The British Carbon Group

NEWSLETTER May 2019

National Graphene Institute, Manchester

See www.britishcarbon.org for further details

Contents

Editorial

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I see that it is nearly two years since the last newsletter, something for which for which I deeply apologise. The non-appearance is due to a number of causes among which were health problems on my part, happily now resolved. The other major upset was the resignation for health reasons of Malcolm Heggie as Group Chair while in office. I have to give you the sad news that Malcolm died in January. An appreciation of his life and work will appear in later pages but I will just remark here that he will be greatly missed. You will also see details of a memorial meeting in his honour being held at Sussex in June.

I have also to report the loss of three other figures in the field of carbon, Prof Millie Dresselhaus in 2017 and much more recently, the death of Prof. Oberlin has just been announced. We have just received the sad news that Prof. Brian McEnaney had died and I am grateful to Prof Tony Wickham for his thoughtful and personal memories of his relation with Brian.

Work on Carbon 2021 continues and you will find a report on the latest state of play here. I should reinforce my earlier plea for support from the carbon community in the UK to make this conference a great success. It's not just attendance, although we hope you will come and take active part in the meeting, but also the preparation that goes into a major event like this. It may seem some time off but there is much to do and it's amazing how time can rush by.

Your committee has been busy not only with Carbon 2021 but with drawing up a programme of meetings for the coming year. We have no fewer than four that the group is either organising or actively sponsoring. A novelty is one aimed at young scientists. We want to draw researchers and others working in carbon-related areas in the earliest period of their careers to come along and give some account of their work, both what they have done but also what they hope to do, either by poster or oral presentations. There was a meeting on these lines some years ago and reports back from some of my junior staff who attended were universally positive.

All our UK members and doubtless many others from outside the UK have been watching events develop around Brexit and hope that nothing will disturb the flow of information and the interaction that occur quite naturally between scientists of any nation and gives us a perspective that may not be shared by the population at large, or at least, sections of it. This is a personal view and not of course that of the British Carbon Group (BCG) as an organisation although I feel that most members of it would share my sentiments. Whatever happens NanoteC 19, sponsored of course by the BCG as usual, will take place in Spain and will I'm sure be a glowing example of the advantages of international cooperation in science.

BCG Committee News

New Chair Elected: At the last AGM, Dr. Geoff Fowler was formally elected as Chair of the BCG, following the resignation of Malcolm Heggie. Prof. Chris Ewels became Vice-Chair, while Dr. Peter Minshall and Dr. Izabela Jurawicz remain as Secretary and Treasurer, respectively. The group is grateful to them for their hard work, especially Izabela who has an onerous and important task. She takes over from Tony Wickham who has acted in this position for many years with great efficiency. Dr Sergey Mikhalovsky, Dr Nassia Tzelepi and Norman Parkyn were re-elected as ordinary members. The group is particularly pleased to welcome Dr Suelen Barg from Manchester as a new committee member.

Preparations Begin for Carbon 2021: At the last committee meeting, Geoff Fowler emphasised the increasing work that lay ahead in preparing for Carbon 2021 as well as running the normal BCG events. He said that the committee had a pressing need for more hands to carry this out. The group discussed the likely structure necessary to do this, including a Scientific and technical committee that would play an essential role in setting the Carbon 2021 meeting up. This needs to represent all the areas of active carbon research in the UK and the group feels the need to call in help from outside the existing BCG committee members..

Co-opting Members: The committee can co-opt members onto the committee for specific purposes with a minimum of formality, following the procedure in our constitution. Most meetings are performed via teleconferencing to reduce disruption to everyone's schedules. We were pleased to be able to co-opt Samantha Wilkinson from the National Nuclear Laboratory at the meeting, with responsibility for electronic communications and publicity. We also co-opted Dr Magda Titirici from Queen Mary University of London to help with Carbon 2021 arrangements.

Tribute: Malcolm Heggie (1955-2019)

Chris Ewels, BCG Vice-Chair

I could feel Malcolm looking over my shoulder with a twinkle in his eye when I sat down to write this obituary. When Malcolm stood up to give an after-dinner speech at a science conference banquet, there'd be a collectively baiting of breath, a sense of "OK, where's he going to go this time?", and more specifically, "is he going to sing?" I haven't got Malcolm's comic timing, nor his surreal and unique sense of humour, but I'll do my best to sum up what he meant to me, as a friend, and as a scientist.

