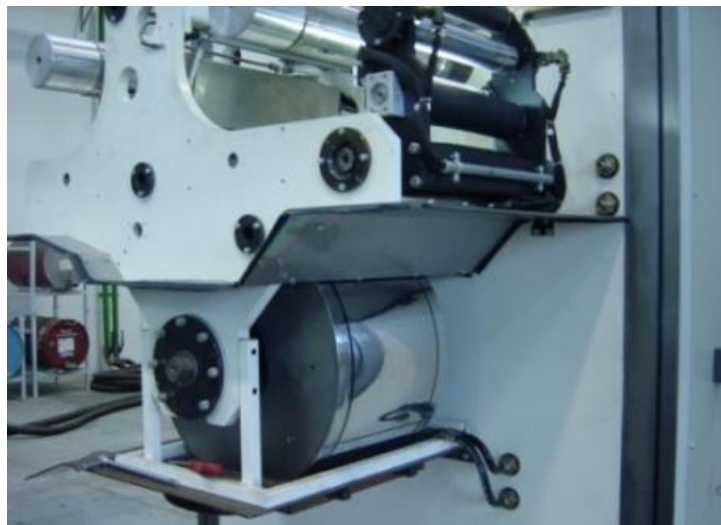

IOP | Institute of Physics
Vacuum Group

NEWSLETTER

2016

Issue no. 16/1

Featured Article - Large area vacuum coating for flexible devices



(See Page 19)

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The Vacuum Group

The Vacuum Group endeavours to appeal to as many people as possible in academe, industry and research by arranging meetings covering the widest possible range of subjects for which vacuum is important.

The composition of the Group Committee reflects the broad coverage of the subject aimed at by the Group, encompassing academics, representatives of vacuum manufacturers and vacuum users in government and industrial laboratories. The Group has been successful in bringing together those engaged in the production and improvement of vacuum equipment with those concerned with its application in such diverse areas as medical physics, large machines for research in the physical sciences, industrial process control and the electronics and semiconductor industries.

The Vacuum Group takes an active interest in education for those working with vacuum technology. The Group maintains close links with the British Vacuum Council ([BVC](#)), the International Union for Vacuum Science Technique and Applications ([IUVSTA](#)) and Vacuum Symposium UK.

The Group has organised a wide programme of half-day and full-day meetings, some of which have taken the form of workshops or included mini-exhibitions. The group has also actively participated in the Vacuum Symposium UK series of conferences.

Chair's Report 2016

I have had the privilege of being the Chair of the Vacuum Group since late 2015 and this is my first report via the Newsletter. First of all let me apologise that this Newsletter is coming out late in 2016, but it is the usual problem of time. All the Committee are volunteers who give of their time freely and we have to be grateful for the work they do on behalf of the Institute and the Vacuum Community, always of course in addition to their duties to their employers. We all know the increasing pressures on folk working in industry, commerce and academe and are always thankful when employers recognise the value that time given to bodies such as the Vacuum Group can help in fostering the dissemination of technical and scientific expertise and understanding of vacuum which underpins much scientific research in diverse fields and many industrial processes.

Recently, our programme of meetings has concentrated on co-sponsoring meetings with other Groups – helping with organising, suggesting and providing speakers and assisting with finance. Inter-group meetings are extremely important in fostering cross-disciplinary ideas and we will continue with this. However, we will also seek to provide the lead in more meetings in the future so that we are seen to be playing our part in the scientific and technical life of the Institute.



Elsewhere in this Newsletter you will find reports on meetings which have been held and those which are in the planning stage.

I look forward to working with you in this

Ron Reid

Annual General Meeting 2016

The Institute no longer requires Groups to hold a physical Annual General Meeting. In truth, few of these were ever representative of the Group membership and they were often a mere formality tucked into a break in a technical meeting.

Since Group Reports are best disseminated through the medium of a Newsletter such as this and the Annual Accounts are rigorously checked by the IoP finance gurus, rehearsing these to a meeting of a few people is actually somewhat of a charade.

That leaves one important function which cannot be elided – namely the nomination and election of Group Officers and Committee Members. The Institute has developed mechanisms by which nominations can be sought and elections carried out electronically, thus involving most members of the Group.

