IOP | Institute of Physics
Vacuum Group

NEWSLETTER JULY 2014

Issue no. 14/1

The ZOOM tank after welding. Zoom is one of 4 new instruments on Target Station 2 of ISIS. Photograph courtesy of STFC

Contents

Chair's Report 2014

In recent years we have tried to provide a programme of meetings that cover all aspects of research and industrial application where pressures below an atmosphere are an important part of the process. This field is much larger than the average person realises. Our Vacuum Symposium in 2012 contained a series of talks trying to highlight some of the areas of importance. The topics of the presentations included vacuum for freeze drying (which is important for food, pharmaceutical products and vaccines), production of magnetic recording heads, coatings to reduce wear, plasma catalysis for conversion of greenhouse gases into fuels, water-resistant coatings on polymers for food protection, production of rare isotopes for medical research and many applications in the semiconductor industry. There is also the need to produce and maintain very low pressures in synchrotrons, fusion and other large systems for research in the physical sciences to minimise collisions which disrupt the particle beams and lead to cooling of fusion plasmas.

Recently physicists at the University of Berkeley in California have shown that even the new 3D printing methods (desktop printing) may, for certain applications, need to be done in a controlled vacuum environment to obtain the most accurately printed components. Without UHV, gas entrapment and release from the feed material appears to present problems (see JVSTA 32(3) May/June (2014) p 033001).

Perhaps the strength of interest in this subject can be seen from the recent International Vacuum Symposium in Paris (9 -13 September 2013) which was attended by over 2500 participants. This number included over 1600 delegates for the scientific meeting, 116 attending short courses on vacuum and 440 exhibitors

The Vacuum Group continues to support those working in vacuum technology by running training courses at the Vacuum Symposium in Coventry. The Group also maintains close links with the British Vacuum Council (BVC) with members of the Group committee serving as Institute of Physics representatives on the Council. Through the BVC, which represents national vacuum interests, members are able to participate in the work of the International Union for Vacuum Science, Technique and Applications (IUVSTA) which, this year, runs its International Conference on Thin Films in Dubrovnik from 12 - 17 October.

I chaired the first IUVSTA European Vacuum Conference which was sponsored by the British Vacuum Council and took place in Salford in April

1988. We have now put a bid in to host EVC-14 in 2016 in Manchester with support of this and other IOP Groups.

The Group is running its 5th Annual Vacuum Symposium as part of Vacuum Expo 2014. Five IOP Groups have worked together to compile a 1 day programme with speakers from UK and overseas (Information on http://www.vacuum-uk.org). The provisional programme is given in the Vacuum Symposium section of this Newsletter.

We co-sponsor two other annual meetings run by the Ion and Plasma Surface Interactions group: Plasmas, Surfaces and Thin Films, run in June and Thin Film Photovoltaics, in September.

I would like to take this opportunity of inviting members of the Group to suggest hot topics for future events. Please also send me news items on events and new reports on topics of interest to our vacuum community.

My thanks to all members of the Group Committee for their hard work during the year and for regularly attending committee meetings. Thanks are due also to IOP staff for their valuable support of our activities and to all group members for their ideas and input to meetings. PLEASE note I am moving my research group to Huddersfield University on 1st September 2014. My new email address is

John Colligon (J.Colligon@hud.ac.uk).

Annual General Meeting

This meeting will take place on 15th October 2014 at 13:45 hrs before 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 John Colligon well before 15th October if you would like to stand for election.

Report on meeting on "Thin Film Oxide Coatings: recent developments and applications", Manchester, 16th April 2014

This meeting was organised jointly by the Vacuum, Thin Films and Surfaces and Ion and Plasma Surface Interactions Groups of the Institute of Physics and held in the Lovell Seminar Room in the Alan Turing Building at Manchester University on 16th April 2014. The aim of the meeting was to provide an update in this field at a tutorial level of interest to academic, industrial and students involved in research, development and application of oxide coatings.

The one-day programme comprised 7 invited talks and 7 contributed papers and covered a wide range of techniques for forming oxide coatings, applications, optimisation of growth parameters and modelling of the growth process.