Prof. Malcolm Heggie passed away on Thursday 17th January 2019 at the age of 63, just over a year after he was diagnosed with brain cancer. His contributions to Carbon Science were manifold, particularly within the UK where he co-founded the British Carbon Group and chaired it for many years, as well as founding and co-organising the annual NanoteC conferences for 20 years, chairing Carbon 2006 and other meetings. He was one of a kind: first and foremost an excellent scientist, rigorous and visionary in his understanding of defects in carbon[1], but also a teacher[2], stand-up comedian[3], organizer, part-time Scot, linguist, motorbike enthusiast, thinker, sportsman and amateur poet and actor[4], to name but a few.

Malcolm Heggie obtained a Physics and Chemistry Combined Honours degree from Exeter University, followed at the same institution by a PhD in 1982 in Theoretical Solid State Physics under Bob Jones. In the ensuing five years he worked as a postdoctoral fellow with Dr Jones on dislocations and plasticity in silicon and quartz, including periods as CNRS Chercheur Associé au CNRS in Grenoble with François Louchet and Gästforskarer in Umeå with Arne Claesson. This was followed by independent research in graphite (with Brian Kelly, UKAEA, and Mike Tucker, CEGB), in ice and quartz (as NERC Special Fellow), and in semiconductors becoming a SERC Advanced Fellow in 1990 within Computer Science at Exeter University. In 1996 he moved to an academic position in Chemistry at University of Sussex, working with John Murrell, Harry Kroto, and other eminent chemists. In 2012 he took a Professorship in Chemistry at the University of Surrey, before launching his own consultancy in 2016, "Black Dog Bytes" alongside a part-time post at Loughborough University.

(left) Malcolm with his group in Chemistry at Sussex University (from left to right: Irene Suarez-Martinez, Natalia Martsinovich, Rob Telling, Andreia Rosa, Sylvain Latil, Elena Besley and Ahlam El Barbary),
(right) Discussing graphite at Exeter in the 1990s (left to right: Jon Goss, Paul Leary, Chris Ewels, Malcolm Heggie).

Much of his research focused on carbon materials under irradiation, primarily nuclear graphites. Following the pioneering work of Brian Kelly and others, he developed during his career a unique insight into the formation and interaction of irradiation induced defect species in nuclear graphites, and how they determine the behaviour and evolution of the material[5].

[1] 2007 'Graphite – a new twist', http://videolectures.net/kolokviji_heggie_gnt/
[2] 2010 'Carbon in Moderation', http://www.vega.org.uk/video/programme/316
[3] 2014 13 Feb Guildford Bright Club 'Stand up for carbon!' www.youtube.com/watch?v=ufiDII2Rqqo
[4] 2010 'Elementary Carbon' project http://www.facebook.com/pages/Organic-Theatre/74733548572
[5] A good summary of his earlier work and its impact on the nuclear industry (notably for reactor lifetime assessment) is available from: http://impact.ref.ac.uk/CaseStudies/CaseStudy.aspx?Id=44016

He began working when density functional behaviour was restricted to small systems containing only a few tens of atoms, and he pushed the boundaries of this technique as it advanced, with latter work routinely requiring tens of thousands of atoms to correctly incorporate effects of long range strain fields. The previous consensus for radiation damage in graphite considered the aggregation of interstitial atoms into discs/sheets of new graphite (graphene) between existing layers, and the aggregation of vacancies into lines, making a slot in the graphite. Malcolm discovered in 1997 that interstitial atoms bonded neighbouring layers together covalently (the so-called `spiro'-structure)[6]. A whole class of cross-linking defects between graphite layers were found[7]. It became apparent from his research that the assumed extreme mobility of interstitial atoms was incorrect and longstanding theories of dimensional change were incomplete. Archival research confirmed quantitative inadequacies in the theory and a new theory was proposed by Malcolm and colleagues[8]. This did not rely on the movement of vacancies and interstitial atoms and the formation of new graphite sheets, but argued instead that `basal slip' is promoted by neutron collisions, resulting in buckling and folding of existing graphite layers[9]. This theory is supported experimentally, and was later refined by Malcolm and colleagues with improved simulations and diffractograms[10]. In the context of the science of radiation damage, this is a paradigm shift, and the description of buckling and folding in layered materials such as graphite was new and fundamental. He was continuing to develop and refine this model up to his death.

Malcolm's science was imaginative, creative and always rigorous. He would insist on agreement between the calculations and available experimental data, with his encyclopaedic knowledge of the literature going back to the 50s and beyond. For me he is very much an "old school" defect scientist who deserves his place alongside the pioneers of dislocation theory, for his insight into dislocation behaviour in anisotropic layered materials.

