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Welcome from the Treasurer

Dear members,
Welcome to the Thin Films & Surfaces Group (TFSG) newsletter for Summer 2019. We would also like to warmly welcome our two new committee members, Sebastian Wood from the National Physical Laboratory and Beaujolais Bussell from the University of Surrey. We are also pleased to welcome back Neil Curson from University College London as a co-opted member.

Our main event of the year to date was the Interdisciplinary Surface Science Conference ISSC-22 held in a sunny Swansea the week before Easter, with around 120 in attendance. A more detailed report on the meeting can be found on page 3. It was great to see

the variety of surface science showcased at the 2019 edition of this flagship biennial event.

The Thin Films and Surfaces Group also organises and supports several other conferences and meetings throughout the year. This summer, we are organising the [Thin Film Coatings for Electro-optics](#) meeting to be held in Liverpool in September and will be supporting the [Plasma Surfaces and Thin Films](#) meeting at the IoP in June. Registration for both of these is currently open via the IoP conferences website.

Also this year, we are planning a VASP workshop, and the continuation of Surface Science Day, as well as an event to celebrate the 50th anniversary of the foundation of the group. We hope to see you at one or more of these events and further

details will be circulated in due course.



As the summer conference season approaches, I would also like to take this opportunity to remind members of the IoP Travel Bursaries available to postgraduate students and early career researchers (details below).

Best wishes,
Dr Holly Hedgeland,
TFSG Treasurer, School of Physical Sciences, Open University

TSFG Student and Early Career Bursaries

The Institute of Physics (IoP) provides financial support to research students 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 http://www.iop.org/about/grants/travel-bursaries/page_69141.html.

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

Silicon Quantum Information Processing 2018 – Report

This is an annual one-day conference that brings together the UK community working in the field of silicon quantum information processing and silicon nanoscale electronics, and is enhanced by the presence of a number of overseas attendees, including invited speakers. The conference this year was held on Sept. 7th, 2018, at University College London. It was a great success, with a particularly high calibre of world-renowned invited speakers and well received contributions from all that presented. There were 59 attendees, including people from Australia, the United States, Switzerland, Germany, the Netherlands and Italy.

Topics that were presented ranged all the way from the fundamental science behind making and measuring simple quantum systems in silicon, including quantum bits (qubits), through to how large-scale silicon quantum computers could be controlled by complex measurement protocols. The conference was kicked-off by Professor Andrew Dzurak of the University of New South Wales, Australia, who gave an invited talk about spin-based quantum computing using CMOS-compatible quantum dots. Later Professor Jason Petta, gave a related invited talk entitled ‘Spinning up a silicon-based quantum processor’, describing the world-leading silicon qubit work coming out of his group at Princeton University, United States. If the qubits described by Professors Dzurak and Petta are to become useful, then the silicon quantum computing community much quickly learn how to scale them up to large numbers, which creates challenges for control and measurement of the qubits. Invited talks by Sebastian Pauka, a talented PhD student from University of Sydney, Australia, and Professor Edoardo Charbon, from the École Polytechnique Fédérale de Lausanne, Switzerland, addressed these issues.



Group photo during the Silicon Quantum Information Processing event at UCL.

The poster session saw a very high quality of research presented, stimulating much discussion. The poster prize winner was Procopios Constantinou and the runner-up was Taylor Stock, both from University College London.

The conference organisers were M. Fernando Gonzalez Zalba, Hitachi Cambridge Laboratory, University of Cambridge, and Neil Curson and John Morton from University College London.

Sponsorship was greatly appreciated from the following: Hitachi Cambridge Laboratory, London Centre for Nanotechnology, UCL; and four Institute of Physics Groups (Thin Films and Surfaces; Nanoscale Physics and Technology; Semiconductor Physics; Quantum Optics, Quantum Information and Quantum Control).

