

3.5 Tesla 49 pole superconducting multipole wiggler at Diamond Light Source

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Editorial

The VACUUM Group began its life as the Vacuum Physics Group which was inaugurated in 1965. The Group continues its endeavours to appeal to as many people as possible in industry and research by arranging meetings covering the widest possible range of subjects where pressures below an atmosphere are an important element. 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 and has recently included in its programme a series of tutorial-level meetings. The most recent of these was held at the UK Diamond Light Source facility on the theme of surface analysis methods. The Group maintains close links with the British Vacuum Council (BVC) - a member of the Group committee serving as one of the 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)

During the past few years, 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 subjects of meetings have included information on choosing and using vacuum equipment, environmentally friendly cleaning of vacuum components, energy-assisted coating, motion in vacuum, automation and control, diamond growth, pressure measurement, ion sources, plasma sampling and surface analytical techniques.

The Group is now running an annual Vacuum Symposium with the third of these (VS3) scheduled to take place at the Ricoh Arena, Coventry from 17-18 October as part of Vacuum Expo 2012 which includes a meeting on “The importance of Vacuum and Plasmas to Industry” on 17th and “Large UHV Vacuum Systems” on 18th. In addition there will be an equipment exhibition and a vacuum training course. Information on <http://www.vacuum-uk.org>

VS4 will probably also take place in Coventry in October 2013 and will include further meetings of the Vacuum Group.

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.

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

Chair's Report 2012

By the time of the final meeting of the year at the Ricoh Arena in October there will have been 4 committee meetings during the course of the year. It is gratifying to see that the group has a full committee and that attendance has been consistently high, generally exceeding 75%.

Technical meetings held include a Tutorial Series meeting on the subject of Surface Analysis Techniques held in April at Diamond Light Source and Vacuum Symposium 2 at Vacuum Expo 2011. Following the success of this conference, Vacuum Symposium 3 will again be held at the Ricoh Arena Coventry coincident with Vacuum Expo 2012.

In addition the group has supported meetings organised by IPSI on Plasma, Surfaces and Thin Films in June and on Advances in Photovoltaics in September. Meetings on coating methods, such as ‘ALD and Plasma Coating’ and ‘How to achieve a high vacuum’ are under consideration.

The Group has again been represented at all of the APTD and GDOF committee meetings during the past year. As noted in the last report the group has been closely involved in the debate over the future of divisions. The conclusion eventually reached is that divisions will terminate by the end of the year and it will then be up to individual groups to decide on means and levels of cooperation with other groups. A number of reservations were expressed since it is not obvious how cross-cultural activities will arise without the divisional support structure.

The Vacuum Group clearly has much in common with a number of IOP groups including Ion and Plasma Surface Interaction, Thin Films and Surfaces, Plasma Physics and Particle Beams and Accelerator Groups. It will be a task for the coming year to decide what level of interaction can best serve the vacuum group's interests ; perhaps with the formation of a common interest grouping.

The Chairman would like to thank the other Group officers and the committee members for their commitment and contributions over the year.

Gordon Livesey

Annual General Meeting

This meeting will take place on 17th October 2012 at 1200 hrs following the last lecture of the morning session at the Ricoh Arena, Phoenix Way, Coventry CV6 6GE. All members and observers are welcome. We are always looking for new members to serve on the Committee. Please contact John Colligon if you would like to stand for election.

Surface Analysis Techniques Meeting

More than 40 delegates gathered together at Diamond Light Source in Oxfordshire on 4th April 2012 for a tutorial style meeting on Surface Analysis Techniques which was organised by the Vacuum Group. The meeting comprised an overview talk from Phil Woodruff of Warwick University followed by six further invited talks from experts on different surface analysis techniques with the opportunity for more in-depth discussions in the coffee breaks and at lunch time. After the talks, many of those present took the opportunity for a tour of Diamond to see parts of the large installed vacuum systems.

The overview talk by Phil Woodruff entitled "Surface Science and Analysis: Historic and Current Perspectives" started by explaining why ultra-high vacuum is a critical enabling technology for many surface analysis techniques and also showed how extreme surface sensitivity and specificity can be

achieved. It then went on to describe some of the techniques available with different incoming and outgoing particles, such as X-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES), ion scattering, secondary ion mass spectroscopy (SIMS) and low energy electron diffraction (LEED).

More detailed talks focussing on particular techniques were then given by Roger Webb (Surrey University) "Ion Beam Analysis Techniques", Hamid Kheyrandish (Aystorm Scientific) "The SIMS Technique & Applications", Wendy Brown (University College London) "Thermal Desorption Techniques", Peter Cumpson (Newcastle University) "NEXUS: UK XPS Facility", Frank Rutten (Keele University) "Ambient Surface Analysis Techniques" and Chris Nicklin (Diamond Light Source) "Electron & X-ray Diffraction for Surface & Interface Analysis."