(left) Malcolm Heggie explaining graphite dislocations at a CECAM Workshop (2006), **(middle)** Malcolm hosting NanoteC 2012 at Sussex University, **(right)** The "finite monkey cage", interlayer interstitial motion catalysed by vibrating dislocations, expressed by Malcolm through the medium of Perspex, magnets and cuddly monkeys.

Alongside his research Malcolm loved communicating his science, whether to undergraduates[11] (he appears in the top 100 internet science lecturers[12]), colleagues, or more widely in schools, pubs, theatres and even comedy clubs (at the "Bright Club" he gave a stand-up comedy routine explaining irradiation and nuclear graphites (really!)[13]). His youth was spent stripping down motorbikes with his brother in the family shed, and his enjoyment of practical, visual "hands-on" science continued, designing universal gear-boxes and latterly building models using toy monkeys and plastic sheets to demonstrate the principles of defect motion (see above). Even in his last weeks he was developing models to show graphite plane buckling using bicycle chains and magnets. He

[6] LDF Calculations of Point Defects in Graphites and Fullerenes, M.I. Heggie, et al. Recent Advances in the Chemistry and Physics of Fullerenes and Related Materials vol. 6, eds. K.M. Kadish and R.S. Ruoff (1998)
[7] Telling, R.H., El-Barbary, A., Ewels, C.P. and Heggie, M.I. (2003) `Wigner defects bridge the graphite gap', Nature Materials, 2(5): 333-337.http://www.nature.com/nmat/journal/v2/n5/full/nmat876.html
[8] Heggie, M.I., Suarez-Martinez, I., Savini, G., Haffenden, G.L. and Campanera, J.M. (2010) `Radiation damage in graphite — a new model' in Proc. IAEA Consultancy, Solutions for Graphite Waste: A Contribution to the Accelerated Decommissioning of Graphite-Moderated Nuclear Reactors, IAEA-TECDOC-1647, Manchester UK, 39-46. http://www.pub.iaea.org/MTCD/publications/PDF/TE_1647_CD/PDF/TECDOC_1647.pdf
[9] Heggie, M.I. (2010) `Carbon in Moderation', Vega Science Trust. http://www.vega.org.uk/video/programme/316
[10] Heggie, M.I., Suarez-Martinez, I., Davidson, C. and Haffenden, G. (2011) `Buckle, ruck and tuck: a proposed new model for the response of graphite to neutron irradiation', Journal of Nuclear Materials, 413(3): 150-155. http://dx.doi.org/10.1016/j.jnucmat.2011.04.015
[11] See for example http://vega.org.uk/video/programme/316
[12] www.bestcollegesonline.com/blog/2009/06/18/100-incredible-lectures-from-the-worlds-top-scientists/
[13] https://www.youtube.com/watch?v=ufiDII2Rqq0

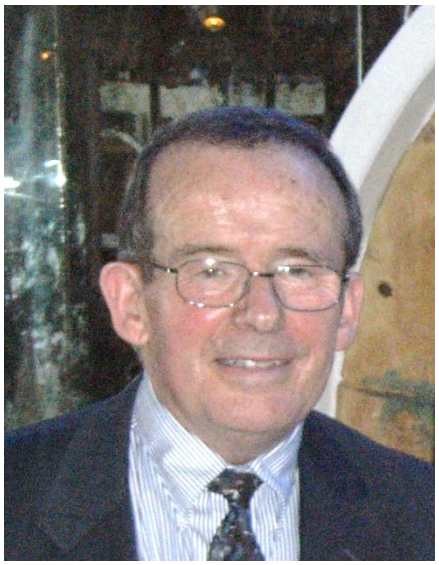
was a true storyteller, drawing his audience on with anecdotes, surreal references, whatever he needed to tell the story he wanted to tell. When Malcolm stood up to talk, you settled in and prepared to enjoy the show.

He was a polymath, priding himself in his ability to flatter people from all corners of the earth in their native language. He was a strident and vocal atheist, cultured and not afraid to voice his opinions. He was very English in many ways, with his unashamedly self-depreciating brand of humour (singing in the car, Randy Newman's "Short people got no reason to live"), and his unpredictable and memorable renditions at NanoteC banquets each year. Less publically Malcolm was always the gentleman and took many people "under his wing", providing help and encouragement scientifically and personally, and always looking out for his friends. I was one of those waifs and strays, emerging from my PhD with little idea of where to go next; it was Malcolm who introduced me to the vast and interesting world of carbon, and set the course for my career.

In a film we made, Malcolm said, "For me the most important thing is to have a career that allows you to do the best you can do. The most difficult thing you can do. That's the importance of a career in science. For me it was the most difficult thing I could do. I could offer that to society as my best contribution"[14]. In Carbon, that apparently simplest of elements, Malcolm found that complexity and challenge he was looking for; our field is the better for it.

