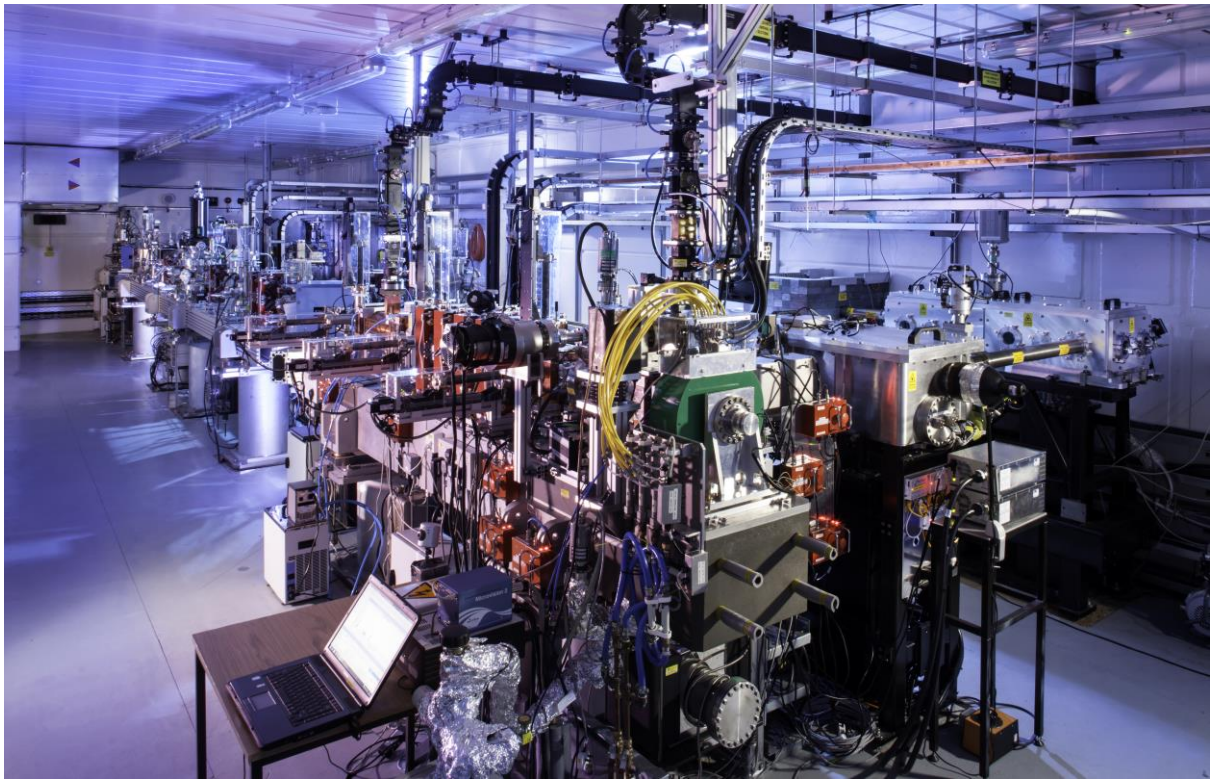
IOP | Institute of Physics
Vacuum Group

NEWSLETTER

Issue no. 15/1

This issue highlights the many areas of science and industry in which vacuum plays a major role. One example is shown below; others are cited in the Chair's Report. Please take a look and, if some of these areas are of interest to you, why not join the Vacuum Group. Contact Ms Anne Crean (Anne.Crean@iop.org)



The Versatile Electron Linear Accelerator (VELA): a new facility which will deliver a capability for the cutting edge development and qualification of advanced accelerator systems, enabling industry to expedite their development from prototypes to market-ready products.

(*photo courtesy of Laura Bennett and Stuart Eyres ,Media Services, STFC Daresbury Laboratory)*

Contents

Chair's Report 2015

When you talk to colleagues in other disciplines you often get the response "there is not much new in vacuum these days". The correct answer is "'nothing' is further from the truth". Vacuum processing is essential in the food industry (freeze drying) with challenges not only to remove water vapour but also to provide the sterile environment essential in food processing. Then there is the electronics industry with ion implantation providing the precise doping levels to produce electronic devices and, in addition, the vacuum coating industry offers improved performance and lifetime of many engineering tools. As I mentioned last year the new kilogram mass standard will soon be based on a force measurement in a vacuum environment. And what about particle accelerators, fusion systems, thin film solar cells, smart coated windows, sensors, vacuum-insulated panels for buildings? Our Sixth Vacuum Symposium on "Challenges in Vacuum Technology" at the Ricoh Arena on 14th October this year will look at developments and problems in some of these many areas of application of vacuum.