This process has been agreed for elections for 2016-17 and is currently being put in hand. All Group Members should receive an email about how to participate.

Group Meetings

The following reports are on meetings sponsored by the Group.

Advances in Photovoltaics 2015

Institute of Physics, 29 Sept 2015,

This event was co-sponsored by IOP Vacuum Group, IOP Thin Films and Surfaces Group, IOP Energy Group, IOP Printing and Graphics Science Group and the EPSRC Supergen SuperSolar Hub.

This one day meeting provided a forum to help assess the current state of the art in solar cells. It brought together a following list of distinguished invited speakers whose expertise covers the range of photovoltaic technologies.

- Recent progress in kesterite-based photovoltaics
David Mitzi (Duke University, USA)
- Progress on the development of high-performing printable solution-processed CIGS devices for low-cost manufacturing
Stephen Whitelegg (Nanoco Technologies Ltd)
- Past, present and future of CdTe thin-film solar cells
Alessandro Romeo (University of Verona, Italy)

- Design of photovoltaic materials: computation guided by chemical intuition
Keith Butler (University of Bath)
- From lab to market – the road for perovskite solar cells
Kevin McIntyre (Oxford Photovoltaics Ltd)



Programme

09:30 Registration and refreshments

Chair: Michael Walls, Loughborough University, UK

10:30 Exploring the limitations of thin film Cadmium Telluride using photoluminescence

Katherine Zaunbrecher, NREL, USA)

11:15 The performance and durability of broad-band multilayer anti-reflection coatings

Piotr Kaminski, Loughborough University, UK

11:30 Highly efficient CIGS solar cells

Stephan Bucheler, EMPA, Switzerland

12:15 Improved spectral response in CZTSSE solar cells prepared from nanoparticle inks

Guillaume Zoppi, University of Northumbria, UK

12:30 Lunch

Chair: Budhika Mendis, Durham University, UK

13:30 Transparent conductors for PV applications

Paul Warren, NSG Pilkington, UK

14:15 The potential for P-type transparent conductors

Patrick Isherwood, Loughborough University, UK

14:30 Electron energy-loss spectroscopy and automated mapping for chemical and electronic characterisation of complex multilayers in solar cells

Thomas Walther, University of Sheffield, UK

14:45 Refreshments

15:15 Design principles from hybrid perovskites for next-generation photovoltaic materials

Aron Walsh, Imperial College London, UK

16:00 Optical enhancement of back contact silicon solar cells

Tasimat Rahman, University of Southampton, UK

16:15 New printed materials for solar cells and application in one step interconnect process

Richard Dixon, Dycotec Materials Ltd, UK

17:00 Close

Summary

This annual meeting is organized by Prof Michael Walls as part of a joint event between the Institute and the EPSRC Supergen SuperSolar Hub

Among the UK speakers, Dr Piotr Kaminski gave a talk on the design and durability of broadband anti-reflection coatings for PV developed at CREST at Loughborough and Dr Patrick Isherwood also from CREST presented his views on the potential for p-type transparent conducting oxides. Progress on fabricating CZTS solar cells was discussed by Guillame Zoppi of Northumbria University. Tasimat Rahman of Southampton University provided details on his work developing 'black' silicon.

The event attracted 65 attendees.



Figure 1: Dr Piotr Kaminski (Loughborough) explains the design of multilayer broadband anti-reflection coatings.

Figure 2: Dr Paul Warren (NSG Pilkington) answers questions on the process conditions for depositing fluorine doped tin oxide on float glass for the thin film photovoltaics industry.





Figure 3 The limitations of thin film CdTe devices revealed using photoluminescence are described by Dr Katherine Zaunbrecher (NREL/Colorado State).

VS6: Emerging Technologies in Vacuum Science

Ricoh Stadium Coventry, October 2015

This meeting was organised as a joint venture by 5 subject groups of the Institute of Physics (Ion and Plasma Surface Interactions, Materials and Characterisation, Nanoscale Physics and Technology, Thin Films and Surfaces, and, Vacuum)

The aim of the meeting was to look at recent developments in science which are traditionally based on the use of a vacuum environment. The meeting was well attended with about 50 delegates who enjoyed the presentations and triggered much discussion.