Oxide coatings have become of increasing importance in recent years and have many applications which include their use as optical and hard coatings, transparent conductive oxides, thermochromic and electrochromic thin films, decorative coatings and photocatalytic films. Typical methods employed for synthesising these materials include sputtering, cathodic arc evaporation and plasma-enhanced chemical vapour deposition.

Interesting talks on the methods for formation of coatings were given by Gin Jose (Leeds) using pulsed laser methods, Louise Bailey (Oxford Instruments Plasma Technology) by sputtering, Kevin Cooke (Teer Coatings Ltd.) by closed-field unbalance magnetron sputter ion plating, by Nianhua Peng (Surrey Ion Beam Centre) by implantation of oxygen ions into Si to form a buried oxide layer, Victor Bellido-Gonzales, Gencoa Ltd, who reported on new system designs to minimise use of sputter cathodes and by John Hodgkinson (Salford) who described the use of atmospheric plasma systems to form copper, copper-oxide and copper/silica nanocomposite films for use as anti-microbial surfaces.

Martyn Pemble discussed the need to replace silicon-based devices by InGaAs and showed recent results where atomic layer deposition has been used to form pin-hole free high-k dielectric layers on this alternative material. Applications of oxides and oxy-nitrides for catalysis were discussed by Kevin Cooke and Louis Bailey, the former showing that higher levels of oxide in the discharge favour formation of anatase TiO_2, the latter presenting data which showed that it was difficult to form silicon oxy-nitride directly and the best route was via oxidation of Si_3N_4. Russell Egdell described a novel solution-based dip-coating method followed by an anneal which produced (001) oriented anatase and Sn-doped anatase films on SrTiO3 (001), the latter a

promising photocatalytic material. Geoff Thornton reported results on the growth and characterisation of TiO_2 (110) and CeO_2 (111) ultra-thin films on crystalline metal substrates which indicated preferential nucleation on step edges associated with defects. Mark Jackman reported on work using synchrotron radiation of anatase (101) and rutile (110) TiO_2 to study effects of oxygen vacancies on the surface and sub-surface regions which showed the rutile to be more resilient to vacancy formation.

The status of Transparent Conducting Oxides (TCO)'s was discussed by Jake Bowers who showed that mixed In/O and Zn/O and Al-doped ZnO can be formed at relatively low temperature. Robert Treharne described a technique for assessing optimum deposition conditions for potential new TCO's from a single deposition run designed so that different regions experienced different deposition parameters. The latest drive is to improve mobility, transparency and mechanical flexibility of these layers.

Roger Smith gave a useful layman's description of a so-called "on-the-fly" Monte Carlo method for modelling TiO_2 film deposition. Results show that the energy of the depositing particles plays an important role in the resulting film morphology, with evaporation producing a void-filled incomplete structure whereas sputtering produces crystalline growth. Mark Lundie presented data on the oxidation of graphene which effectively opens its band gap to make it optically active for photonics applications

I take this opportunity of thanking all speakers for their interesting presentations which provoked a lively discussion. Thanks also to Andrew Thomas and Alan Webb for chairing sessions, for Manchester University for hosting the event and, especially, to Kathy England in the Photonics Institute for tremendous help with registration and organisation of the projection facilities and refreshments.

John Colligon
23 April 2014

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 15th and 16th 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: 5th Vacuum Symposium and VacuumEXPO

Ricoh Arena, Coventry; 15 October 2014

Here is your chance not only to attend a free meeting but also to win a poster prize presented by the IOP VACUUM GROUP and visit a large exhibition of equipment. Although free, registration is necessary (details via the Vacuum Symposium web-site). Poster presenters have the option to give a ***strictly*** 2-minute presentation (2 slides maximum) at the end of the morning session of VS5 on 15th October.

We have an excellent programme of speakers from UK and overseas, selected with the help and support of 5 IOP groups (Ion and Plasma Surface Interactions, Nano-scale Physics and Technology, Materials and Characterisation, Thin Films and Surfaces and Vacuum). The Provisional Programme is given below.

VS5 Provisional Programme (at 1 June 14)

0915 Welcome and Introduction: John Colligon

0930 "Structure-property relationships in submicron thin films"
Steve Bull : School of Chemical Engineering of Advanced Materials, University of Newcastle, UK.