We look for IOP members in all the above areas to join the group committee and to feed in ideas for possible meetings to cover this vast array of vacuum-related applications. Even if not on the committee please send your ideas to our Honorary Secretary, Saim Memon, for topics for meetings and talks.

In the past year we joined other groups to run an early-career researcher 1 day conference in Loughborough. This was attended by over 50 delegates and, after an excellent overview of the status of JET by Dr Guy Matthews from the Culham Centre for Fusion Energy, there were many interesting papers presented by these early-career scientists. The event included a well-supported poster session.

I would like to thank my fellow officers and members of the committee for their interest and support over the past year. I have been on the committee for several years now and feel it is time to stand down so I will leave the committee at our AGM which takes place at 1200hrs following the VS6 morning session in the Ricoh Arena, Coventry. All group members are welcome so please try to come along.

John Colligon

6th July 2015

IOP Research Student Conference Fund

The Institute of Physics provides financial support to research students to attend international meetings and major national meetings.*

The Institute of Physics (IOP) handles the application process but it is the relevant IOP group that makes the decision on whether to award the bursary and its value.

Am I eligible?
Research Student Conference Fund (RSCF) bursaries are available to PhD students who are a member of the Institute and of an appropriate Institute group. For example, if an applicant is a member of the Women in Physics Group only then they could only seek support to attend a conference related to women in physics and not to low temperature physics. To be eligible for that meeting, the applicant would also need to be a member of the Low Temperature Group.

What is the bursary worth?
Students may apply for up to £300 during the course of their PhD. Students 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.

How can I apply?
Application details and application form (Word, 85 KB)
(http://www.iop.org/about/grants/research_student/file_38809.doc)

RSCF applications are considered on a quarterly basis and should reach the Institute by: 1 March, 1 June, 1 September or 1 December; a decision will be made within eight weeks of the closing date. Your application must reach us by the deadline which is at least **three months** before the conference you wish to attend. We strongly recommend that you submit your application early.

All recipients are asked to produce a report on return from their conference before receiving payment.

Further information

For further information please contact supportandgrants@iop.org.

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

Annual General Meeting (AGM) of the Vacuum Group

This meeting will take place on 14th October 2014 at 1200 hrs after the first lecture of the afternoon session at the Ricoh Arena, Phoenix Way, Coventry CV6 6GE. All members and observers are welcome.

The composition of the Group Committee should reflect the broad coverage of the subject, encompassing academics, representatives of vacuum manufacturers and vacuum users in government and industrial laboratories. We are always looking for new members to serve on the Committee which normally meets 3 times per annum. At these meetings we plan our events programme for the year ahead and rely on committee members to suggest new themes and help with the planning and running of new topical scientific seminars and meetings.

Please contact Saim Memon (memonsaim@gmail.com) well before 14th October if you would like to stand for election.

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 event – this year it will be held at the Ricoh Arena, Coventry on 14th and 15th October.

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

ANNOUNCEMENT: 6th Vacuum Symposium and VacuumEXPO
Ricoh Arena, Coventry; 14-15 October 2015

Emerging Technologies in Vacuum Science
We have an excellent programme of speakers from UK and overseas, selected with the help and support of five IOP groups (Ion and Plasma Surface Interactions, Nano-scale Physics and Technology, Materials and Characterisation, Thin Films and Surfaces and Vacuum).

Emerging Technologies in Vacuum Science, Coventry 14th October 2015
Programme for 6th Vacuum Symposium

0920	*Welcome and Introduction* John Colligon
	SESSION 1: Chair Alison Crossley
0930	Near-ambient pressure x-ray photoelectron spectroscopy *Joachim Schnadt* *Department of Physics, Lund University, Lund, Sweden*
	Analytic microscopy of superconducting materials *Susannah Speller* *Department of Materials, University of Oxford, Oxford, UK*
1030	Tea/Coffee in Exhibition area

	SESSION 2: Chair, James O'Shea
1100	The He spin echo spectrometer and the scanning He atom microscope *Holly Hedgeland* *University College London, London, UK*
1130	UHV atomic force microscopy and development of a new understanding of the atomic resolution AFM imaging of molecules *Adam Sweetman* *School of Physics & Astronomy, University of Nottingham, Nottingham, UK.*
1200	In-vacuum realisation of the new definition of the kilogram *Stuart Davidson* *National Physical Laboratory, UK*
1230	Vacuum Group Annual General Meeting (AGM), Exhibition and Lunch Break
	SESSION 3: Chair, Steven Schofield
1400	Phase change material opto-electro-mechanics *Harish Bhaskaran* *Materials Department, University of Oxford, Oxford, UK*
1430	Photocatalytic thin films *Glen West* *Manchester Metropolitan University, Manchester, UK*
1500	Ultra-high vacuum compatible electrospray ion beam deposition for the deposition of complex, fragile and non-volatile molecules on surfaces in vacuum *James N. O'Shea* *School of Physics and Astronomy, The University of Nottingham, Nottingham, UK*
1530	Symposium ends. Exhibition continues