The first paper by Joachim Schnadt from Lund University, Sweden described recent developments in a technique to operate x-ray photoelectron spectroscopy at near-ambient pressures (circa 1 mbar), thus increasing the range of materials that can now be analysed using this method and allowing some observations whilst chemical reactions are taking place. Electron spectroscopies usually require a good vacuum. Susannah Speller explained the importance of analytic microscopy in determining the relationships between chemistry, microstructure and properties of superconducting materials including lead-free superconducting joints essential for superconducting magnets and Holly Hedgeland described the development of a scanning helium microscope which gives surface sensitive images with sub-micron resolution without surface damage and, using helium atoms, no surface charging problems. Holly also explained the operation of a Helium Spin echo Spectrometer which provides information on the picosecond surface dynamics of diffusion and vibration and allows basic parameters, such as adsorbate-substrate friction, to be compared

with theoretical model values. Progress in the understanding of the performance of another vacuum-based analysis method, UHV Atomic Force Microscopy, was described by Adam Sweetman. Intermolecular contrast can be seen related to the hydrogen bonding between molecules but Adam showed that a detailed understanding of the coupled tip-molecule system and tip structure is needed to interpret these results.

Stuart Davidson described the progress toward a new definition of the kilogram mass which does not require reference to a material artefact such as the current Platinum cylinder. Two routes are being developed; one uses the Avogadro number and is realised via a sphere of single crystal silicon, the other uses the Watt balance in a vacuum and relates the measured force via Planck's constant to the kilogram. Both experiments realise the kilogram in vacuum. The accuracy of both methods is now better than the required 2 parts in 10^8 and it is expected that the redefinition will be ratified in 2018.

The applications of phase change materials, chalcogenide glasses such as GeSbTe (GST) and AgInSbTe were described by Harish Bhaskaran. When a current flows through a layer of GST which is sandwiched between 2 layers of Indium-Tin-Oxide crystalline to amorphous transition occurs and optical reflectance over a narrow wavelength increases with potential application to, for example, smart windows. Phase change materials with possible application as tunable resonators were also discussed. Glen West showed that the anatase phase of TiO_2 was required for photocatalytic activity, with applications such as self-cleaning materials, the reduction of atmospheric pollution and splitting of water to produce hydrogen fuel. However, its large band-gap requires UV illumination to induce catalysis. By doping the TiO_2 with various metal and non-metallic elements the band-gap can be modified to allow utilisation of visible and near-visible radiation present in artificial lighting and sunlight, thus extending the applications available. Also, by using High Power Impulse Magnetron Sputtering the deposition temperature can be significantly reduced to enable deposition onto polymeric materials and multi-functional, multi-layer devices. James O'Shea described a UHV-compatible electro-spray method for deposition of non-volatile molecules. The technique opens up a wide field of study of the interaction of large molecules, such as polymers, some organometallic complexes, proteins and nanoparticle clusters, with an atomically clean surface in UHV which allows a new range of surface science study to be undertaken.

The representatives of the 5 groups organising the event and the audience agreed that a similar joint programme should be considered for the 7th Vacuum Symposium in October 2016. I have enjoyed organising these symposia for the last 4 years but now have other commitments so we look for a new programme leader. In conclusion I would like to thank Sue Waller and Marie White and members of the ASTeC group in Daresbury Laboratory for their valuable help with this meeting.

John Colligon, October 2015

Plasmas Surfaces and Thin films: Early Career Researchers Meeting

Loughborough University. 6th April 2016

Held at Loughborough University and organised by Roger Smith and Sabrina Blackwell and supported by the Ion and Plasma Surface Interactions and the Vacuum Groups of the Institute of Physics.

As a result of the new IoP building work, last year's annual "Plasmas, Surfaces and Thin Films" meeting was held at Loughborough University. Last years 'early-career scientists' presentations were well-received therefore it was decided to run a "Early Career Researchers Meeting". This year's meeting brought together ~ 50 early researchers covering a range of topics and was held in the new conferencing facilities at the Loughborough University.