[14] https://youtu.be/q7F_fIAUIG8?t=381

Tribute: Professor Emeritus Brian McEnaney (1936-2018)



Tony Wickham

I received the sad news of Brian McEnaney's passing last autumn, after a long struggle against Parkinson's disease, just as I was leaving for a visit to China, quickly followed by a visit to Lithuania. I was therefore somewhat late in offering my condolences to his wife Mary and the rest of the family.

My association with Brian began when several of his students from The University of Bath became attached in various ways to Berkeley Nuclear Laboratories in Gloucestershire where I was in charge of graphite monitoring (charting the irradiation behaviour of the nuclear moderator in Britain's power-producing reactors). His research group was very active at that time in the structural analysis of nuclear graphites, so the association was obvious, and the two groups worked closely together for a number of years. When I finally decided to leave Berkeley in 1995, Brian was very quick to offer me a Visiting Fellowship at Bath, where I was involved both in lecturing to students and in liaising with the research students.

This all took place before he gained his Chair in the School of Materials. I vividly recall his Inaugural Lecture, in which he reviewed the nature of carbon in all its forms. This was very recently after the discovery of the fullerenes, and I know that Brian was aware of Harry Kroto's earlier work on carbonaceous species in space: perhaps a 'space' analogy was obvious, when Brian described the discovery of this new 'allotrope' of carbon as being as surprising an event as suddenly finding a new planet in the solar system!

By this time, we were both closely involved in the activities of The British Carbon Group, and we worked together on the International Carbon Conference held in Newcastle upon Tyne in 1996. This led to a direct involvement in investigating venues for the next UK location in the carbon-conference cycle (2006), taking us ultimately to Aberdeen and to recommending a venue (Robert Gordon College and University) which our colleagues accepted with some trepidation over whether international delegates would travel to such a 'remote' location and whether the weather would be awful (i.e. typically Scottish). In the end, we had 30°C wall-to-wall sunshine and 670 delegates all having an exciting time exploring a haunted castle, the location whisky and (occasionally) some carbon science.

When I fetched up in the wilds of Mid Wales in 1997, I quickly discovered that Brian and Mary had a timeshare holiday home not far away. This led to several Easter visits by Brian, Mary and their grandchildren to our farm. A particular memory is of conveying Brian and the children in a small trailer behind my ATV up to the top of our nearest 'mountain' to enjoy views of the Brecon Beacons and Black Mountain. Mary wisely stayed in the house, while Brian sustained only minor injuries from the sometimes bumpy and occasionally near-vertical trip!

A long association continued in the field of graphite behaviour: both of us assisting EdF-Energy with their irradiated-graphite investigations in support of reactor safety cases through the Graphite Core Committee while also involving ourselves in the business of dealing with the disposal of irradiated graphite from nuclear facilities world-wide.

Brian's legacy of detailed research papers speaks for itself. His contributions in the field will be admired and remembered for a long time, and I look back on our friendship which sadly was too soon over.

The University of Bath have also paid tribute:

https://www.bath.ac.uk/announcements/obituary-professor-brian-mcenaney-formerly-of-materials-science/

Forthcoming Event: Atomistic Computational Studies of Carbon - A meeting to celebrate the scientific achievements of Malcolm Heggie

The meeting to celebrate the life and achievements of Malcolm is being organised by Chris Ewels, Hazel Cox and Roger Smith and supported by the British Carbon Group and CCP9 will be held on **June 12th** at the **University of Sussex**. The meeting will include scientific presentations from colleagues and friends from around the world, exploring point defects, dislocations, mechanical properties and other aspects of atomistic simulations of carbon and related materials, and will be opened by his daughter Laura. There will also be space to present scientific posters during lunch and coffee. The meeting is free but please register through the website so we have the right numbers for lunch and coffee breaks (also if you are interested to speak at the meeting or present a poster). The AGM of the British Carbon Group will be held in the framework of this meeting.

http://tinyurl.com/heggie-memorial

Forthcoming Event: "Learning from other carbons"– a meeting for young scientists

This meeting is a new venture for us and aims at getting together the younger scientists working on any aspect of carbon. It will be held at the **National Graphene Institute, Manchester** on **June 18th**. This is a meeting totally aimed at our younger members, both current and future, and will be as informal as is compatible with coherent organisation. It will be an ideal opportunity for networking and meeting workers from other branches of carbon research and commercial activity. We are asking for all contributions about current or past work both from universities and especially from those working in industry. This need not necessarily be finished work as accounts of work-in-progress and its intentions are welcomed. Please visit the website for more details on registration and submission of abstracts:

https://britishcarbon.org/2019/05/10/young-carbon-researchers-networking-day/

Forthcoming Event: CNPComp2019 - Carbon-based nano-composites

This meeting, one of a well-established series, is being supported this year by the BCG and will take place this year in **London** on **July 17-19th**. It is intended to include one of the Group's Ubbelohde lectures. Fuller details will be available later but further information can be got from the website