1000 "A study of nanoparticle biomolecular coatings by XPS and particle sizing techniques"
Caterina Minelli: National Physical Laboratory, Teddington, UK

1030 Coffee break

1050 "Every atom counts: Manipulation of single functional molecules on surfaces"
Leonard Grill; Chemistry Department, University of Graz, Austria

1120 "Atomic Layer Deposition: a process technology for functional ultra-thin films"
Paul Chalker: School of Engineering, University of Liverpool, UK

11.50 2 Minute Poster presentations

1210 Lunch /Exhibition/ Posters

1345 ***IOP Vacuum Group members AGM***

1400 "Interpretation of scanning tunnelling spectroscopy of semiconductor nanostructures."
Philipp Ebert and Holger Eisele[+]: *Peter Gruenberg Institut, Juelich, Germany, [+]Technical University, Berlin, Germany*

1430 "Nanoscale Scanning Probe Microscopy"
Jay Weymouth and Franz Giessibl: Institute of Experimental and Applied Physics, University of Regensberg, Germany

1500 "Production of superconducting coatings"
Reza Valizadeh: STFC Daresbury Laboratory, Daresbury, UK

1530 Tea break/ Exhibition/Vacuum Group Poster Prize presentation

1600 "A layman's view of ion-surface modelling"
Roger Smith: Computing Science, Loughborough University. UK

1630 "New developments in ion-beam analysis of materials"
Chris Jeynes: Surrey Ion Beam Centre, University of Surrey, UK

1700 Short 10 minute contributions
(Please send titles to J.Colligon@hud.ac.uk)

Report on the 4th Vacuum Symposium Ricoh Arena, Coventry; 16 October 2013

Vacuum-based coating technology and applications

The aim of this meeting was to provide an update on methods where vacuum and the use of plasmas and energy-assistance methods are used in industrial coating processes. Some 40 delegates attended this event, which was organised jointly by the Vacuum and Ion and Plasma Surface Interactions Groups of the Institute of Physics.

Erwin Kessels from the Technical University of Eindhoven gave an interesting overview of Atomic Layer Deposition (ALD) which allows for the deposition of uniform, ultrathin films with Ångstrom-level resolution and with a high conformality on complex (nano)structures. Conventional deposition processes are reaching their technological limits and ALD is now being considered for a growing number of applications outside the normal semiconductor industry applications.

Other contributions related to energy-assisted physical vapour deposition methods where energetic atoms of coating material are deposited on a substrate, often with additional energy provided by energetic ion bombardment. An overview of the effects of energy-assistance on coating properties was given by John Colligon which highlighted the importance of added energy per depositing atom and the effects of impurities on the properties of the deposited material. Subsequent talks by Arutiun Ehiasarian (High Power Impulse Magnetron Sputtering: HIPIMS) and James Dutton (High Target Utilisation Sputtering: HiTUS) illustrated the latest methods for producing coatings using energy-assistance. The former generates a high degree of ionised coating particles whereas the latter steers the plasma and allows interaction with the substrate and sputtered species. The HiTUS has a major advantage of efficient use of target materials owing to planar removal of materials rather than the non-uniform race-track removal characteristic of magnetrons.