Prof. Mike Walls began the morning's proceedings by giving a very stimulating history on CdTe solar cells, comparing the different techniques to deposit CdTe. As deposited CdTe suffers from low efficiency due to high density of defects, post CdCl₂ treatment results in Cl diffusion along the CdTe grain boundaries and re-crystallisation removes stacking faults. Therefore it was thought that MBE could be used to improve efficiency, however due to the lack of grain boundaries there is no transport mechanism for the Cl diffusion, hence reducing the efficiency. Voids present in magnetron sputtering leads to catastrophic damage after CdCl₂ treatment.

This talk was then followed by many interesting papers presented by the 'early-career scientists'. Fabiana Lisco from the Loughborough University gave a talk on her PhD work demonstrating the successful use of Atmospheric-Pressure Plasma jet to activate surfaces of many substrates (both rigid and flexible), removing adventitious C contamination and improving wettability for a significant time duration. Brice Delfour-Peyrethon of Manchester Metropolitan University gave a fascinating talk entitled "HiPIMS plasma diagnostic and low temperature deposition of photo-active Titania thin films in an industrial-scale rig" in which he described the HiPIMS dis-charge and explained how this could be modified to influence the growing film. For example, a low process pressure resulted in a high density film and a high process pressure resulted in a film with columnar structure and defects. A higher duty cycle increased the deposition rate and modifying the frequency did not appear to effect the properties of the growing film. Daniel Loch from Sheffield Hallam gave a very fascinating talk on "Plasma Analysis of Inductively Coupled Impulse Sputtering by Investigation of Cu, Ti and Ni species". He explained that the deposition of magnetic materials, such as Ni, is problematic with magnetron sputtering as the magnetic field necessary for the sputter process is reduced due to quenching of the magnetic field by the target material. Daniel presented a relatively new technique which does not require a magnetron "Inductively Coupled Impulse Sputtering (ICIS)". This technique results in a high degree of ionised sputtered material producing high quality dense films.

The feedback from the meeting was positive, suggestions from the previous meeting were taken on board, all attendees were issued with a name badge and a list of delegates. The only slight negative factor was that due to the meeting being focused on early careers the interest from industry was low, however on a positive note the new conferencing facilities at the Loughborough University were a huge success.

Hayley Brown

Summer School on nanoScience@Surfaces

Cavendish Laboratory, Cambridge, 1-4th August 2016

The Summer School on nanoScience@Surfaces was held in the Cavendish Laboratory at the University of Cambridge, 1-4th August 2016. The summer school was organised and sponsored by the IOP Thin Films and Surfaces Group. The meeting was co-sponsored by the IOP Vacuum Group, the RSC Solid Surfaces Group, Scienta Omicron and the Centre for Doctoral Training in advanced characterisation of Materials at UCL and Imperial College London.



The School was primarily aimed at PhD students carrying out research involving the study of surfaces and interfaces at the atomic and molecular scale, including Condensed Matter Physics, Material Science and Physical Chemistry. In total

there were 85 delegates from 13 different countries. The School included a combination of lectures, research talks and workshops which covered the basics of experimental and computational techniques which may be applied to surface science and engineering. It also included a poster competition, a careers session and several social activities including a conference meal at The Old Courts main hall at Gonville and Caius College.

The invited speakers included 2 international speakers, Professor Fulvio Parmigiani (University of Trieste) and Professor Anders Nilsson (Stockholm University). There were many other UK speakers including Professor Wendy Flavell (The University of Manchester), Dr Rachel Oliver (University of Cambridge), Dr Bill Allison (University of Cambridge), Dr Katie Moore (The University of Manchester), Dr Andrew Thomas (The University of Manchester), Dr Ron Reid, Professor Angelos Michaelides (UCL), Professor Geoff Thornton (UCL), Professor Martin McCoustra (Heriot-Watt University), Dr Giovanni Costantini (University of Warwick), Dr Natalie Belsey (National Physical Laboratory) and Professor Martin Castell (University of Oxford).