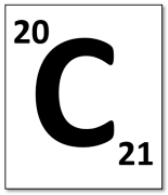
www.sems.qmul.ac.uk/events/cnpcomp2019/

Forthcoming Event: NanoteC19

Our now world-famous series of conferences will take place this year in **Zaragoza**, Spain from 27-30th August 2019. There is little need to say much more about NanoteC, all information is on the NanteC website:

https://nanotec19.icb.csic.es/

Forthcoming Event: Carbon 2021



The British Carbon Group is proud to announce that the 2021 International Carbon Conference will be held at Imperial College in London, UK, from Sunday, July 11th to Friday, July 16th 2021. Further details will be available later on the conference website http://www.carbon2021.org

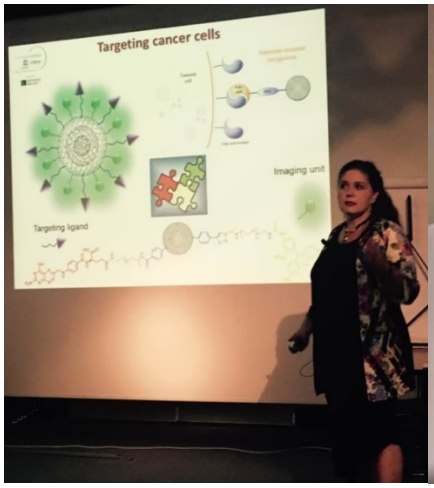
Previous Events: NanoteC17

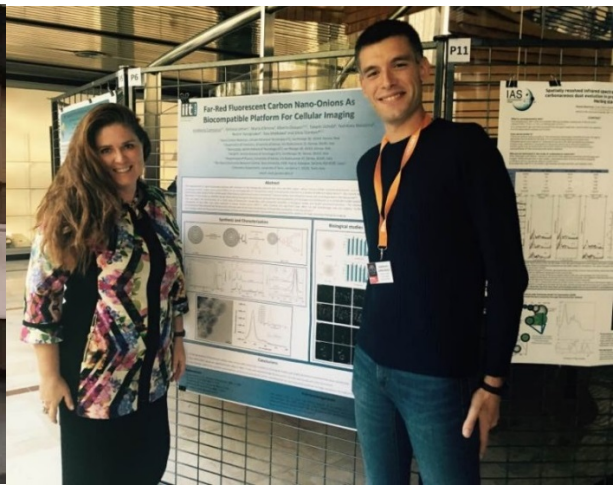
This article is a brief review of NanoteC17, held in Nantes and was written shortly after the previous newsletter came out. Since then we've hosted the 20th anniversary edition in August 2018 at Sussex University, and details of **NanoteC19**, to be held at the end of August in Zaragoza, Spain, appear later in the newsletter – registration is now open at https://nanotec19.icb.csic.es/! This article should give a feel of what to expect…

NanoteC has now been running (mostly) annually since 1998 which made 2017 its fateful 19th birthday. The conference was born in Sussex University just after Sir Harry Kroto received the Nobel Prize for the discovery of C60, and carbon nanoscience was undergoing one of its periodic boom times. People were discovering that you could coat carbon nanotubes with layered inorganic materials, put fullerenes inside of them, mix them into polymers to increase the strength and render the composites conductive, and maybe even think about nanotube mass production. Graphene was not even "on the horizon" at that point, and was instead just the playground for poor theoretical modellers whose computers weren't large enough to handle proper multi-layered graphite.

Since then NanoteC, the British Carbon Group's flagship nanocarbon conference, has charted the ongoing story of carbon nanoscience as it has grown and matured; gradually taking nanomaterials from scientific curiosities to marketplace standards, while adding new allotropes to the list. At the same time the original NanoteC attendees have grown up, some have married each other, and a new generation of NanoteCers have now joined the club. NanoteC has started to travel about, and first came to Nantes, on the west coast of France, in 2004, before revisiting in 2011 and now again in 2017, hosted by the 'Institut des Materiaux Jean Rouxel', a CNRS laboratory based at the University of Nantes.

