HarwellXPS – EPSRC National Facility for Photoelectron spectroscopy

HarwellXPS is the EPSRC national facility for X-ray photoelectron spectroscopy (XPS). Run by Cardiff University and University College London (UCL), with our partners at the Henry Royce institute at the University of Manchester, the HarwellXPS facility has a remit to provide the best specification commercially-available facilities for XPS in terms of energy resolution, lateral resolution and angular resolution available from laboratory-based instruments worldwide.

We provide the widest range of associated equipment and facilities in support of XPS research needs, including coincident and correlative techniques such as Ion Scattering Spectroscopy (ISS), Reflection Electron Energy Loss Spectroscopy (REELS), Ultraviolet Photoelectron spectroscopy (UPS) and Raman. We also facilitate access to Near-ambient Pressure XPS (NAP-XPS) and High Energy XPS (HAXPES), offering access to photon energies up to 9.25 keV in a lab-based system.

These analysis methods are supported by laboratory-based X-ray absorption spectroscopy (XAS) providing XANES and EXAFS analysis for transition metals as well as our forthcoming SEM-EDX system to allow correlation with XPS analysis at the exact same location.

Key analytical software for the analysis of XPS and related spectra is provided for all users, with remote access. An experienced team is available to assist and advise on interpretation and data reduction. Hands-on training is provided in XPS measurement and analysis, interpretation and quantification of XPS spectra and images, with additional formal training provided when the need is identified. All this is supported by online channels, such as the [HarwellXPS YouTube channel](#) and in-person training courses.

HarwellXPS provides its service to academia and industry, with a particular focus on those which have not traditionally used the techniques, but for which it could provide a valuable new tool in surface analysis. Further information on the following link:

<http://portal.harwellxps.uk>



TFSG Committee

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Mr Joshua Ellingford - Plasma Quest Ltd
Dr Andrew Pratt - University of York
Dr Steven Stanley - Light Coatings Ltd
Dr Matthijs Van Spronsen - Diamond Light Source
Dr David Ward - University of Cambridge
Dr Glen West - Manchester Metropolitan University
Dr Sebastian Wood - National Physical Laboratory

Co-opted Members

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