During the summer school, delegates were able to choose 2 workshops to attend from the 3 workshops available. These were; STM image analysis run by Dr Joe Smerdon (University of Central Lancashire), CasaXPS analysis run by Dr Andrew Thomas (The University of Manchester) and CASTEP/Materials Studio run by Felix Hanke (Biovia). The STM image analysis and CasaXPS analysis workshops were "hands-on" sessions. Delegates learned about the techniques and tried their hand at analysing some data with advice and guidance from the workshop providers. The CASTEP/Materials studio workshop was an interactive demonstration session where delegates learned about DFT calculations for surface science applications.

At the poster competition there were prizes for first, second and third place available. First place was awarded to Neil Robinson (University of Cambridge) for his poster "Two-dimensional NMR relaxometry as a non-invasive tool for comparing adsorption strengths in silica-supported catalysts". Second place went to Matthew Bergin (University of Cambridge) for his poster "Imaging surfaces with helium". Joint third place was awarded to Zoe Henderson (University of Central Lancashire) for her poster "Water-cation interactions in ionic liquid multilayers: a near-ambient pressure X-ray photoelectron spectroscopy study" and Dario Valter Conca (UCL) for his poster "Investigation of the molecular interactions relevant to receptor-mediated virus entry using HIV receptors as a model".

On the final day, delegates took part in a careers "speed dating" event. There was an introductory talk from Vishanti Fox, careers and CPD manager at the IOP, about the help and guidance available for PhD student members. Delegates were then split into 6 groups and had about 15 minutes to chat informally with each of the 6 speakers. The speakers were Dr Kieran Cheetham (NSG), Dr Cerianne Whitehead (AkzoNobel), Dr James Dutson (Plasma Quest),

Dr Jon Treacy (Thermo Fisher Scientific), Dr Mark Jackman (Domainex) and Dr Natalie Belsey (NPL). The idea of this careers session was to allow students to discover what opportunities there are outside of academia for people with their skills.

In the final session of the conference, Professor Martin McCoustra, acting in his capacity as vice-chair of the British Vacuum Council, awarded Professor Martin Castell the British Vacuum Council Senior Prize and John Yarwood Memorial Medal.

By the end of the week there was some discussion about turning the summer school into a regular event and running it every 3 years. Thank you to all the organisers and sponsors who made this event possible and to the enthusiastic group of students who attended.

Karen Syres (conference chair), August 2016

VS7: Vacuum Quality in Vacuum Process Engineering – does it matter?

Ricoh Stadium, Coventry, 12th October 2016

The vacuum environment is required for varied processes; these may include the study of specific particles or removal of unwanted species before admitting those that are required for study or use.

The residual gases still present in the vacuum achieved may not always be regarded as important, but they can have a detrimental effect on the proceeding process.

Before processing, by simply pumping to base pressure thereby achieving ultimate quantity, may not be sufficient, as what is in the residual gas, the quality, is really what is important.

This meeting addresses these issues for very large-scale environments to the smaller scale process chambers for plasma processing.

Invited Oral Programme

10.00 Introduction – Dr Alan Webb

10.10 [Vacuum quality at Diamond; examples of why it matters](#)

Dr Hugo Sheirs, Diamond

10.50 [Semiconductor Etching — quality rather than quantity](#)

Dr Alan Webb, Consultant

11.30 [Ion beam processing — the role of vacuum quality](#)

Dr David Pearson, Oxford Instruments

12.10 [Extending the limits of detection into the PPT range](#) with a QMS

Jonathan Leslie, Mass Spectrometry Solutions, MKS Instruments

13.00 Close — Posters + Exhibition

Technical Programme Committee:

Dr Alan Webb, Consultant

Dr Gordon Jones, Waters Incorporated

Dr Hayley Brown, Plasma Quest Ltd

Dr James O'Shea, University of Nottingham

**Vacuum Symposium UK**

Vacuum Symposium UK was formed to embrace all of the UK vacuum community. Its aim is to bring together academics, industrialists, engineers, manufacturers and anyone using vacuum to promote UK pre-eminence in the subject.

Vacuum is a key enabling technology for a wide variety of applications that are of growing importance in the 21st Century. Whilst there is an abundance of information on the Internet we believe that the annual event organised by Vacuum Symposium UK provides a unique opportunity for networking and education, in addition to topical meetings of interest to vacuum users.