In 2017 we had nearly 90 participants from thirteen different countries across Europe, Asia and America, including as far away as Russia, Japan, Korea, and Mexico (over 70% of participants were from outside France). Over four days, topics covered varied wildly but spanned the range of carbon nanomaterials, including fantastic invited lectures on fullerenes in space, carbon nanoparticles for cancer therapy, atomic resolution microscopy of defects in graphene, nanodiamond and a new family of carbon nanoscrolls for energy applications.



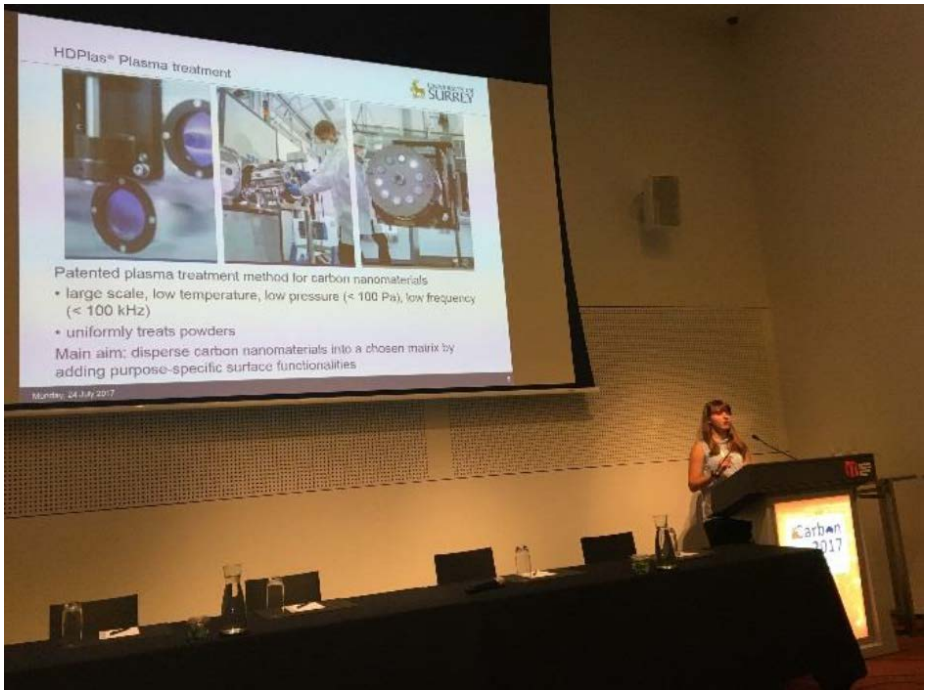


NanoteC has always been a very informal and relaxed conference and this year was no exception. A good sign was the many questions after each talk, and the active poster session (helped slightly with some local beers and ciders!) The conference banquet was at "L'Interlude" restaurant, just before the Nantes "Rendezvous de l'Erdre" free jazz festival. Just as the Nobel prizes have the Ignobel awards, this year's two poster prizes (awarded to Luiz Galvao Tizei and Dmitry Rybkovskiy) were complemented by a new innovation, the "NanoteC Awards".

They won't be listed here ('What happens at NanoteC, stays at NanoteC'), but Pablo can probably be persuaded to tell all if you buy him a beer.

The organizers were particularly grateful for the financial support, notably from the University and Nantes Metropole (which allowed us to set a very low student registration fee), and also our commercial sponsors Renishaw and Attonuclei. They were active conference participants, organizing live demonstrations of Raman spectroscopy with the laboratory spectrometer, and a tour of the facilities at Attonuclei, a local Nantes-based company developing quantum dot technology. Particular thanks go to the laboratory bosses for opening up the mythical IMN helical staircase during the conference, which as well as being very practical allowed everyone else in the IMN to give it a try for the first time!