As Diamond was in a scheduled maintenance shutdown period, the facility tours of Diamond were able to take in the main ultra-high vacuum accelerator complex consisting of a 100 MeV linear accelerator, a 158 m circumference booster ring and a 562 m circumference 3 GeV storage ring (see Fig 1) which produces high intensity synchrotron light for scientific applications. A number of 5m long extruded aluminium narrow gap vessels are installed in the Diamond storage ring (Fig 2); externally fitted permanent magnet arrays (not installed in Fig 2) cause the stored electron beam to undulate and emit intense synchrotron light. These vessels are internally non-evaporable getter (NEG) coated to maintain ultra-high vacuum conditions throughout their length. The NEG coating pumps active gases such as hydrogen and carbon monoxide and can produce local pressures in the extreme high-vacuum (XHV) range. Two superconducting wigglers are also installed which perform a similar function (see cover picture) with superconducting magnet coils operating at 4.2K.

The tours also took in the I07 Surface and Interface Diffraction Beamline, one of more than 20 beamlines currently operating at Diamond where the synchrotron light is used for scientific and engineering applications. I07 is a high-resolution X-ray diffraction beamline for investigating the structure of surfaces and interfaces under different environmental conditions, including harsh and real-world environments.

Overwhelmingly positive comments on the meeting were made by the delegates on the day and afterwards. The organisers, Matthew Cox and Terry Whitmore, thank the speakers for investing their time and enthusiasm in this successful meeting and for making it informative and interesting. Also may we send a big thank you to everyone who attended the meeting and contributed to the lively discussions.

Matthew Cox
Diamond Light Source



Fig 1: View in the Diamond storage ring tunnel . The electromagnets focus and deflect the stored electron beam (green, red and yellow in coloured version). The large elbows which connect the vacuum vessels to the ion pumps are clearly visible.



Fig 2: 5 m long extruded aluminium non-evaporable getter (NEG) coated ultra-high vacuum vessel installed at Diamond. The NEG coating pumps active gases such as hydrogen and carbon monoxide and can produce local pressures in the extreme high-vacuum (XHV) range.



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.

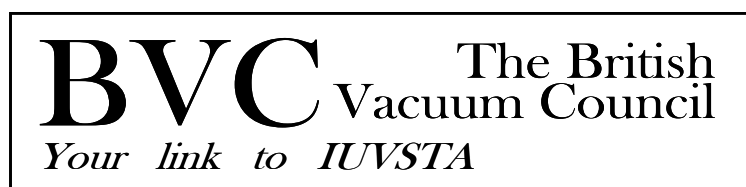
Vacuum is a key enabling technology for a wide variety of applications that are of growing importance in the 21st Century. Whilst there is an abundance of information on the Internet we believe that the annual event organised by Vacuum Symposium UK provides a unique opportunity for networking and education, 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 17th and 18th 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



BVC web site gets a “mega makeover”

Over the last two years discussions have been taking place to move the BVC web-site to a new server. The offer from IOPP to host it as one of their micro-sites was accepted and, whilst the move was in progress, an upgrade was also undertaken.

A BVC sub-group of the Committee met to identify areas that could be improved and also, where new material could be added. A large amount of material, including images, reports and documentation was held by individuals, collected over the years and not so far submitted to the web site. This was all gathered, collated and sent through to the web editors.

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

Waters to Build New Mass Spectrometry Headquarters near Manchester, U.K.

This new Facility will Combine World-Class Customer Demonstration Labs with Advanced R&D and Expanded Manufacturing Capacity and a Bat House.....!

Amid the economic doom and gloom there are some oases of good news if you look hard enough. Waters Corporation, an American-owned corporation, with a key business strategic venture in Manchester is investing for the future. The company is developing its Mass Spectrometry Headquarters in the North West of England with the building of a world class facility with combined advanced R&D and manufacturing capabilities and customer demonstration laboratories.

This development is excellent news across a number of scientific disciplines not least of all vacuum science which is a key enabling technology. The importance of vacuum science to the successful functioning of an analytical

mass spectrometer cannot be overestimated. The level of vacuum pressure in a mass spectrometer is critical to the core operating technologies. For certain MS functionalities to operate the vacuum pressure and composition need to be controlled and manipulated. The vacuum pressure and composition is critical to ionization efficiency and transmission, ion mobility separation, collision-induced dissociation experiments, the optimisation of the time-of-flight mass-to-charge separation. This Waters Corporation development is good news for the UK, the North West and, quite selfishly, the vacuum science community. It may also be good news for a colony of bats.

New Mass Spectrometry Headquarters.