The meetings within Vacuum Symposium UK are free to attend. We welcome anyone with experience and contacts to organise a vacuum related meeting that will attract and interest the diverse spectrum of vacuum users. See our website www.vacuum-uk.org for more details.

The Vacuum Symposium event is co-located with Vacuum Expo – the UK's premier exhibition of vacuum equipment – all on one site, under one roof. Attendees are welcome on one or both days of the

Vacuum Symposium UK is an independent organisation (Registered Charity No. 1137989). Our roots were based in the RGA User Group but nowadays we seek to encompass all aspects of vacuum with a view to establishing a UK annual event worthy of hosting an International vacuum conference.

Steve Shannon

SS Scientific Limited

Vacuum Group Poster Prize 2016

The Vacuum Group Poster prize was presented at VS7 at the Ricoh Stadium, Coventry.

This year's IOP Vacuum Group poster prize winner was Alexander Shaw, Wolfson School of Mechanical, Electrical and Manufacturing Engineering, Loughborough University, Leicestershire LE11 3TU for the poster whose abstract is below.



Reaching beyond the surface in plasma treatments

A.H. Shaw¹, G. Shama², F. Iza¹

¹Wolfson School of Mechanical, Electrical and Manufacturing Engineering, Loughborough University, Leicestershire LE 11 3TU, UK

²Chemical Engineering Department, Loughborough University

Cold atmospheric pressure plasmas have been shown to possess bactericidal potential.

Many research groups are looking into developing biomedical applications for plasma; however some big questions still remain. There are several main hurdles that need to be jumped before plasma has a chance to break through into the medical treatments market, one of these is penetration. Can plasma penetrate beyond the surface and reach cells beyond those on the surface?

Can we make plasma treatments to penetrate, for example, through skin?

This research looks into whether a 'plasma injection system' can be developed to fire droplets of water through plasma and penetrate skin. Previous research has shown that penetration of water jets (2.5-6 μ L of fluid) into the skin is possible. We are looking at much lower volumes of fluid to be injected in a repetitive droplet firing system as opposed to a jet.

Our current system uses a piezo-electric actuator that drives a syringe plunger to fire water droplets out of an orifice with a diameter that ranges between 50 μ m and 200 μ m.

These droplets travel between two plasma electrodes that are used to generate an RF plasma. The plasma is modulated as a means to control the gas temperature of the discharge, and the injection system and the RF generator are synchronised to control that the injected water droplets transit between the electrodes when the plasma is active. At high input power, the droplets can be fully evaporated and with large droplets the discharge gets quenched. At lower input power, however, droplets can transit the plasma without evaporating and undergo reactions with the background plasma, up-taking reactive species such as H₂O₂. The droplet then carries on to the surface of the skin model where they have enough momentum to penetrate and reach beyond the outer surface.

Preliminary results show that penetration of the droplets into artificial skin (agar)^{1,2} is possible and that fired droplets of low concentrations of hydrogen peroxide can kill bacteria, such as *Escherichia coli*, embedded in it.

Future work entails developing a stronger firing mechanism to deliver droplets with even higher velocity, therefore being able to penetrate targets with even smaller droplets and measurements of the concentration of hydrogen peroxide in the droplets after passing through the plasma.

1. J. Li et al., J. Biomech. Eng. **132**, 101005-1 (2010)
2. J Stachowiak et al., J Control. Release **135**, 104 (2009)

Harry Leck Memorial Medal



Each year the organising committee of Vacuum Symposium UK seeks nominations for the Harry Leck Memorial Medal. The Medal is awarded for distinguished contributions to British scientific research and/or related scientific/technical communities, in the field of Vacuum Science and Technology.

The medal has been established to honour the memory of **Professor John Henry Leck**, known to his friends as 'Harry'. Harry was a former Chair of the IoP Vacuum Group.

The inaugural medal awarded at VS6 in 2015 was to Dr Austin Chambers.

The 2016 medal was awarded to Dr Ron Reid.

Austin is also a former Chair of the IoP Vacuum Group and Ron is the current Chair.