Event: The World Conference on Carbon 2017: Carbon for Grand Challenges

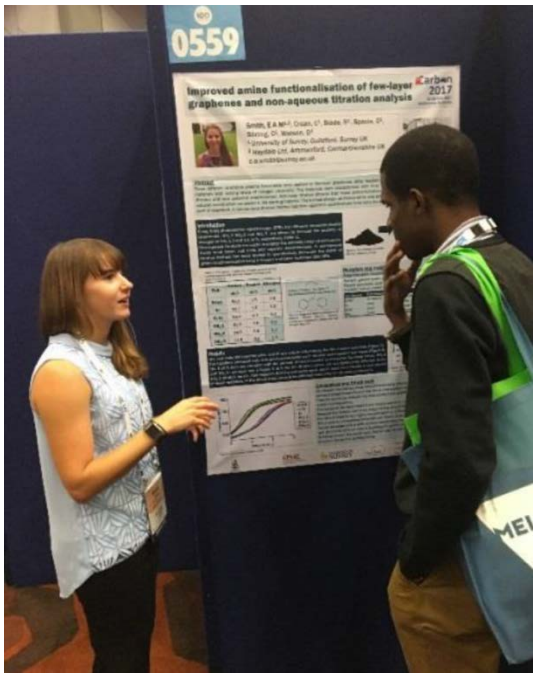


Emily Smith

The World Conference on Carbon 2017: Carbon for Grand Challenges was held as part of the 2017 Royal Australian Chemical Institute (RACI) Centenary Congress. The congress was hosted by the Melbourne Convention Centre between 23rd and 28th July 2017. There were a total of nine major conferences held simultaneously. Carbon, the main conference of which I attended, was chaired by the President and Vice Chancellor of University of Surrey, Prof. Max Lu; Dean of Science at University of Loughborough, Prof. Mark Biggs and Professor in School of Engineering in University of Queensland, Prof. John Zhu. The conference commenced with an Indigenous Welcome to Country dance from the Wurundjeri people where the delegates were offered a eucalyptus leaf as a sign of honouring the ancestors of the land. Dr Alan Finkel gave an opening talk with a powerful message - be a scientist and save the world.

I presented my very first post-graduate talk on the first day, titled “Tailoring few-layer graphenes for supercapacitors in a hydrogen-argon mixed plasma”. I remain very grateful for being accepted to present at this high-calibre conference because there were many well-known and highly cited authors present. The experience was second to none and I believe my nerves made me very severe in presenting – next time I need to smile more and engage with the audience.

I was able to listen to a few presentations that were especially suited to my own topic. These included but are not limited to: Prof. Francois Beguin (Hybrid capacitors in neutral aqueous electrolytes with asymmetric carbon electrodes), Prof. Max Lu (Challenges and opportunities in energy materials), Prof. Krisztina László (Surface modification of graphene and graphene oxides by nitrogen plasma) and Prof. Zhong-Shuai Wu (Graphene-based materials for flexible and planar micro-supercapacitors). These presenters are extremely experienced and respected in their fields.



I presented a poster titled “Improved amine functionalisation of few-layer graphenes and non-aqueous titration analysis”. I received a lot of helpful advice on improving the poster and was able to explain the work to a number of people. I was also able to discuss future avenues of the project and find out from other researchers where I could be more efficient in my final year and produce novel results.

It was an honour to attend the “Remembering Mildred Dresselhaus” memorial service, to find out more about the ‘Queen of Carbon’ and be inspired with her thoughtful temperament and likeability. In addition, I attended the Carbon Conference Dinner where I sat talking to a range of scientists in different fields. I had the honour of being introduced to Prof. Max Lu, the President and Vice-Chancellor at the University of Surrey, where I am currently studying.

Event: Graphene 2017

Rakesh Kumar

The international conference “Graphene 2017-the 7th edition of Graphene and 2D materials conference series” has been one of the largest European event in Graphene and 2D Materials, which held in Barcelona (Spain) from the 28th to 31st of March 2017. Almost 1000 participants from all over the world attended, presented and discussed their remarkable research findings covering all the major research fields such as material synthesis and processing, technology exploration, 2D material based device technology- especially sensors and electronic devices, observations of novel physical phenomenon that answers many fundamental question on 2D material characteristics for their applications at low and room temperature necessary for the use of Graphene and other 2D materials for the commercial applications in near future.

1. Conference Highlights:

a). Plenary Speakers: Following were the three speakers for plenary talks

1. Prof. Andre Geim (University of Manchester, UK) discussed his group’s recent work on van-der-Waals heterostructures. He explained the behaviour of a highly viscous electron liquid in Graphene and new quantum oscillations occurring well above room temperature in moderate magnetic fields

2. Prof. Tony F. Heinz (Stanford University, USA) delivered an interesting talk on transition metal dichalcogenides in the MX2 family. He described the exciting electronic, optical and excitonic properties of these materials (which are otherwise semiconductors) upon forming fascinating counterparts to the semi-metallic graphene and insulating hexagonal BN monolayers.

3. Prof. Phillip Kim (Harvard University, USA) discussed three different experimental observation that manifest novel Coulomb drag phenomena in 2D materials when two electrically isolated conductors are brought close, a current in one conductor can generate friction and drag electrons in the other via Coulomb interaction, thereby causing a charge imbalance in the dragged layer.

b) Keynotes and invited talks: 6 parallel workshops, 100 Keynotes & Invited speakers 150 oral contributions, and 400 posters were presented. I presented my poster under the Graphene-based biosensors session on 28th and 29th March and attended most of the Graphene-based biosensors invited talks and workshops as these were related to my Ph.D. research work.

