

Summer 2018

# IOP | Institute of Physics

## Thin Films and Surfaces Group

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## Welcome from the Secretary

Dear members,

It is my pleasure to welcome you to the 2018 summer newsletter from the Thin Films and Surfaces Group (TFSG) of the IOP. We traditionally only publish a newsletter once a year, but this year we are trialling two, slightly shorter, editions.

TFSG is now also seeking two ordinary members to join the committee, for up to 4 years. People from both industry and academia are very welcome to apply. For more details, please contact me directly. **The deadline for nominations is 12th July 2018.**

In IOP news, after extensive development, the new London home of the IOP at King's Cross is nearing completion and we are hopeful it will be completed later in the year.

Thank you to the students who applied for travel bursaries in the past year for attendance at

conferences, you can find some of their reports on pages 3-4 in this newsletter. If you would like to apply, please see the information in the box below.

I would also like to remind you of the upcoming summer school on nanoScience@Surfaces, which is being held at the Cavendish Laboratory, Cambridge, between 30th July and 2nd August. It is sponsored by the IOP Thin Films and Surfaces, Vacuum, Nanoscale Physics and Technology Group, Structural Condensed Matter Physics, and Ion and Plasma Surface Interactions Groups. It is also supported by the EPSRC CDT in the Advanced Characterisation of Materials at University College London and Imperial College. It is primarily aimed at PhD students carrying out research involving the study of surfaces and interfaces, covering both experimental and computational techniques.

[www.nanoscisurfaces2018.org](http://www.nanoscisurfaces2018.org)

Our main event next year will be ISSC22 (Interdisciplinary Surface Science Conference) in April 2019, which this time will be held in Swansea. Please

keep an eye on the Group calendar on the IOP website for further updates.

If you have any ideas for other future meetings, please contact the Chair of the TFSG, Andrew Jardine ([api24@cam.ac.uk](mailto:api24@cam.ac.uk)).

Best wishes,



Kieran Cheetham (Secretary of the TFSG)

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## 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](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.

## Reports on Meetings Organised and Sponsored by the TFSG

### Symposium on Molecular Phenomena at Surfaces

*Giovanni Costantini*  
*Department of Chemistry, University of Warwick*

The Symposium on Molecular Phenomena at Surfaces took place at the University of Warwick on July 27th, 2017. This one-day event was jointly sponsored by the Materials Global Research Priority (GRP) of the University of Warwick and the Institute of Physics (IOP). It was organised in two oral sessions with three international and one UK speaker (Prof Nian Lin, Hong Kong University of Science and Technology, Hong Kong; Prof Steven Tait, University of Indiana Bloomington, USA; Prof Federico Rosei, University of Québec, Canada; Prof Philip Moriarty, University of Nottingham) and was followed by a poster session open to everybody but with a focus on early career researchers (ECRs). Attendance at the symposium was free of charge, but all participants were required to register in advance on the symposium website

<https://www2.warwick.ac.uk/research/priorities/materials/newsandevents/materialsymposium/>

The scientific focus of the symposium, i.e. the interaction of molecular species with surfaces, plays a crucial role in nanotechnology: not only are the great majority of molecular nanodevices supported on a substrate, but surfaces have also recently emerged as the only environment where the synthesis of a wide class of new functional materials is possible. These topics were analysed in great detail in the invited talks and in the poster session with highlights being on-surface polymerisation reactions, single-molecule charge transport, chemical reactivity at the individual molecule scale, and the investigation of potential energy landscapes at the single chemical bond level.

The symposium was extremely successful. It was attended by more than 40 researchers (academics, research associates, graduate and undergraduate students) from various research institutions – mainly concentrated in the Midlands – who very actively participated in the discussions following the oral presentations and in a very lively poster session. This latter brought together international and UK experts with early career researchers in an informal setting, offering extremely valuable networking occasions and, in particular for ERCs, a unique opportunity to showcase their research and to directly interact with leading researchers.

### Surface Science Day @ Liverpool 2017

*Hem Raj Sharma*  
*Department of Physics and Surface Science Research Centre,  
University of Liverpool*

The one day workshop was held at Victoria Gallery and Museum of the University of Liverpool on 11th December. The workshop was attended by about 90 participants from 22 institutes in the UK. There were 9 invited talks from major universities and 20 poster presentations, mostly by PhD students and postdocs. We hope that the event provided opportunities to share recent developments in the field, exchange ideas, and build a network. The event was second in series. The first event was organised at University of Central Lancashire. The third event will be organised in 2018 and the venue will be announced a later date.