Further details and nomination forms are available at <http://www.vacuum-uk.org/about/harry-leck-memorial-medal/>

BVC The British
Vacuum Council

The Institute of Physics is a member of the British Vacuum Council and nominates members of the Council.

The web site contains the BVC mission statement, remit, activities, events, members, the current committee, and a whole lot more ! There is a leaflet to download, explaining the purpose of the BVC, that can be folded into a third the size of A4 and can be used at conferences and meetings for delegates to read. Additionally, there is a PowerPoint™ presentation of 'What the BVC is and what it does'. This can be further used as an educational tool to give a brief introduction to the history and 'workings' of the BVC.

The BVC offers two prizes annually; The British Vacuum Council Senior Prize (with associated John Yarwood Memorial Medal) and the British Vacuum Council Junior prize (which comprises the BVC Medal and C.R. Burch Award). Within the web-site there are lists of former recipients and details of how to nominate a candidate for a current prize. Nomination is always open which means that, if the deadline is missed one year, the nomination can be submitted the following year for consideration by the Committee. See it all here <http://www.british-vacuum-council.org.uk/>

Please consider making a nomination.

The BVC is your link to IUVSTA (The International Union for Vacuum Science, Technique and Applications), and the web-site is an ideal way to trace this link. The site can directly link you electronically to the IUVSTA web site. The IUVSTA Divisional Representatives can be found, who are your link to IUVSTA activities within your field, via the web-site <http://iuvsta.org/>

Alan Webb

British Vacuum Council Report

There were no nominations for the junior prize this year, but several for the senior. This was won with a unanimous vote for Professor Martin Castell from the University of Oxford. This will be presented later in the year.

The BVC visited the Vacuum Roadshow at The Herriot Watt University, Edinburgh on Wednesday 8th June, which runs alongside the Photonex show, similar to the model within Vacuum Expo at the Ricoh, Coventry. This was the first year in Edinburgh that the Vacuum component has been added to optics, so it is still very much in its infancy.

The feeling was that, although it was well supported in terms of visitors, it has yet to be embraced by the equipment manufacturers. It may take a few years to become established. Consequently, it was felt that the BVC take a 'watching brief' for the time being to see how the event evolves. There is also the possibility of running technical meetings and training sessions at the show.

The BVC had a stand again at Vacuum Expo 2016, taking place on Wednesday 12th and Thursday 13th October. The stand had information on the running of the BVC with leaflets and contact cards, together with information on the Prizes and how to nominate potential candidates. There were also be copies of 'Vacuum Focus', the supplement within Physics World, only available in 'hard copy'.

The 20th International Vacuum Congress (IVC-20) 2016 was held in Busan, Korea (South) on August 21st -26th , 2016 and IVC 21 in 2019 will be held in Sweden.

A bid had been made by the BVC to host the 22nd International Vacuum Congress (IVC 22) in 2022, headed by the BVC with European support. This would be held in Edinburgh, UK (on behalf Europe)

Other bids have been made from Japan, Brazil, and Mexico, the Japanese bid being the main competition. Out of the four Japan and the UK were considered the strongest. The rounds of voting resulted in the Japanese winning. The UK bid was thought to be strong enough to resubmit again.

The BVC web site (<http://www.british-vacuum-council.org.uk>) continues to be actively updated with events and news.

As of August 2016, being the end of the IUVESTA triennium, the officers and the co-opted members of the IUVESTA Divisions have been amended on the web site.

The committee are following up a proposal to run training webinars together with the IoPP. This will be discussed in the context of all aspects of vacuum, vacuum applications and techniques.

Alan Webb

November 2016

BVC Prize 2016

The 2016 BVC Senior Prize and Yarwood Medal was awarded to Prof Martin Castell, University of Oxford, for seminal contributions to the field of surface atomic structure characterisation through the use of ultra high vacuum (UHV) scanning tunnelling microscopy (STM) .