Dr Neil Curson
*Dept. of Electronic and Electrical Engineering
University College London*

Surface Science Day 2018 – Report

[Surface Science Day 2018](#) was held in the University of Birmingham on 17 December 2018. This followed the previous two “Surface Science Day” events held in University of Central Lancashire (2015) and University of Liverpool (2017). 86 people from 21 Universities/organisations registered for the meeting. The meeting was sponsored by the IOP Thin Films and Surfaces Group, the IOP Nanoscale Physics and Technology Group, RSC Solid Surfaces Group, Hiden Analytical, Scanwel, cnTech, Scientaomicron, Edwards, University of Birmingham. The list of invited presentations was as follows

- P Sloan*, University of Bath, *Controllably Quenching a Single Chemical Reaction*
- M Buck, University of St Andrews, *Changing Direction: Self-Assembly of Aromatic Carboxylic Acids at the Liquid/Solid Interface*
- C Hardacre, University of Manchester, *Non-Thermal Plasma Activated Catalysis*
- R Nichols, University of Liverpool, *Charge Transfer at the Single Molecule Level with Metal and Semiconductor Electrodes*

- P King, University of St Andrews, *Electronic Structure and Charge-density Wave Order of Monolayer Transition-metal Dichalcogenides*
- G Held, University of Reading, *Near-ambient Pressure XPS/NEXAFS at Diamond Light Source*
- H Arnolds, University of Liverpool, *Raman Spectroscopy of Molecular Electronic Junctions*
- L Siller, University of Newcastle, *Bio-inspired Energy Materials and Processes – from Nanoscale Science and Surface Science to Applications*
- J Ellis, Cambridge University, *He Spin-Echo Measurements as a Probe of Rate Theory*

Twenty posters were displayed during the poster session. Three students received poster prizes. Barbara Simoes from the University of Birmingham received the prize for the best poster. Rory Megginson from the University of St Andrews and Simon Smalley from the University of Central Lancashire received the runner up prizes.

Dr Quanmin Guo,
*School of Physics and Astronomy,
University of Birmingham*



Photograph of the Surface Science Day event, courtesy of Dr Quanmin Guo

* Dr P Sloan could not attend due to flu. Dr Q Guo stood in and gave a talk on “*Supported magic number hybrid clusters*”

ISSC 2019 – Report

In April 15-18, the 22nd iteration of the TFSG’s flagship biennial Interdisciplinary Surface Science Conference (ISSC-22) met at the Village Hotel in Swansea. The meeting drew participants from twelve countries across four continents, reaching the capacity of around 120 attendees more than a month in advance. The event featured a wide range of exciting oral and poster presentations with 20 invited speakers, 28 submitted talks and 36 posters. They mixed experimental and theoretical aspects of well-defined surfaces with applications in fields ranging from catalysis and semiconductor devices to gas and biosensors. This linked with the cognate field of nanoscale physics and technology including work on cluster deposition onto surfaces, nanoscale materials and advances in instrumentation for probing at the nanoscale. A very satisfactory feature of the meeting was the level of discussion after the talks where graduate students were prominent, inspired by the reward of Cadbury’s Creme Eggs.

Four prizes were awarded for outstanding student contributions to the meeting. At the conference dinner TFSG chair Andrew Jardine awarded two prizes of £100 for the best student poster presentations to Karuna Kumari Pillala from IIT Hyderabad, India, and Kerry Whittlesea from Aberystwyth University, UK. At the close of the meeting Phil Woodruff awarded two prizes of £150 for the best student oral presentations to Henry Chandler from St Andrews, UK, and Luc Jacobs from the Université Libre de Bruxelles, Belgium (pictured). Abstracts for all posters and talks are available on the [conference website](#).



Phil Woodruff (left) with awarded students Henry Chandler (middle) and Luc Jacobs (right).

The meeting was kindly sponsored by Scienta Omicron, Sigma Surface Science and the Royal Society of Chemistry, and attracted fourteen exhibitors whose contributions were also greatly appreciated. As well as the support from the Thin Films and Surfaces Group, the Nanoscale Physics and Technology Group and Swansea University also contributed significantly. The organisers would like to thank all the sponsors, supporters and especially attendees who helped make this stimulating meeting a great success.

Richard Cobley and Alex Lord (Chairs)
Thierry Maffei (Vice-Chair)
Richard Palmer (Secretary)

Early Career Reports

The Wilhelm and Else Heraeus (WEH) Seminar on Surfaces and Interfaces of Ionic Liquids took place in the Physikzentrum in Bad Honnef, Germany, on Dec. 3-6, 2017. The seminar consisted of talks given by 20 esteemed experts in the field of ionic liquid surface science; and two, two-hour poster sessions for the 40+ attendees.



WEH Seminar attendees outside of the lecture theatre in the Physikzentrum. Photograph courtesy of Mrs Martina Albert, WEH Foundation.

The seminar was aimed at academic and industrial researchers at all career stages in the relatively new field of ionic liquid surface science. Surface science, by its very nature, is interdisciplinary; and surface science of ionic liquids in particular incorporates a variety of backgrounds, from physics, to chemistry, to engineering. The seminar facilitated a supportive forum for discussion, which meant not only gaining

insight into recent work in the field, but also the exchange of valuable advice and experiences with colleagues.