We thank all invited speakers and poster presenters for their valuable contribution. Thank you all participants for coming over despite the bad weather. We are grateful to sponsors and the director of Surface Science Research Centre, Prof Rasmita Raval for the support. Without their support, we would not be able to make the registration free and provide an award for the best student poster. We wished that we could support invited speakers too but the budget did not allow us to do so. Last but not least, we thank all local staffs and students who helped making the event successful.



**If you have any ideas for future meetings, please contact the group chair, Dr Andrew Jardine ([apj24@cam.ac.uk](mailto:apj24@cam.ac.uk)).**

## Research Student Conference Fund Reports

### 13th European Conference on Surface Crystallography and Dynamics (ECSCD – 13), 19th-21st June 2017

Palacio de Miramar, Donostia-San Sebastián, Spain

*Peiyu Chen*

*Department of Materials, University of Oxford*

The conference is organised by Donostia International Physics Centre (DIPC). It is a well-established meeting point for the international surface science community. ECSCD is aimed at discussing the recent advances on the characterisation of dynamical processes and structure of surfaces, as well as their interplay at the atomic length scale.

The conference has been an enjoyable and informative experience for me. It was a truly international conference where I met researchers and students from a wide range of universities from all over the world. Via an oral presentation on my PhD project, I demonstrated my progress in the field of substrate effects on two dimensional nanocrystal MoS<sub>2</sub> and I collected professional opinions and peer reviews on my current and future work.

During the poster session, I met a few peers in similar fields whose research methods provided me with insights into my own research, e.g. low-temperature scanning tunnelling microscopy (STM) imaging, charge-density wave (CDW) phase of transition metal dichalcogenides, etc.

The talk presented by Professor Jeppe Lauritsen from Aarhus University in Denmark is of particular interest to me. It was also inspiring talking to him afterwards to learn about the most up-to-date research ideas about growing MoS<sub>2</sub> on rutile and their in-situ MoS<sub>2</sub> synthesis in ultra-high vacuum (UHV). We have agreed to start working together on my MoS<sub>2</sub>/SrTiO<sub>3</sub> project in his lab in the next months.

Along with the wonderful scientific aspects of the conference, the venue was the historical Palacio de Miramar, built as a vacation resort for Maria Cristina of Austria who ruled Spain in the end of the 19th century. It was one of the most beautiful sceneries I have been to, and I enjoyed walking past the beach (La Bahía de la Concha) every morning, which is one of the most famous urban beaches in Europe.

The conference is a great success, and I deeply appreciate the kind hospitality of the organisers who made it a rewarding experience for all.

*Shuqiu Wang*

*Martin Castell Group, Department of Materials, University of Oxford*

The 13th European Conference on Surface Crystallography and Dynamics (ECSCD – 13) was held on 19-21 June 2017 at Palacio de Miramar, San Sebastián, Spain. A total of 65 papers were presented at the conference, which featured over 72 delegates.

The first day kicked off with a fascinating presentation by Dr Jascha Repp (University of Regensburg) on studying individual molecules using ATM and terahertz STM, with sub-molecular resolution and complementary information. A diverse range of surface science topics were presented, including atom switch on molecular rotors, molecular adsorption on anatase, quantum dot engineering and 2D van der Waals materials.

On the second day, Dr Andrea Locatelli (Elettra – Sincrotrone Trieste, Italy) gave a keynote on gas trapping under graphene studied by LEEM and PEEM. There were a few invited talks on cutting-edge science, such as curved crystal surfaces, enantioselectivity on chiral surfaces, quasicrystals of perovskite oxides, transition metal oxide surfaces, intermolecular bonds observed by dynamic force microscopy. Other contributed talks had a broad range from molecules to oxides, characterised by various techniques. The conference dinner was held at Restaurant Ni Neu, and offered selected local tapas.

The final day featured an interesting keynote on graphene nanoribbons with the potential of electronic devices, given by Dr Daniel Sánchez-Portal (DIPC). Many topics were discussed, including graphene dynamics (growth, defects, reactivity, gas trapping), organic-metal interfaces and water interfaces.

The conference was very well-organised by Universidad del País Vasco/Euskal Herriko Unibertsitatea (UPV/EHU) and Donostia International Physics Center (DIPC), particularly by Dr María Blanco-Rey, the chair of the conference.

The conference was a big success. I have learned many cutting-edge materials studied by various techniques, which significantly broadened my horizon. The intense discussions also led to new ideas in my research project and potential cooperation.