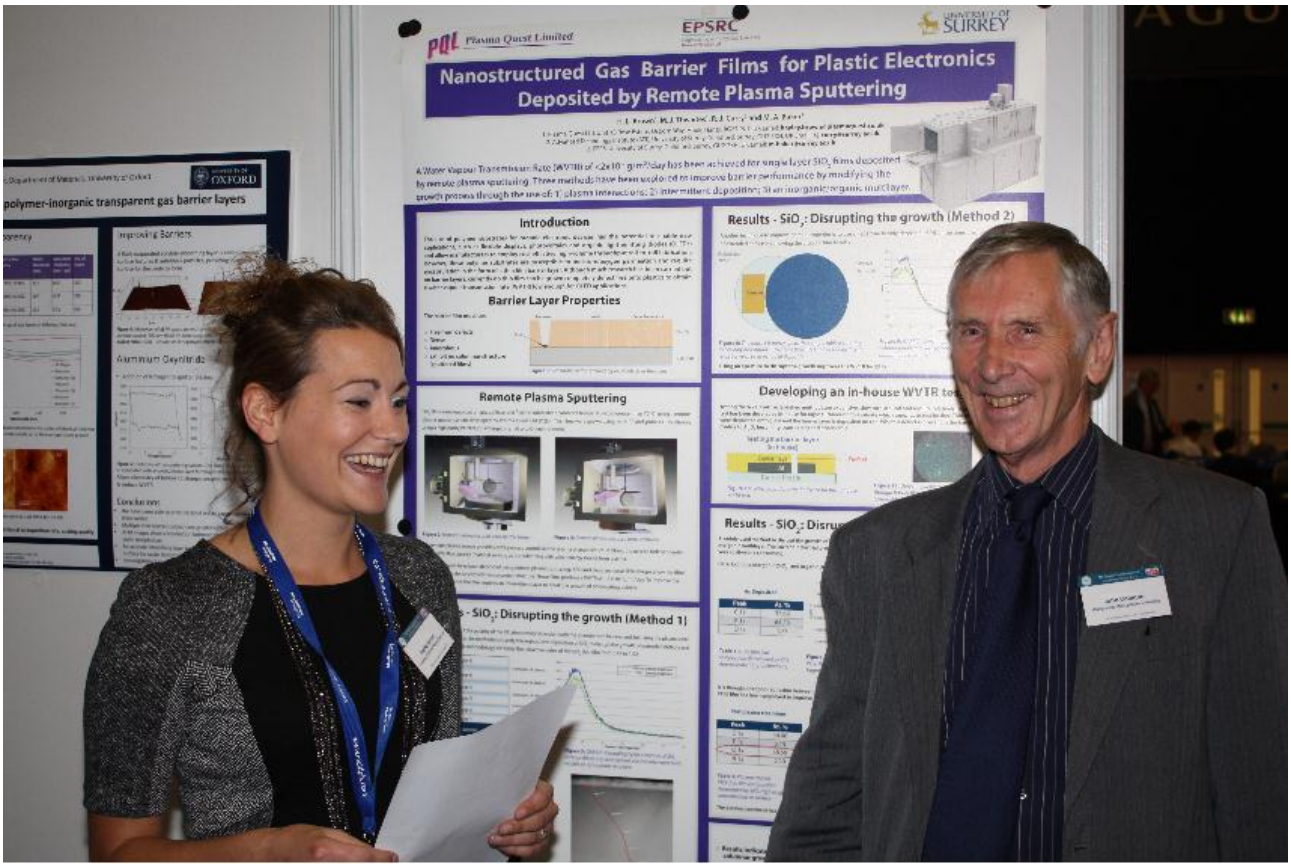
Talks on applications of the coatings included a Plasma-Assisted Chemical Vapour Deposition diamond coating process described by Chris Walker of Diamond Hard Coatings Ltd which allows formation of well-bonded carbon materials on a range of substrates. Another novel coating was described by Ben Wardzinski of the European Space and Technology Laboratory (ESTL). Traditionally lead has been used to coat ball-bearings but, owing to the toxic nature of lead, alternatives, such as Indium, are being sought. The results showed that indium had a reasonable lifetime and, although this was shorter than lead, its friction coefficient was lower. A third application of coatings as a pumping surface for synchrotron and accelerator systems was described by Oleg Malyshev of STFC Daresbury Laboratory. Alloys of Ti, Zr, Hf and Zr and of individual metals have been tested and shown to have good pumping properties, low activation energies and reduced electron-stimulated desorption yields.

Clearly there are many developments in this vacuum-based coating field and the meeting captured only a selection of them. The proposed theme for next year is Surface Modification and Analysis and hopes to capture progress in that important area.

John Colligon
Alan Webb

2013 Prize-Winner Dr Hayley Brown

Posters presented at the 2013 Vacuum Symposium were of high standard and the judges had a difficult decision to make. The winner was Hayley Brown from the University of Surrey. A photograph of the presentation and summary of the work displayed in the poster are given below.