I presented my work with a poster, titled: “*Reversible CO₂ Reaction with a Superbasic Ionic Liquid.*” I received positive feedback from attendees that came to look at my work. All of the presentations were interesting, but there was one talk in particular that resonated with me, as it was an interesting approach to the same topic as my work. The talk, given by Professor Margarida Costa Gomes of the National Centre for Scientific Research in France, outlined research into carbon dioxide capture by systems consisting of metal-organic frameworks suspended in ionic liquids. These systems, given the name “porous liquids”, were studied by Costa Gomes and her research group using a combination of experimental methods and theoretical modelling.

The WEH Seminar on Surfaces and Interfaces of Ionic Liquids was a great success, with a great turn-out and stimulating atmosphere. The seminar not only gave me the opportunity to present my work to colleagues in the field, but it also presented the opportunity for me to exchange exciting ideas with potential future collaborators. I thank my supervisor, Dr Karen Syres, our collaborators at the University of Manchester: Dr Rebecca Taylor, Dr Chris Hardacre and Dr Andrew Thomas; and finally I thank the Institute of Physics Thin Films and Surfaces Group for their financial support that allowed me to attend the seminar.

Zoë Henderson,
PhD student,
University of Central Lancashire



During the period from 26th to 31st August 2018, I was attending the 34th European Conference on Surface Science (ECOSS34) at Aarhus in Denmark, with the kind support from the IOP Research Student Conference Fund awarded by the Thin Films and Surfaces Group.

In the conference, I gave a talk entitled “*In Situ Investigation of Degradation at Organometal Halide Perovskite Surfaces Using Near-Ambient Pressure X-Ray Photoelectron Spectroscopy*”, which has attracted great attention from both the surface science and energy materials community. This expe-

rience gained me the capability to orally present academic work to numerous audiences and the questions asked by the audiences after the 17-minute talk also inspired me some ideas for future research.

In addition to the oral presentation, talks and posters from other experts in ECOSS34 is significantly valuable to me. For example, Prof Roman Fasel delivered a plenary talk with regard to graphene nanoribbons. This presentation gave an excellent idea about how to gain insights into materials design by investigating surface science. Another instance is that Prof Miquel Salmeron presented works about solid-liquid interfaces, which provides me with many ideas for designing future experiment associated with perovskite and water interfaces.

Furthermore, in the sessions I attended, I realised how worldwide researchers and scientists designed and presented their work, and learnt a number of novel surface characterisation techniques, which could be applied into my research in association with metal halide perovskite materials. Apart from the benefits mentioned, the conference also offered great opportunities to network with worldwide researchers. During the event, I got to know many people from Europe, Japan, China, etc. It is vital for me to build worldwide collaboration in the future to enhance my academic research output. Overall, ECOSS34 was a very successful conference that allowed us to immerse in surface science and the city, Aarhus.

In conclusion, if without support from the IOP Research Student Conference Fund, I might not get the chance to participate in the fantastic ECOSS34 conference. I do appreciate this award and strongly advice any eligible talents to apply this fund to support your attendance in a relevant conference.

Jack Chun-Ren Ke
PhD student
The University of Manchester



ECOSS-34 was held in the city of Aarhus in Denmark and I am very grateful to the IOP Thin Films and Surfaces Group for part funding my travel to this conference. I had the opportunity to present two talks. Firstly, “*A spectroscopic study of PCBM:P3HT heterojunctions*” presented a chapter of my PhD the-

sis which discussed the use of electrospray deposition to grow ultra-thin electron acceptor/donor heterojunctions as used in organic photovoltaic solar cell devices. This in-situ deposition technique allowed us to explore how soft X-ray spectroscopies can be used to study such devices.

Secondly, “*RIXS and ultra-fast molecule-surface charge transfer dynamics*” explored the use of Resonant Inelastic X-ray Scattering to study ultra-fast charge transfer dynamics in a model dye sensitised solar cell. Presenting this approach, which is novel/new in the ultra-fast dynamics community, raised interesting questions to how the technique could be applied to other areas.

Attending the conference also had a very positive impact on my current research, which is largely focussed on ambient pressure X-ray photoelectron spectroscopy. This was certainly a hot topic of the conference and seeing what others are doing with the technique and having discussions with key players from around the world is of huge value.