Report on the 5th Vacuum Symposium, *Ricoh Arena, Coventry; 15th Oct 2014*

Surface Modification and Analysis

This meeting, held on 15th October 2014 at the Ricoh Arena, Coventry, was jointly organised by five Institute of Physics groups ("Ion and Plasma Surface Interactions", "Materials and Characterisation", "Nanoscale Physics and Technology", "Thin Films and Surfaces" and "Vacuum"). Invited Speakers from National Research Laboratories and Universities in the UK, Germany and Austria presented latest information on many aspects of surface modification and analysis. Contributions on surface modification covered atomic layer deposition with plasma-assistance to form dielectric layers in high electron mobility transistors, power electronic devices and solar cells, coatings inside vacuum tubes to provide pumping and low electron-emission surfaces and manipulation of atoms such as hydrogen on a surface to control the action of a functional molecule. Developments in analytical methods included measurement techniques to determine mechanical properties of a multilayer or multi-component system, measurement of biomolecular interface properties of importance in the performance of nanoparticle drug delivery products, improved interpretation methods for interpretation of scanning tunnelling data, modified tips and frequency modulation in atomic force microscopy to bring resolution to the pico-meter scale and an in-air particle-induced x-ray emission analysis technique which has provided data allowing reconstruction of the original image in a old stained-glass window. In addition, a talk tracing latest modelling methods of film deposition by energetic particles was given combining molecular dynamics and the so-named "on-the-fly" Monte Carlo technique. Several videos illustrating the predicted growth modes of films were shown and it is clear that such models offer an important insight into the influence of deposition parameters on film growth.

The meeting attracted over 60 delegates who also enjoyed the equipment exhibition during the refreshment and extended luncheon breaks. Several Poster presenters gave a 2 minute presentation on their work at the end of the main morning session. The annual Vacuum Group poster prize was presented in the exhibition area. The 2014 prize was won by Holly Hedgeland for her poster on "Quantum States and Molecular Structures on Silicon"

Thanks are due to all speakers and to Sue Waller and Marie White from STFC Daresbury who prepared the booklets and dealt with the registration. We also acknowledge and thank all the Exhibitors and STFC whose support

for the event allowed delegates to attend this scientific meeting free of charge.

John Colligon
Surface Coatings and Characterisation
School of Computing and Engineering
The University of Huddersfield
Huddersfield HD1 3DH, UK

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'.

Procedure

To nominate somebody for this award please fill in the 'Nomination Form' which is available on the vacuum symposium web site located at www.vacuum-uk.org. An obituary of Professor Leck can also be viewed there). Fill in the relevant details and submit the completed form via email to nominations@vacuum-uk.org .

Nomination details might include for example: citations, career highlights, achievements, wider community contributions, awards etc.

To ensure that nominations can be considered and a successful candidate notified well in advance of the annual Vacuum Symposium UK meeting, only nominations received by the **1st May** will be considered for award during that year. In most cases awards will be made at a suitable time during the annual Vacuum Symposium meeting.

The medal winner will be selected by trustees of the charity set up under the working name of Vacuum Symposium UK. At the discretion of the trustees a 'Prize Committee' may be set up in some years to assist with selection if this is deemed appropriate.

Report on the Early Career researchers' meeting on "Plasmas, Surfaces and Thin Films".

This meeting took the place of the IPSI Group's annual June meeting in London, "Plasma, Surfaces and Thin Films", moving this year to Loughborough due to the unavailability of a suitable venue in London.

It was organised by Roger Smith and Sabrina Blackwell of the Ion and Plasma Surface Interactions Group with support by the Vacuum, Thin Films and Surfaces and Materials and Characterisation Groups of the Institute of Physics. It was held at Loughborough University on Wednesday 17th June 2015 and was free to attend.

The programme consisted of ten oral and sixteen poster presentations. The posters were submitted from all supporting groups and there were three prizes, which were judged during the lunch interval and presented at the tea break in the afternoon.

The Groups would like to thank the independent judges for their contribution to the meeting and the difficult choices that they had to make. To be totally impartial, they cannot be named!!!

The meeting started with an excellent overview of the status of JET by Dr Guy Matthews from the Culham Centre for Fusion Energy, and then followed many interesting papers presented by the 'early-career scientists'.