### 33rd European Conference on Surface Science (ECOSS 33), 28<sup>th</sup> Aug-1<sup>st</sup> Sept 2017

Szeged, Hungary

*Rodrigo M. Ortiz de la Morena*  
*University of St. Andrews*

From the 28th of August to the 1st of September 2017 the 33rd European Conference on Surface Science was held in Szeged, Hungary. Even though I did not attend the ECOSS 32, I was told that it was promised this conference will be a great conference, in a nice city and with a perfect sunny weather, a promise I can confirm was delivered. This was my first international conference and I was given the chance to present my work in a talk.

As one of the biggest surface science conferences more than 200 oral presentations were given over 5 days in 5 parallel sessions plus 2 poster sessions with more than 30 posters per session. It started with an opening ceremony in the main auditorium. After the formal opening by the local committee with a short introduction to the city of Szeged and its university by the university dean, the first plenary talk was given by one of the most prominent figures in surface science: Gabor A. Somorjai. In this talk he said something very memorable that will make a great quote "Don't work on surfaces but interfaces".

The range of topics was very broad ranging from band structures of solid surfaces to two-dimensional molecular self-assembly. This type of conference is most interesting not only to established scientists but also to young researchers like myself since you not only hear about work related to your own research but learn new things that you immediately start thinking about how to apply them to your work. Furthermore, it gave me the opportunity to present my own research in my first international conference. Also, it gave me the great opportunity to meet a wide spectrum of people, from previous students in my faculty who are now postdocs abroad or people who were postdocs in the group and now are group leaders themselves.

During the conference some activities were arranged to do after a whole day of talks. On the first day a visit to ELI-ALPS was arranged. This will be a state of the art research facility that will start producing results before the end of the year and promises to be the CERN of laser research. We also had social activities such as a visit to the main church of the city, climbing all the way up the bell tower and even a concert inside the church with the pipe organ. Of course, on the last night before the end of the conference the gala dinner was held with a show of traditional dances and live music was performed while we enjoyed a great dinner.

On the last day we had some more great plenary talks by C. T. Campbell, E. Molinari, R. J. Behm and of course the closing

ceremony in which the location for the next ECOSS was announced. It will be held in Aarhus, Denmark a place I lived during my Erasmus as an undergrad. So, I'm looking forward to meet all the people I met this year at my first ECOSS and attend their talks in order to stay updated. Finally, I would like to thank the IOP for enabling me to attend my first international conference.

### **COMING SOON**

### **nanoScience@Surfaces Summer School 2018**

30 July – 1 Aug 2018  
Cavendish Laboratory,  
Cambridge University



Registration for the second nanoScience@Surfaces Summer School is now open:

[www.nanoscisurfaces2018.org](http://www.nanoscisurfaces2018.org)

Topics will include: Modelling surfaces with DFT, Spectroscopic techniques, Scanning Probe and Electron Microscopy and Surface Structure from Diffraction Techniques.

This event is co-sponsored by the IOP Thin Films and Surfaces Group, Vacuum Group, Nanoscale Physics and Technology, Ion and Plasma Surface Interactions Group, and Structural Condensed Matter Group, and supported by the EPSRC CDT in Advanced Characterisation of Materials, University College London.

## Researcher Profile

### Andy Clare - Developing the next generation of fuel cell

Over the last 20 or so years fuel cells have both grown and waned in popularity to be a genuine contender in the alternative energy space. Whilst a few years ago the technology was perpetually “ten years away” this is no longer the case and now thousands of commercial fuel cell systems can be found in operation across myriad applications around the world. From powering robot drones in automated distribution warehouses to supplying power directly in peoples’ homes, notably in Japan and South Korean, emerging markets in the USA and Germany are helping to bring new applications and opportunities to this sector.

Ceres Power, a spin-out company borne from the work of Professor Brian Steele and others at Imperial College in 2001, are at the forefront of developing and commercialising a new breed of solid-oxide fuel cell (SOFC). This third generation of metal-supported low-temperature SOFC combines the conductive metal oxide electrolyte characteristic of this fuel cell class together with processing and operating conditions that enable steel to be used as the underlying mechanical support. By manufacturing cells this way, cost and robustness targets required by an ever-demanding commercial market can be met. Ceres’ cells continue to lead in this field having recently demonstrated best-in-class robustness to cyclic operation (**Leah et al., ECS Transactions, 78 (1), 87-95 (2017)**), a natural pre-requisite of operating in the real world, whilst still maintaining low cost.