Before the main conference started, I also attended a workshop for early career researchers on the topic of X-ray spectroscopies. This was very interesting and provided a good introduction to some state of the art spectroscopic techniques I had awareness of but little technical understanding. Overall, the conference was a very successful and valuable trip.

Dr Robert Temperton
University of Nottingham



The ECOSS 34 conference offered me a great chance to meet scientists working similar projects with me from all over the world, and discuss the latest advances in surface physics, chemistry and materials, and also allowed me to know the current progress of the surface science approach in the related innovation fields of heterogeneous catalysis, organic molecular architectures, 2D materials, graphene, nano-electronics, bionanoscience and functional materials. It also includes surface magnetism and interfacial conductivity, which I am very interested in and plan to design related experiments if I have chance in the future. What’s more, most staffs took part in the conference use UHV scanning probe microscopy system and doing density functional theory calculations of packing structure, which has given me chance to talk

with them and found where I need to improve in operating my scanning probe microscopy system. I visited Aarhus laboratory, watching how their Aarhus 1500 SPM working, which is a great combination system allowing Atomic Force Microscopy and Scanning Tunnelling Microscopy to record surface information including topography, electronics and vibration frequency. It broaden my views and gave me some more ideas for designing projects.

A very interesting thing is that the conference added a satellite meeting, where they invited many professors who had top contributions in this field in China. I am a Chinese, so it offered me a chance to know the most popular topics in China in the research field of surface science. Their projects are more related to surface reactions, bottom up molecular assembly and electronics structures of 2D materials. Graphene and nanoribbons are very popular there in the latest two years.

I also gave a short contributed talk in the conference. My talk project is investigation of CUP gold magic number clusters rotation on Au(111) surface at room temperature. It briefly introduced the forming of metal organic cluster system formed with C70 and gold atoms with fixed ratio, and the rotation of whole cluster system triggered with thermal energy at room temperature and tip electric field. It combines the Ostwald ripening synthesis of gold layers on gold substrate as well as van de Waals, surface polarization between clusters and molecules. Prof. Leonhard was interested in my projects and asked me questions like how I judge and measure the number of gold atoms joining in or diffusing away only by STM scanning and how I control the effect from tip electric field during recording cluster rotation. I found the missing part of my experiments and understand where I need to correct or improve.

What's more, the conference offered me chance to make many good and excellent friends, they helped me a lot in research and taught me how to balance life and STM research, as STM research normally takes months one group of data. I made a friend from St Andrews, he also used fullerene molecules as target molecules, investigating the multi-stage molecular switch of Li-C60 system on Au(111) surface. It give me some inspirations.

Prof. Liv in Aarhus University provided us warming and nice experience staying in Denmark, enjoy meeting, enjoy people and enjoy nice science equipment. I learnt a lot and enjoy a lot. We had

chance of visiting the 100 years old village and enjoyed free homemade beers there. It is a great memory.

Finally, thanks IOP deeply for funding and supporting me this conference travelling.

Yitao Wang

PhD student

University of Birmingham



This year I attended the 34th European Conference on Surface Science (ECOSS-34), with support from the IOP Thin Films and Surfaces Group through the Research Student Conference Fund (RSCF).

Being the 1st year of my PhD I was incredibly excited (and quite apprehensive) about attending my first international conference and giving my first talk. The experience certainly exceeded my expectations. Each day the conference started with a plenary talk from an invited speaker and was then split between 5 parallel sessions, which over the week covered 15 topics ranging from heterogeneous catalysis to surface astrochemistry.

My talk was in the 2D materials session and I was one of nineteen candidates for the ECOSS oral presentation prize. My PhD will largely focus on in-situ studies of electrocatalysts for the oxygen reduction reaction, specifically nitrogen doped graphene (N-Gr) and in an early attempt to form N-Gr I found that N₂ bubbles, and predominantly single species pyridinic doping, are formed when pristine graphene on an oxidised copper substrate is annealed in ammonia. Though a similar identifying N₂ XPS peak had been seen in nitrogen doped carbon nanotubes, this result had not been reported in graphene and was therefore the basis of my talk. It was well attended and I received great feedback.

Though several questions were asked during the discussion section of my talk I was really pleased that a number of attendee sought me out to discuss my work throughout the week. This interest will hopefully lead to improved research techniques and possible collaborations in the future.