The event was well supported during the day with over 50 delegates attending, which produced some lively discussions during the lunchtime poster session.

The three prize winners were

IPSI Prize £100: D. Shaw from York University

Poster title: Surface modification of polymer films using an atmospheric plasma jet.

Vacuum prize £100: Sagar Agrawal from, FCIPT, Institute for Plasma Research, Gandhinagar, Gujarat, India,

Poster title: , ZnO:Al Thin Film Deposition by Magnetron Co-Sputtering

Materials and Characterisation prize £50: Andrew McInnes from Loughborough University

Poster title: Fabrication and photoelectrochemical studies of Bi2Ti2O7 polychlore thin films by aerosol assisted chemical vapour deposition.

Judging by the numbers attending and the favourable comments received, the event was a real success and may well be repeated next year.

The day's programme:

ORAL PROGRAMME

1020: Coffee/Tea and Arrival

1040: Guy Matthews, Head of the JET Plasma Operations and Boundary Unit "Fusion and Plasma-Surface interactions"

1120: Yevhen Zayachuk, Oxford University "Interaction of high ion flux density deuterium plasmas with tungsten"

1140: Xiaoou Yi, Oxford University "Collision cascades and microstructural evolution in heavy-ion irradiated tungsten: a coordinated study of electron microscopy and multiscale modelling"

1200: T.J. Petty, Liverpool University "The dependence of tungsten fuzz growth on He ion fluence in the range 1024-1028 m-2"

1220: Ion and Plasma Surface Interactions Group AGM. Poster session and Lunch Break

1400: Dave Bosworth Cambridge University, "DC Magnetron Sputtering of Ultra Thin NBN and MOSI superconductors for single photon detectors"

1420: Fabiana Lisco, Loughborough University "Surface Activation using an atmospheric plasma process for thin film photovoltaic device fabrication"

1440: Tom Morton, Sheffield University "Structure and wear mechanism of novel CrAlBYCN/AlSiCN PVD coating deposited using a combined UBM and HIPIMS process in a reactive gas mix."

1500: Tea break and announcement of poster prize winners

1530: Andy West, York University "The Role of Reactive Oxygen Species in Fast Plasma Ashing Using an Atmospheric Pressure Plasma Jet"

1550: Lanxi Zhang, Loughborough University "Characterisation of an Atmospheric-Pressure Air DBD Discharge"

1610: A. Nominé, Open University ”High-speed video imaging of Plasma Electrolytic Oxidation discharges”