Surface sensitive analytical techniques are well suited to inform research and development of the typically laminar SOFC cell format. Both surface-only and dissectional analyses find application enabling two- and three-dimensional understanding of these multi-layer ceramic designs. Earlier this year Ceres completed a successful field trial deployment of its SteelGen SOFC platform, a 1kW<sub>e</sub> class combined heat-and-power system. This milestone event demonstrated real-world

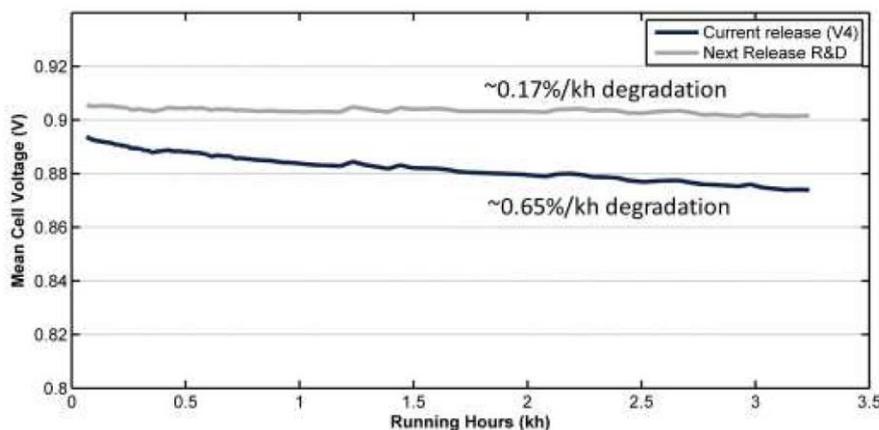
annual household energy cost savings of £400, carbon emission reduction of 2 tonnes and near-zero production of NO<sub>x</sub> and SO<sub>x</sub>: the equivalent of taking a diesel car off the road. Furthermore, the next generation of Ceres SOFCs due for customer release are proving to be even more durable, with truly world-leading sustained performance.

Thin film analysis techniques continue to play an integral role in the ever growing SOFC sector and as such are poised to have a direct impact on robust, data driven development of the next generation of fuel cells. Thanks to the application of these techniques, distributed low emission energy generation, more reliable energy networks and security, range extenders in electric vehicles and a tip of the scales towards a lower carbon footprint are now just off-shore, rather than a dot on the horizon.

Andy Clare – Senior Scientist  
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A SteelGen unit installed in a house (Henfield, UK).



Comparison of average fuel cell voltages in a durability test. Comparison of current product release and prototype next generation cell.

## Thin Films & Surfaces Lecture Series

The Thin Films and Surfaces Group (TFSG) Lecture Series enables universities in the UK to bring a European or international inspirational surface scientist to give a lecture at their institution, open to all the surface science community to attend free of charge.

We are looking to entice the 'big names' in our field and promising Early Career Researchers. The lectures should be aimed to a wider audience beyond a narrow sub-field will be publicised to all members of the Thin Films and Surfaces Group of the IOP and must be open to attendees outside of the host institution (subject to the capacity of the available venue).

To facilitate this series, funds can be requested from TFSG to contribute towards the travel costs of the invited speaker. Groups inviting Early Career Researchers to present their work are particularly encouraged to apply.

The call for funding for 2018 is now open and applications will be presented to the IOP General Fund, provided they meet the rigorous standards of the call and are approved by the TFSG Committee. For this round, funds of up to £300 for a speaker from Europe, or £500 for an international speaker may be applied for.

Application forms can be requested from the Chair of the TFSG, Andrew Jardine ([apj24@cam.ac.uk](mailto:apj24@cam.ac.uk)).

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## TFSG Committee

### **Chair**

Dr Andrew Jardine                      University of Cambridge  
[apj24@cam.ac.uk](mailto:apj24@cam.ac.uk)

### **Vice-Chair**

Dr Karen Syres                              UCLan  
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### **Secretary**

Dr Kieran Cheetham                      University of Liverpool  
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### **Treasurer**

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### **Ordinary Members**

Dr Matthew Blunt                              UCL  
Dr Stephen Kukureka                      University of Birmingham  
Dr Theodoros Papadopoulos              University of Chester  
Dr Santanu Ray                                  University of Brighton  
Dr Andrew Thomas                              University of Manchester  
Prof Phil Woodruff                              University of Warwick

### **Co-opted Members**

Dr Neil Curson                                  UCL

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<http://tfsg.iop.org>

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