Professor John Colligon, chair of IOP Vacuum Science Division, with the 2013 prize-winner Hayley Brown

Nanostructured Gas Barrier Films for Plastic Electronics Deposited by Remote Plasma Sputtering

H. L. Brown[ab], M. A Baker[a], R. Curry[a], P. J. Hockley[b], M. J. Thwaites[b]
a) University of Surrey, Guildford, Surrey, GU2 7XH, UK
b) Plasma Quest Ltd, Unit 1B Rose Estate, Osborn Way, Hook, Hampshire, RG279UT, UK

The use of polymer substrates for organic electronic devices promises to enable new applications, such as flexible displays, photovoltaics and organic light emitting diodes (OLEDs). The deposition onto polymers will also allow manufacturers to employ more cost effective high-volume throughput roll-to-roll fabrication. Unfortunately, these polymer substrates are susceptible to

moisture/oxygen permeation and require encapsulation in the form of a thin film barrier layer. Although much research has been carried out on barrier layers, currently no thin film can be grown completely defect free onto plastics to obtain a water vapour transmission rate (WVTR) low enough for OLED applications.

In this work, SiO_2 has been deposited using a novel technique, remote plasma sputtering. This method can be used to deposit dense films onto polymer substrates and a standard single layer SiO_2 thin film has achieved a water vapour transmission rate (WVTR) of $<2x10^{-2}$ g/m^2/day. Three different growth procedures have been explored to improve barrier performance. Firstly, the sputter deposition process was interrupted at regular intervals during the deposition and the surface of the film exposed to the plasma for short periods. Secondly, a rotating aperture was used to limit deposition to 50% of the time. Both of these methods disrupt the growth of extended defects by allowing the growing film to relax. The third method involved depositing an inorganic/organic multilayer structure.

The thin films have been characterised using scanning electron microscope (SEM), glancing angle X-ray diffraction (GAXRD), atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS) and scanning transmission electron microscopy (STEM) to understand the key parameters impacting on the barrier properties.

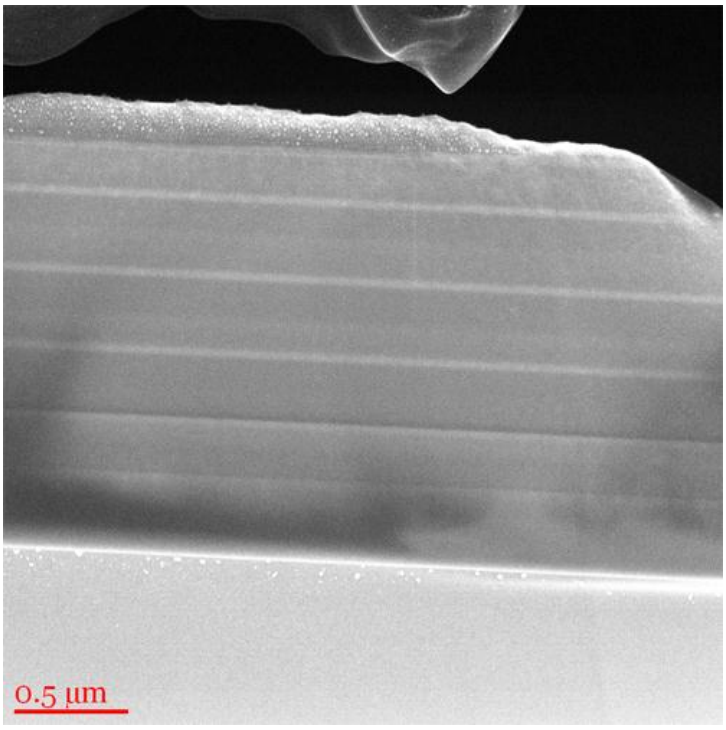


Figure 1: STEM image in secondary electron (SE) mode of SiO_2 grown at 2.5 kW with plasma interruptions (lighter bands indicate densified regions)

SEM cross-sections and GAXRD data reveal that both the standard single layer SiO_2 and SiO_2 layer with interrupted growth, exhibit amorphous and dense layers with no columnar growth. Secondary electron images recorded in the STEM show that interrupting the growth and exposing the film to the plasma for short periods leads to densification of the coating (see the bright regions in Figure 1).

This SiO_2 layer with growth interruptions and the layer grown using an aperture both exhibited an increased refractive index, indicative of a densified structure. Compared to the standard single layer SiO_2 the WVTR for both densified thin films showed a modest improvement (by up to 33%).