At the beginning of 2012, Waters Corporation (WAT:NYSE) announced it had signed a land-purchase agreement with The Royal Bank of Scotland for a new Mass Spectrometry (MS) Headquarters in Wilmslow, Cheshire, near Manchester, U.K.

Situated on the 37-acre Stamford Lodge site on the A538 Wilmslow/Altrincham road, three miles south of Manchester Airport the new facility is intended to unite Waters' existing mass spectrometry operations located on four separate sites in South Manchester and Altrincham. The plans for the new facility include state-of-the-art customer demonstration laboratories, research and development capabilities, and an expanded manufacturing capacity. The plans, however, did not initially include the re-housing of a colony of Brandt's bats residing in Stamford Lodge, an old building on the site! To satisfy the current planning regulations a special building has had to be included in the site development plans to house this protected species. The new bat house was completed in early May 2012 and ecologists have been regularly monitoring bat activity by carrying out dawn and dusk surveys. The bats have recently returned to Stamford Lodge from hibernation but, to date, there is no evidence that they have been inside their new home. The final bat survey will take place in September of this year and physical relocation of any bats remaining in Stamford Lodge will take place at that time.

A bit more about Mass spectrometry. This is very much a scientifically-led discipline with highly driven academic and commercial components. It is extremely important for identification and quantification of chemical components in complex mixtures. It is a very sensitive analytical technique, enabling scientists to confidently measure components or contaminants present at levels well below a millionth of a gram. It is routinely used to safeguard our food and water supply, protect the environment, provide medical diagnosis and develop health-care solutions. It should not be forgotten that vacuum science is a key enabling technology.

And for 'Waters': the company's mass spectrometry technologies have advanced significantly over the past few years, especially with the introduction of a new range of more advanced instruments, embracing high definition time-of-flight, triple quadrupole and ion mobility technologies. The company is very keen to maintain Manchester's long legacy of mass spectrometry innovation which started with John Dalton's Atomic Theory in the early 1800's and will now continue with the development of the company's global headquarters for mass spectrometry, in Wilmslow.

Finally, it should be noted that Waters Corporation is working closely with Cheshire East Council's Regeneration Service and the Cheshire East Council clearly recognises this development as an excellent opportunity to regenerate this area of Wilmslow and an opportunity to bring a new perspective to the economic make up of the area. Clearly, this will be an excellent neighbourhood for a respectable of a colony of Brandt's bats.

The new Waters MS Headquarters is expected to open in 2014.

For more information about the New Headquarters, go to:

www.waters.com/wilmslow

For general information about Waters Corporation (www.waters.com)

Gordon Jones

Waters Corporation

New Microwave Plasma Chemical Vapour Deposition facilities at Cardiff School of Physics and Astronomy

New Microwave Plasma Enhanced Chemical Vapour Deposition (MWPECVD) facilities have been installed at Cardiff School of Physics and Astronomy for the development of nanocrystalline diamond. A custom Seki 6550 series reactor has been configured with safety fall-back systems to handle long duration unattended running, as well as low temperature growth and doping with trimethylboron. It is capable of growing all kinds of diamond although it is configured mostly for the growth of nanocrystalline diamond.

Cardiff University is developing nanocrystalline diamond for applications as diverse as Micro and Nano-Electro-Mechanical Systems (MEMS/NEMS), tribological coatings, Surface Acoustic Wave (SAW) filters and sensors, biosensors, Superconducting Quantum Interference Devices (SQUID) and Electrochemistry. Nanocrystalline diamond exhibits many of the extreme properties of diamond such as an unrivalled Young's modulus (1100 GPa), high thermal conductivity, lowest friction and wear and highest acoustic wave velocity. The system is available for collaborations that are mutually beneficial and interested parties should contact Dr Oliver Williams at Cardiff University.

Oliver Williams (williamso@cf.ac.uk)

Forthcoming events

The Group plans to run a meeting on “Vacuum-based Coating Techniques and Applications” in late Spring 2012. We will also co-sponsor the IPSI annual meeting on Plasmas, Surface and Thin Films and will join Vacuum Expo again in October 2013 to run our 4th Vacuum Symposium. Check the Vacuum Group web-site at www.iop.org for further details.

IUVSTA will hold its 19th International Vacuum Conference in Paris 9-13 September 2013 and 16th International Conference on Thin Films in Dubrovnik, Croatia from 13–16 October 2014.

Committee 2011-2012

Chair: Dr. R. Gordon Livesey; Hon. Sec.: Professor John Colligon
Hon Treasurer: Mr Joe Herbert

Members: Dr Matthew Cox, Dr Gordon Jones, Dr Sunil Patel, Dr Carl Richardson, Dr Steve Shannon, Dr Steve Taylor, Dr Alan Webb, Mr Terry Whitmore.

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.

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