1630: CLOSE

POSTER PROGRAMME

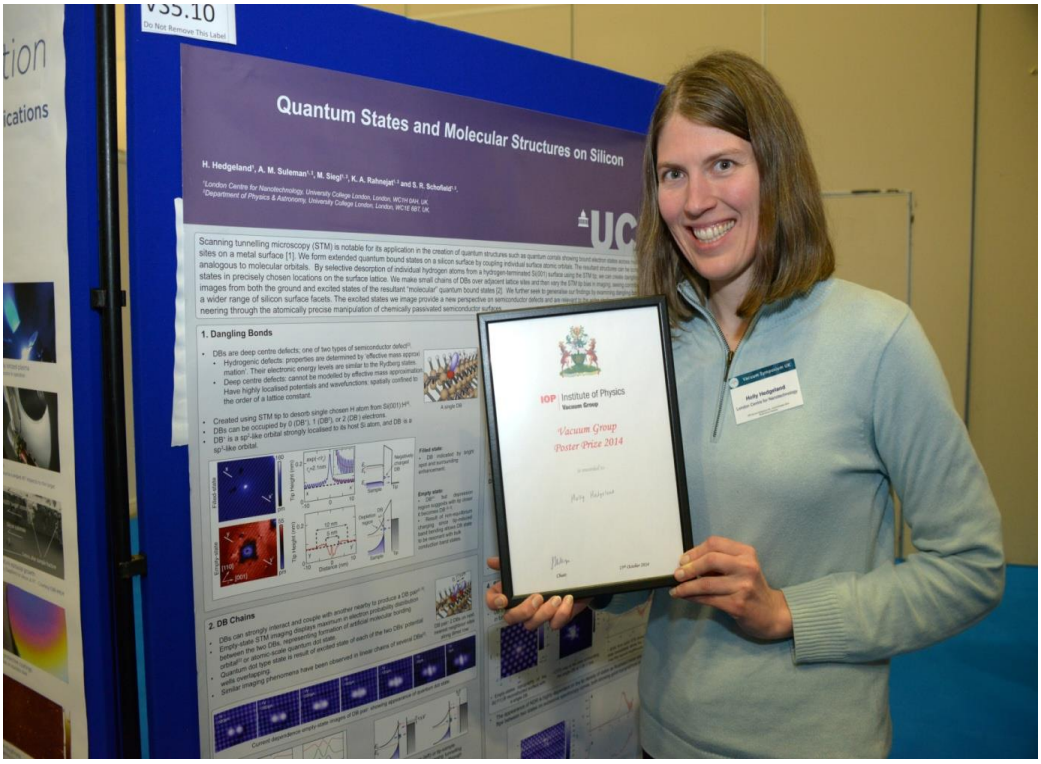
- *N. Somont, Huddersfield, Radiation hardness of MAX phases Ti_3AlC_2 and Cr_2AlC*
- *Subhashi Jayathilake, Loughborough, Towards the fabrication of novel and low cost transparent conducting oxides for electronic and optoelectronic applications*
- *Mukul Bhatnagar, FCIPT, Institute of Plasma Research, Gujarat, India Atomistic modelling of interaction between Silver and a dielectric surface.*
- *Andrew McInnes, Loughborough, Fabrication and Photoelectrochemical studies of Bi2Ti2O7 Pyrochlore Thin Films by Aerosol Assisted Chemical Vapour Deposition*
- *Preeti Puntambekar, Loughborough, Cold Atmospheric-Pressure Plasma Treatment for Promotion of Cell Adhesion onto PDMS substrates*
- *Paul Brack, Loughborough, Aerosol-Assisted CVD of Bismuth Vanadate Thin Films and their Photoelectrochemical Properties*
- *Adam Lloyd, Loughborough, Development of a reactive force field potential for modelling the growth of Ag on ZnO.*
- *D. Shaw, York University, Surface modification of polymer films using an atmospheric plasma jet.*
- *Paulo Seri, Bologna Italy, The effect of plasma surface modification on biodegradation rate and biocompatibility of a poly(butylene succinate)-based copolymer*
- *Anna W. Oniszczuk, Sheffield, Target Poisoning in Mixed Ar, N2 and CH4 Atmosphere, in Processes Using Different Target Materials for HIPIMS/DC and DC Cathode Modes.*
- *Michael Gona, Loughborough High rate deposition of AZO thin films by pulsed DC magnetron sputtering*
- *Hayley Brown, Surrey University, Nanostructure Gas Barrier Film for Plastic Electronics Deposited by Remote Plasma Sputtering*
- *Christos Potamialis, Loughborough, Sputtered MoOxNy as a back contact buffer for CdTe solar cells*

- *Sagar Agrawal, Divya Dileep, Priyanka Marathey, Ramkrishna Rane, Subroto Mukherjee, FCIPT, Institute for Plasma Research, Gandhinagar, Gujarat, India, ZnO:Al Thin Film Deposition by Magnetron Co-Sputtering*
- *Mark Wooton, Loughborough, Radiation Damage in Advanced Materials for Next Generation Nuclear Power Plants*
- *Aidan Wilkinson Loughborough, Conductivity properties of highly disordered nanoscale thin films*
- *Sibel Yilmaz, Loughborough, Optimisation of Cadmium Chloride Process for CdTe Solar Cells*

2014 and 2015 Poster Prize Winners

2014 Prize-Winner: Dr Holly Hedgeland

Posters presented at the 2014 Vacuum Symposium were of the usual high standard and the judges had a difficult decision to make. The winner was Holly Hedgeland from the University College London. A photograph of the presentation and summary of the work displayed in the poster are given below.



2014 Vacuum Group prize-winner Holly Hedgeland

(*photo courtesy of Laura Bennett and Stuart Eyres ,Media Services, STFC Daresbury Laboratory)*

Poster Title: Quantum States and Molecular Structures on Silicon

H. Hedgeland[1], A. M. Suleman[1, 2], M. Siegl[1, 2], K. A. Rahnejat[1, 2] and S. R. Schofield[1, 2].

1. London Centre for Nanotechnology, University College London, London, WC1H 0AH, UK. 2. Department of Physics & Astronomy, University College London, London, WC1E 6BT, UK.

Scanning tunnelling microscopy (STM) is not only a powerful imaging technique within the field of Surface Modification and Analysis but the sharp metal tip of the microscope can also be used to manipulate atoms on a surface. A notable application of this method is the creation of quantum structures such as the quantum corral where adsorbed atoms assembled into a circle allow bound electron states to be imaged in a pattern reminiscent of a stone landing in a pond.

We exploit the same phenomenology when forming extended quantum bound states on a silicon surface by coupling individual surface atomic orbitals. Silicon atoms are most stable when forming bonds in a tetragonal structure, in the same way that carbon does in diamond. At the surface, this can lead to an exposed bond since there is no layer above to join to. We exploit a surface with this structure where the upwards-pointing bonds have been passivated through the addition of hydrogen atoms. By selective desorption of individual hydrogen atoms from a hydrogen-terminated Si(001) surface using the STM tip, we can create unterminated dangling bond states in precisely chosen locations on the surface lattice.