The third method to disrupt defect growth employed polytetrafluoroethylene (PTFE) to act as 'smoothing' interfacial layer between the SiO_2 layers and both layers were grown in the same system (different to the current industrial process). The sputter parameters were optimised to increase adhesion between the PTFE and SiO_2 layers. The WVTR is currently being recorded for this structure.

ZOOM: Small Angle Scattering Instrument at ISIS

Zoom is one of 4 new instruments on Target Station 2 of ISIS.

ISIS is a world-leading centre for research in the physical and life sciences at the STFC Rutherford Appleton Laboratory near Oxford in the United Kingdom. Our suite of neutron and muon instruments gives unique insights into the properties of materials on the atomic scale. We support a national and international community of more than 3000 scientists for research into subjects ranging from clean energy and the environment, pharmaceuticals and health care, through to nanotechnology and materials engineering, catalysis and polymers, and on to fundamental studies of materials. For more information about ISIS and the ZOOM project, please visit the website http://www.isis.stfc.ac.uk

This particular instrument can measure small angle diffraction and will have a flexible set up, allowing several different configurations (including the use of polarized neutrons).

The vacuum tank was designed and modelled by a team of in-house .engineering staff and was manufactured by SDMS in France. Due to the size

of the tank it was manufactured in 2 halves that were later welded together on site. The whole vessel was then leak tested by staff from the ISIS Vacuum Section.

The vacuum tank volume is approximately 48m^3 and will be pumped down using a combination of roots and screw pumps to achieve a vacuum level of 0.1mbar in approximately 40mins.

The inside of the vacuum tank will contain various detectors for measuring the diffracted neutrons. Access to these detectors will be via 2 doors on the side of the tank.

The entire Vacuum Tank is mounted on a set of rails allowing axial movement (up to 1.5m) to accommodate different sample environments. Commissioning tests on the detectors will start on the tank later this year with first users expected in March 2015.

Sunil Patel
STFC Rutherford Appleton Laboratory

The ZOOM Vacuum tank after welding - Photograph courtesy of STFC

Research Student Conference Fund

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

The Institute of Physics 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 £250 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.

Groups have limited funds to award bursaries and so students may not receive the full amount they have requested. If the full amount is not awarded students may apply again to receive further support for a different conference until they reach £250 overall.

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?
For details and application form please look at the iop.org web-site information for students section.

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.

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

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/

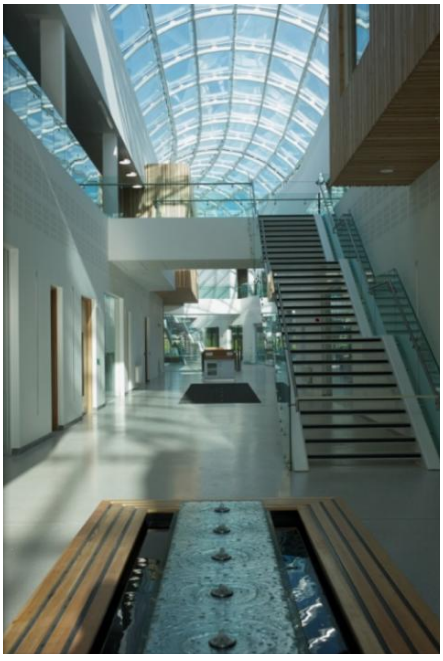
Alan Webb
The Open University

Final Update - Waters Corporation: New Mass Spectrometry Headquarters near Manchester, U.K.

Over the last two years we have reported on the building of a new mass-spectrometry headquarters in Wilmslow near Manchester by Waters Corporation. Well this process is now complete.

The construction of the £60m headquarters began on the 37-acre Stamford Lodge site on the A538 Wilmslow/Altrincham road, three miles south of Manchester Airport, at the beginning of 2012. The construction of the headquarters was completed on time and at the beginning of this year the company relocated more than 500 employees and associated laboratory facilities from four separate sites in the South Manchester and Altrincham areas.

The Waters Manchester South Head-Quarters (MSHQ) is really an extraordinary facility. It provides an exceptional and stimulating working environment for its employees. The building itself is purpose-built combining advanced R&D, manufacturing capabilities and customer demonstration laboratories whilst meeting BREEAM standards (Building Research Establishment Environmental Assessment Methods) for environmental performance, and best practices in sustainable design.