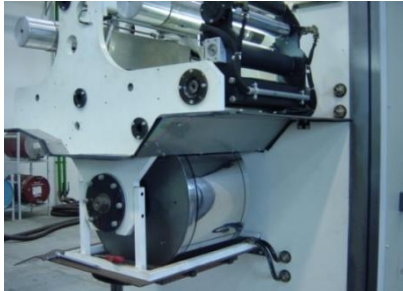
The Deputy Chair of the BVC, Prof Martin McCoustra, is seen below presenting the medal to Prof Castell at the Summer School on nanoScience@Surfaces held at the University of Cambridge, 1-4th August 2016.



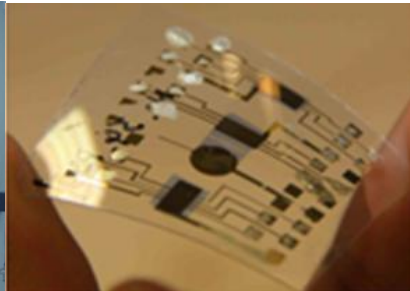
Selected Reports on Professional Activities of Group Members

Large area vacuum coating for flexible devices

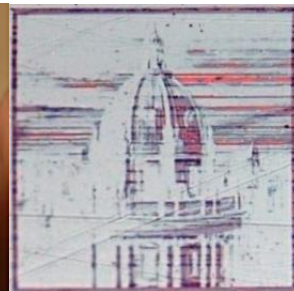
Prof Hazel Assender, University of Oxford



Roll-to-roll webcoating
facility



Evaporated OFETs on
PEN



Phase change
display materials

Vacuum deposition of thin films has an important role to play in the projected growth in wearable and flexible technologies (WAFT), the subject of a four-year EPSRC-funded project bringing together collaborators from the universities of Oxford, Exeter and Southampton, and nine industrial partners. The work depends upon the integration of technologies such as phase change materials for displays, photovoltaics and thermoelectrics for power, and novel sensor devices. Central to the exploitation of such technologies is low cost processing onto flexible (polymer, paper or textile substrates). Roll-to-roll vacuum deposition is widely used for very low cost production e.g. metallization for food packaging, and we seek to use the kind of production methods used for these very low cost, large area, applications for the manufacture of functional devices. The benefits of vacuum-based processing over ambient, solvent-based, processing include the ability to deposit very thin layers, multiple layers and combinations of materials such as pure (non-nanostructured) metals and ceramics which in many cases leads to enhanced properties. One example is the deposition of simple circuits based on organic field effects transistors (OFETs): we have manufactured OFETS with an all vacuum-evaporated process i.e. with high throughput speed using materials that are all ductile. Arrays of 100 transistors have been manufactured with practically 100% yield and consistent and stable performance. The vacuum deposition route allow direct integration with metallization of conducting tracks, and high performance encapsulation layers. Thus, in-vacuum processing has an important role to play in the anticipated growth of wearable and flexible technologies.

Forthcoming events

Advances in Vacuum Glazing Systems with lab tour at Ulster University, Newtownabbey, County Antrim, UK. Date tbc.

Committee 2015-2016**Chair**

Dr Ronald Reid CEng CPhys FInstP

Secretary

Dr Saim Memon

London South Bank University

Treasurer

Dr Sunil Patel

STFC - Rutherford Appleton Laboratory

Ordinary Members

Dr Alan Webb, CPhys FInstP

Dr Matthew Cox CPhys MInstP, Diamond Light Source

Dr Hazel Assender CPhys MInstP, University of Oxford

Dr Oleg Malyshev, MInstP, STFC Daresbury Laboratory

Dr Yueping Fang, MInstP. University of Ulster

Dr Hayley Brown, AMInstP, Plasma Quest Ltd

Dr Andrew Chew, MInstP, Edwards Ltd

Dr Gordon Jones, MInstP, Waters Corporation

Mr Luke Sansby, Associate, Vacuum Engineering Services

Join the Vacuum Group

The Group welcomes new members.

If you are already a member of the IoP, then go to your MyIOP page and simply sign up. **It will not cost you anything extra!** Alternatively follow the instructions on http://www.iop.org/activity/groups/page_38363.html

If you are not yet a member of the IoP then go to <http://www.iop.org/membership/index.html> and follow the links there to get full information.

This newsletter is also available on the web and in larger print sizes

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