We image pairs and small chains of dangling bonds, which exhibit the formation of extended quantum bound states. The topography of the structures can be interpreted by modelling the single dangling bond as if it were an atomic state with electrons bound within a potential well, with the individual atomic orbitals coupling to produce the quantum states in direct analogy to molecular orbitals. We see contributions to the images from both the ground and excited states of the resultant “molecular” quantum bound states. The excited states imaged provide a new perspective on semiconductor defects and are relevant to the wider challenge of quantum state engineering.

For interested readers, further details can be found in Nature Communications 4, 1649 (2013)

2015 Prize-Winner: Sagar Agrawal

The 2015 Vacuum Group Poster Prize was awarded during the Early researchers meeting in Loughborough on 17th June 2015 to Mr Sagar Agrawal from the Institute for Plasma Research, Gandhinagar, Gujarat, India.2015 Vacuum Group Poster prize to Mr Sagar Agrawal. A photograph of appreciation and summary of the work displayed in the poster are given below.

2015 Vacuum Group prize to Sagar Agrawal

Title: ZnO:Al Thin Film Deposition by Magnetron Co-Sputtering

Sagar Agrawal, Divya Dileep, Priyanka Marathey, Ramkrishna Rane, Subroto Mukherjee, FCIPT, Institute for Plasma Research, Gandhinagar, Gujarat,India

RF sputtering of ZnO:Al_2O_3 ceramic targets for TCO (Transparent Conducting Oxide) application in solar photovoltaic devices is well known and widely used. The most often used concentrations for ZnO:Al TCO are:

ZnO : Al_2O_3 = 98% : 2% Weight = 98.4% : 1.6% Atomic

ZnO : Al_2O_3 = 98% : 2% Atomic = 97.5% : 2.5% Weight

Reactive sputtering in an Ar+O_2 environment of metallic targets Zn:Al=98:2wt% has also been used and has achieved the lowest resistivity ($6x10^{-4}$ Ω-cm). In addition reactive sputtering of pure Zn metal targets to

achieve low resistance and highly transparent films as TCO's has also been tried but there is limited work on co-sputtering of ZnO and Al targets for preparation of ZnO:Al films to form TCO's for PV devices. In the present work we have presented results for co-sputtering of ZnO and Al in Argon gas to prepare ZnO:Al for TCO application.

A magnetron sputtering deposition system with two magnetrons in confocal arrangement was used. A pure ZnO (Zinc Oxide) ceramic target (99.99% pure) was mounted on one magnetron and RF power used for sputtering. An Al (Aluminium) metal target (99.999% pure) was mounted on the other magnetron and DC power used for sputtering. Both the magnetrons sputtered simultaneously and the Al-magnetron deposition power was controlled to control the Al concentration in the film. Al concentration was measured by EDX (Energy Dispersive X-Ray Spectroscopy) of the film.

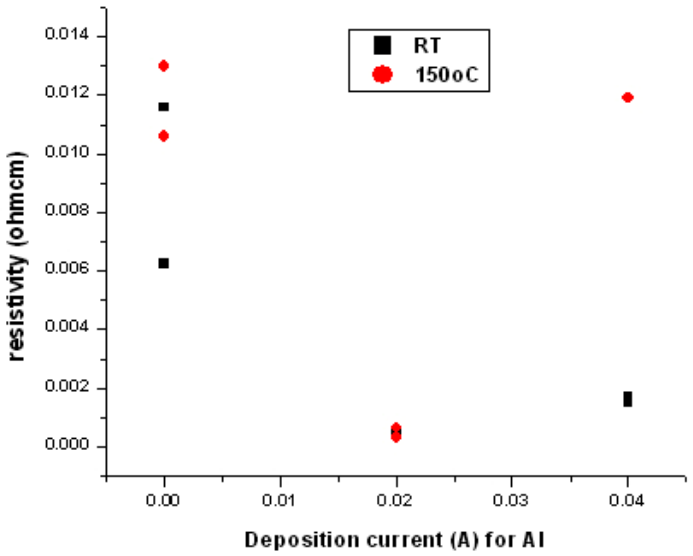
The base pressure of the vacuum system was $1x10^{-7}$ mbar. Films were deposited on normal soda lime glass (SLG) which was pre-cleaned using Iso-Propyl Alcohol (IPA) followed by vacuum plasma cleaning. The distance between substrate and target was ~10cm. the gas used for sputtering was Argon (Ar – 99.999 pure). All the films were deposited for 80 minutes at $1x10^{-3}$ mbar. Films were prepared of pure ZnO and two different Al concentrations (0.02A, 0.04A DC) at room temperature (RT) and ~150 ^{o}C. Experiments were repeated to test the reproducibility of the results.