Central corridor – The Ion Path

The building is set in 37-acres with managed gardens/lawns, woods and areas left fallow. The river Bollin runs through the site and this spawns a brook and a small wetland area. The need to re-house colonies of Soprano, Pipistrelle and Brown long-eared bats in a purpose-built bat house proved successful and it can be reported that they are not neighbours from hell.

The company and the employees are rightly proud of their new home; it reflects the ethos of the business and demonstrates Waters Corporation's commitment to continuing support of Manchester/North West's long legacy of involvement with mass-spectrometry.

Gordon Jones, Waters Corporation

Application of Vacuum Technology

Vacuum Insulated Glazing: Improving the Energy Efficiency of Buildings

Centre for Renewable Energy Systems Technology (CREST), School of Electrical, Electronic & Systems Engineering, Loughborough University

Background

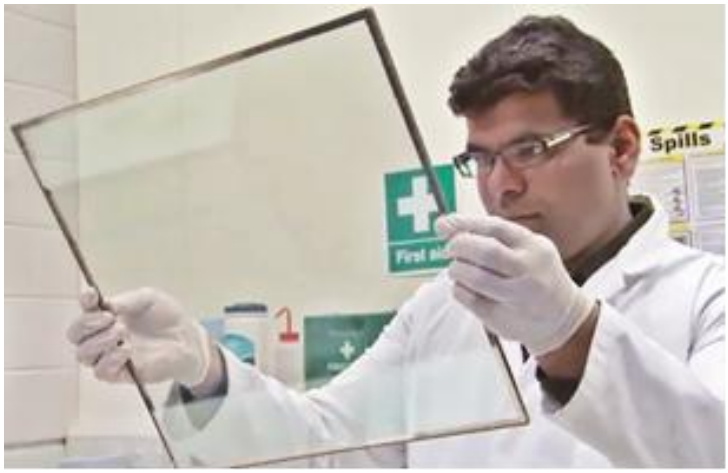


Figure 1: Fabricated Vacuum Insulated Glazing

Heat loss through the windows of buildings is one of the factors contributing to high energy consumption for space heating resulting in excessive CO_2 emissions which lead to climate change. Replacing standard double air filled glazing, U value of 2.85 $Wm^{-2}K^{-1}$, with vacuum insulated glazing, U value of approximately 0.8 $Wm^{-2}K^{-1}$, reduces the heat loss by more than three times and reduces the frame thickness due to the thinness of vacuum insulated glazing (8.15mm) as illustrated in Fig.1. Further reduction of U value less than 0.5 $Wm^{-2}K^{-1}$ can be achieved by using triple vacuum glazing; this reduces heat loss through windows to approximately the same level as that through external solid walls. The research on the design and development of energy-efficient vacuum insulated glazing at Loughborough University, led by Prof. Philip C. Eames and Saim Memon, forms part of the CALEBRE (Consumer Appealing Low Energy technologies for Building REtrofitting) project aimed to establish a robust refurbishment package for reducing UK domestic CO_2 emissions resulting from solid-wall dwellings.

What we developed

A laboratory was established at CREST, Loughborough University, for the fabrication of vacuum glazing. The vacuum assembly system can attain a pressure of $1x10^{-6}$Pa. It includes facilities for material testing/design, support pillar placement, glass sheet cleaning and a heating system for the fabrication of glass units with different edge sealing materials, as illustrated in Fig. 2. High and low temperature hermetic sealing materials were prepared and tested to understand the sealing properties and achievable cavity vacuum pressure.