A talk that I found particularly relevant to my work was that on 'Imaging reaction dynamics by environmental microscopies' by Cedric Barroo. The reaction videos he demonstrated in his talk have lead

me to wonder whether I could see N₂ bubbles forming in my own reaction. This is something I intend to investigate. Though outside of my area, I also enjoyed the astrochemistry talks which were of a really high quality. The highlight of my week was actually the final talk of the conference given by Prof. Jens Norskov. His talk on ‘A molecular view of heterogeneous catalysis’ was both excellent and inspiring. I had attended a number of theory based talks throughout the conference but Prof. Norskov linked theory, computational and experimental work incredibly elegantly.

Though days were often tiring, there was still plenty of networking taking place during the evenings, with poster sessions and attendees going out for dinner and drinks together. It was a very welcoming environment and put all my worries at ease from the first night. The conference dinner was held at Den Gamle By (“The old town”) which was a living museum with houses spanning from the 1800’s to the 1970’s and was exclusively reserved for conference attendees on the night. Other excursions included a free pass to the nearby art exhibit and a view of Aarhus from a rainbow panorama on the roof.

Overall I think ECOSS-34 was a great success, and I look forward to attending ECOSS-35 in Luxemburg 2020!

Khadisha Marie Zahra
PhD student
University of Manchester

COMING SOON

- **Jun. 12th:** Plasma Surfaces and Thin Films, hosted in London
- **Sept. 5th:** Thin Film Coatings for Electro-optics, hosted in Liverpool
- **Sept 12-13th:** Molecules at Surfaces: What do we really know? hosted in Liverpool
- **Sept. 25th:** Advances in Photovoltaics, hosted in London
- **Oct.:** TFSG 50th Anniversary Meeting (exact date and place to be confirmed)
- **Oct. 22nd:** Computational workshop on surface electronic structure using VASP, hosted in Chester
- **Dec. 16th:** Surface Science Day, hosted in Manchester

Facilities relevant to TFSG

Henry Royce Institute

The Henry Royce Institute for advanced materials has launched a new funding scheme for PhD, DPhil, and EngD students to access world-class materials science facilities and equipment across its nine partners. Funding is available for any student studying in the UK to access equipment and facilities for a single package of work to support their research project.

The Royce PhD Equipment Access Scheme is open and accepting applications. In brief:

- Open call closing **28th of June 2019**
- Students may apply to access equipment available on the [Royce website](#) (not available at their host institution)
- Initial enquires must be made by the student using the online web form available [here](#).

Instruments of particular interest to the surfaces and thin film community include, but not limited to, the atom probe instrument, plasma facility, hard X-ray photoelectron spectroscopy, versatile X-ray photoelectron spectroscopy (Enviroesca) and PVD, PECVD coating system.

For queries regarding the PhD Equipment Access Scheme please contact the Royce CDT Manager at: david.stanley@manchester.ac.uk

Surface Science Opportunities at Diamond II

Diamond II, the proposed upgrade to the UK national synchrotron source, offers a number of opportunities for the Thin Films and Surfaces community. It is expected that the new source will run at a higher energy of 3.5 GeV, have a lower emittance (enabling smaller and brighter beams) and free up space for new beamlines. There are currently a number of beamlines (instruments) available that are relevant to surface science including four in the ‘Structures and Surfaces’ group. These focus on angle-resolved photoelectron spectroscopy (including spatially resolved nanoARPES), near ambient pressure X-ray photoelectron spectroscopy, hard X-ray photoelectron spectroscopy, X-ray standing waves, photoelectron diffraction, surface X-ray diffraction and other grazing incidence X-ray scattering techniques. This portfolio has served the community well since Diamond opened in 2007. In September 2018, Diamond hosted a series of workshops to develop the science case for

the upgrade. This has been approved and is (or will soon be) publicly available from the Diamond website. The meetings highlighted the opportunities for future science but we are now entering a more detailed stage of defining potential concepts for beam-line upgrades and new instruments. It is crucial that Diamond engages with the user community, and the Structures and Surfaces group will be developing its future strategy over the coming months together with key user representatives (to be invited through consultation with the Diamond User Committee group representatives – Andrew Thomas and Gavin Bell). This will culminate in a workshop in Feb/Mar 2020 to present the group strategy roadmap for wider consultation and comment.

Please note that funding for Diamond II is to be requested through the large infrastructure projects mechanism and not the research councils directly. Diamond is looking to develop and enhance the suite of instruments, ensure they remain world leading and that they are accessible to the whole community – we are keen to offer unique capabilities that will enhance your research. Please get in touch if you would like further information or to discuss how you could get involved in developing the ‘Structures and Surfaces’ group strategy for Diamond II.

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