Film crystallinity and growth were measured using X-Ray Diffraction (XRD) and Scanning Electron Emission (SEM). Optical properties of transparency and band-gap were measured using an Ultra-Violet-Visible (UV-VIS) spectrophotometer. Electrical Properties of sheet resistance, resistivity, charge carrier density, carrier mobility were obtained using a four-point probe and Hall measurement.

SEM and XRD results show a decrease in crystallinity and increase in stress with increase in Al% and films become amorphous for even higher Al-concentrations. This crystallinity improves if the film is grown at higher temperature (~150 ^{o}C) and, above 5% Al concentration, films become amorphous. This may be improved by using higher temperature but this still needs to be tested in further studies. Four-point probe and Hall measurement results for electrical properties of the films show that the lowest resistivity is achieved for ~1.6-1.8 atomic Al% samples (equivalent to 0.02A deposition current as shown in the figure). Although charge carrier density increases with Al concentration, mobility of electrons decreases due to an increase in

defects in the film. UV-VIS spectrophotometer measurements of the films for band-gap and transparency measurement show a smaller increase in band-gap for higher Al concentration. Transparency is above 70% for lower Al concentration.

These films will now be tested as TCO's for their performance on a PV device and results compared with the presently-used TCO's.



Resistivity variation with Aluminium content for ZnO:Al films

Mitigation of particles from Sputter Ion Pumps

A D Chew* and T Wynohrad#

*Edwards Ltd, Innovation Drive, Burgess Hill, West Sussex, RH10 9TW, U.K.

#Gamma Vacuum, 2915 133rd Street West, Shakopee, MN 55379, USA

Sputter Ion Pumps (SIP) are used in a wide range of HV and UHV/XHV applications. In this article we describe a phenomenon of particulate emissions from SIPs; their source and a technique developed for their mitigation (an 'Eximo shield').

Contemporary SIP versions generally comprise elements of repeated 'Penning cells'. These are relatively small and rely on a strong magnetic field (~0.12T) and large potentials (anodes at up to 7 kV and grounded cathodes) to establish a self-sustaining plasma. See Figure 1. The pumping action of a SIP relies upon the ionizing collisions of electrons with neutral molecules.

Resultant positive ions are attracted to the cathode (usually made of Ti). This results in sputtering of the cathode material and freshly covered Ti surfaces pump by ‘gettering’. There is also ‘direct’ ionic pumping of positive ions which become buried and trapped in the bulk of the cathode and also the burial of atoms at the anode under deposited Ti[1].

Figure 1 Cross-section of a SIP

SIPs have no moving parts or lubricants and do not require a supporting ‘primary’ pump. They provide clean, zero maintenance and stable operating pressures. There can though under certain circumstances, be an emanation of particles which can have an impact upon electrical and optical components. Figure 2 shows an example of this: the neutral-coating of isolating ceramics.

Figure 2 New versus after-life insulators

Other possible examples include neutrals interfering with electrons in a synchrotron. A challenge lies in developing a technique which minimizes this discharge without compromising on reduced conductance (and pumping speed) of the SIP from the use of standard shielding and baffling techniques.

In a relatively simple apparatus a ‘collector’ plate was positioned ~15 cm in a column with direct line-of-sight above a 20 l/s SIP inlet flange. The potentials

along the column were variable to be able to simulate different scenarios (e.g. a SEM column); the collector current being a direct measure of emissions. These measurements combined with XPS analysis indicated that the SIP emissions were primarily neutrals with a relatively smaller amount of positive ions. Irrespective of the nature of the neutrals they can generate secondary electrons with the potential for interference.

An 'Eximo' shield is shown *in situ* below which also shows how it blocks emission pathways.