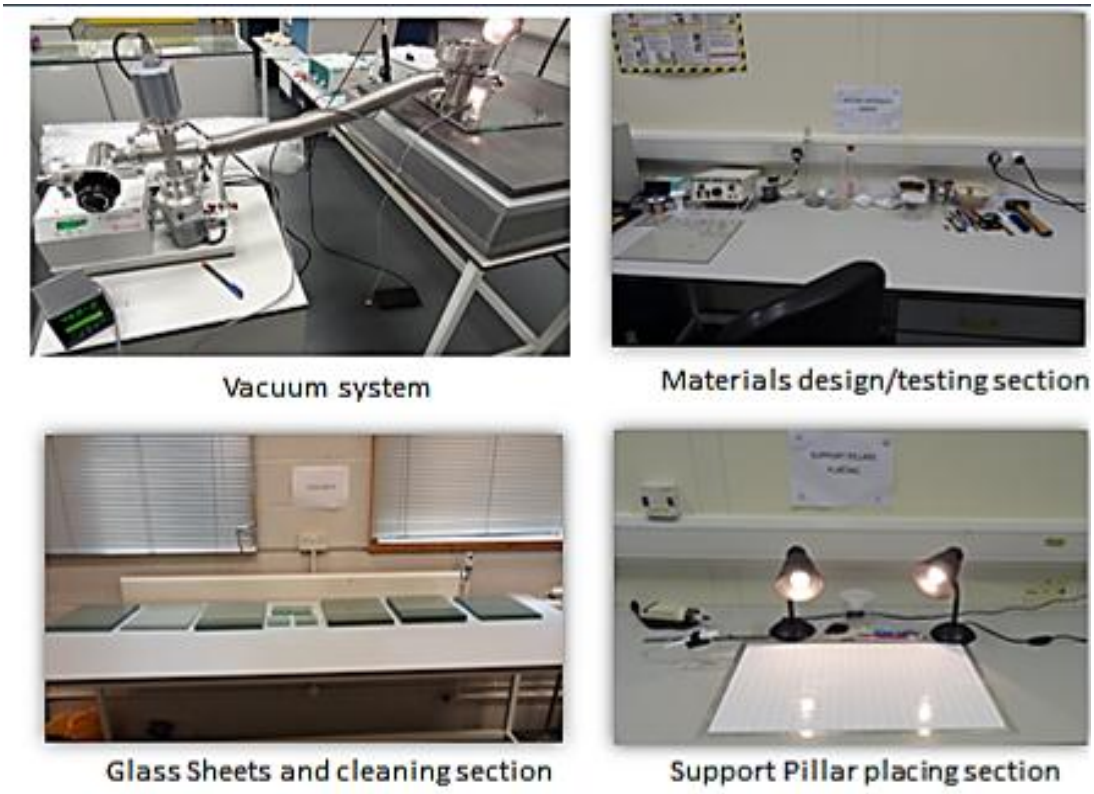


Figure 2: Vacuum glazing production facility illustrations

What we achieved

In vacuum glazing, an evacuated cavity supresses gaseous conduction and convection to provide high thermal resistance. A high vacuum (less than 0.1 Pa) is required and must be maintained by a hermetic seal around the periphery. In my recent PhD programme I developed new low temperature (less than 200˚C) and novel high temperature (up to 450˚C) glass edge seals. These included a new low temperature composite edge seal, in which double and triple vacuum glazings each of dimensions 300x300mm were fabricated with internal vacuum pressures of 4.6×10^{-2}Pa and 4.8×10^{-2}Pa, respectively, and a double-glazed lead-free, solder-free and cost-effective high temperature edge seal of dimensions 300x300mm with measured internal vacuum of 8.2×10^{-4} Pa.

Saim Memon
The Technology Research Centre Ltd.

Forthcoming events

The Vacuum Group will co-sponsor the IPSI annual meeting on Plasmas, Surfaces and Thin Films in June 2015 and plans to join Vacuum Expo again in October 2015 to run our 6th Vacuum Symposium. Check the Vacuum Group web-site at www.iop.org for further details.

IUVSTA will hold its 16th International Conference on Thin Films in Dubrovnik, Croatia from 13–16 October 2014.

If our bid for the 14th European Vacuum Conference is successful it is planned to take place in Manchester in September 2016.

Committee 2013-2014

Chair: Professor John Colligon ; Honorary Secretary: Dr Carl Richardson
Hon Treasurer: Dr Sunil Patel

Members: Dr Andrew Chew, Dr Matthew Cox, Mr Joe Herbert, Dr Oleg Malyshev, Dr Gordon Jones, Dr Saim Memon, Dr Steve Taylor, Dr Alan Webb.

Join the Vacuum Group

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

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

The contents of this newsletter do not necessarily represent the views or policies of the Institute of Physics, except where explicitly stated.

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

Tel: 020 7470 4800
Fax: 020 7470 4848