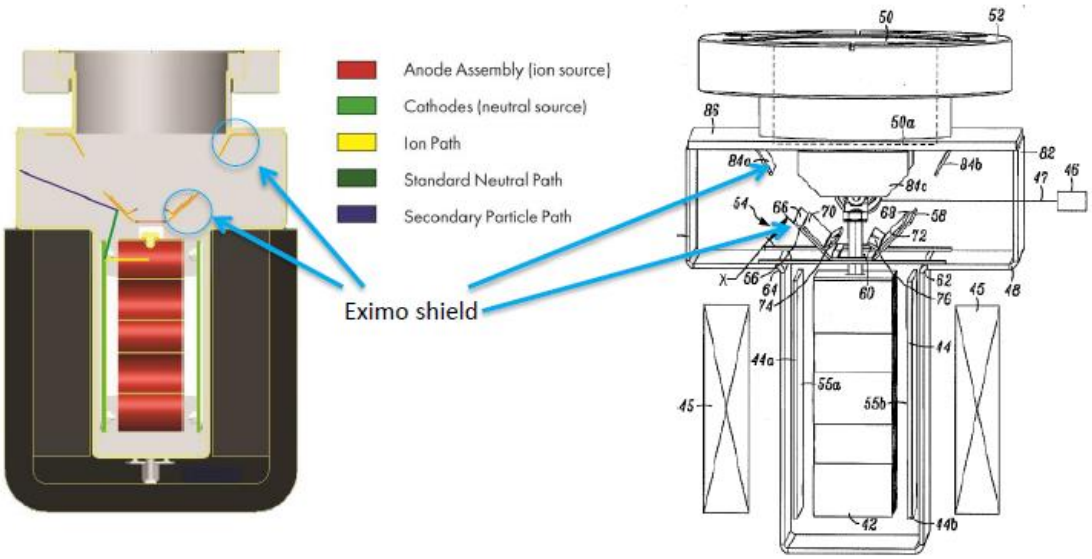


Figure 3 'Eximo' shield (in orange) integrated in a SIP:
US Patent No. 7.850.432 B2

The reduction of emissions using the Eximo shield is shown below; with typical emissions reduction by x1/1000.

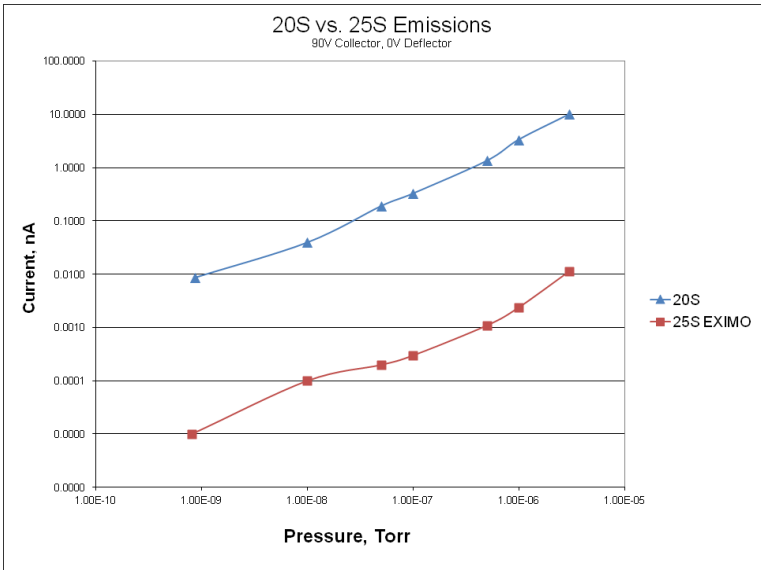


Figure 4 Effect of an Eximo shield on emissions (1 Torr = approx 1.33 mbar)

Importantly the Eximo shield design results in a negligible loss of the SIP conductance/speed and achievable ultimate pressure. This is to be contrasted with a potential for >50% speed loss for a standard dual elbow configuration.

(Gamma Vacuum web-site has a more detailed explanation: http://gammavacuum.com/)

Andrew Chew
8th May 2015
andrew.chew@edwardsvacuum.com

BVC The British Vacuum Council

BVC web site

The new 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/

The BVC is a 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-us.org/

Alan Webb
The Open University

Forthcoming events

The Vacuum Group will co-sponsor the IPSI annual meeting on Plasmas, Surfaces and Thin Films in June 2016 and plans to join Vacuum Expo again in October 2016 to run our 7th Vacuum Symposium. Check the Vacuum Group web-site at www.iop.org for further details of meetings.

The 14th European Vacuum Conference will take place in Portoroz, Slovenia from 6 – 10 June 2016 .

Committee 2014-2015

Chair: Professor John Colligon ; Honorary Secretary: Dr Saim Memon
Hon Treasurer: Dr Sunil Patel

Members: Dr Hazel Assender, Hayley Brown, Dr Andrew Chew, Dr Matthew Cox, Mr Joe Herbert, Dr Oleg Malyshev, Dr Gordon Jones, Dr Steve Taylor, Dr Alan Webb.

Join the Vacuum Group

The Group welcomes new members. For details of how to join please contact Anne Crean at IOP (Anne.Crean@iop.org)

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

The Institute of Physics, 76 Portland Place, W1B 1NT, UK.

Tel: 020 7470 4800 Fax: 020 7470 4848