2.) Personal benefits: 1) Interaction with researchers working in suspended Graphene membranes area, 2) proposals for research collaboration with researchers in DTU-Denmark and Oregon State University, USA, for joint research work have been submitted and 3) Graphene-membranes samples are under the process of mailing to one Dr. Paco Martinez Research Scientist from ScienTec Iberica Rufino Sanchez, Madrid (Spain) for SPM study of suspended Graphene and 4) besides all a significant amount of knowledge and information for my Ph.D. research work, which I believe, has been the key benefit of this conference.

3.) Whether you thought the conference was a success?: I consider it is one of the prestigious events - I have ever attended- inviting people worldwide to explore and discuss the roadmap for Graphene and 2D materials whilst sharing, exchanging and exploring new avenues of Graphene-related scientific and commercial developments.

4.) Additional information:

i) A 2-days Industrial Forum: To get an updated understanding of Graphene-based technologies from worldwide industries.

ii) A Brokerage event to foster technical cooperation in the field of Graphene.

Event: 11th Conference on New Diamond and Nano Carbons (NDNC 2017)

Jemma Rowlandson

The 11th Conference on New Diamond and Nano Carbons (NDNC 2017) took place from 28th May – 1st June 2017 in Cairns, Australia. The NDNC covers a broad range of topics from theoretical modelling of materials to their synthesis and application in devices, with over 200 attendees from all over the world. A large part of the conference focused on diamond-related research, however parallel sessions covered a variety of carbon materials including graphene, carbon fibres, activated carbon, and many more. I was fortunate to have the opportunity to give an oral presentation entitled 'Towards Tuneable Lignin-Derived Activated Carbons for Water Filtration Applications' at the NDNC, the very last conference of my PhD career!

The conference was very well organised and a fantastic experience. For me the stand-out lecture was given by the keynote speaker Dr. David Garret, from the University of Melbourne, on 'Carbon based technologies for Electric Medicine'. The talk centred on a recently published article by Garret and co-workers [1] on the use of diamond electrode arrays in improving prosthetic vision. The research undertaken was both inspiring and absolutely fascinating. The self-contained device comprised of a high density diamond electrode array encapsulated within a diamond box, which was implanted on top of the retina (in the epiretinal position). Diamond as an implant material is highly advantageous being both biocompatible and biostable, increasing the lifetime of the implant. The device has proved promising technology for improving the visual acuity of retinal implants. Due to the sheer variety of presentations on offer at the NDNC I have gained a great deal of knowledge, particularly on diamond and graphene materials and their applications.

Attending the conference was a very rewarding experience, and highly beneficial. I presented my research into tuneable lignin-derived nanoporous carbons for water filtration. The feedback on my presentation was excellent, and I was fortunate to win a prize for the best oral presentation by an early career researcher or student, sponsored by Applied Sciences. There was a discussion on the appropriate pore size for water filtration in activated carbons which I found particularly beneficial, and was further pointed towards some useful literature on the topic. In addition, the relaxed and friendly environment of the conference provided ample networking opportunities. As a final year PhD student I had several in-depth and helpful discussions with early career researchers and other PhD students on post-career options after completing the PhD, and advice on what steps to take next.

Overall, the conference was a great success. Both invited and contributed talks were highly informative, with the plenary and keynote speakers presenting ground breaking research. The poster sessions were one of the highlights, being crowded until the final moments with researchers enjoying technical (and not so technical) discussions and forming collaborations, which of course continued long after the sessions finished over a pint of Australian lager in the nearest bar. Personally, the conference was an excellent learning experience, a chance to present a culmination of my PhD research, and a fantastic opportunity to meet and connect with other researchers. I would like to thank the Carbon Group of the Institute of Physics whose support made my attendance at this conference possible.

[1] A. Ahnood, H. Meffin, D. J. Garrett, K. Fox, K. Ganesan, A. Stacey, N. V. Apollo, Y. T. Wong, S. G. Lichter, W. Kentler, et al., Adv. Biosyst. 2017, 1, 1600003.

Event: 233rd ECS Meeting, May 2018 Seattle.

Rakesh Kumar

The Electrochemical Society (ECS) conducted its 233rd Meeting from 13th- 17th May, 2018 in Seattle, WA, USA. The event was held at the Washington State Convention Center and Seattle Sheraton. This had been one of the biggest science and technology events that I have ever attended. Fourteen parallel symposiums on wide range of topics (Battery, Dielectric Science and Technology Electrodeposition, Electronics and Photonics, Energy Technology, Industrial Electrochemistry and Electrochemical Engineering, Nanocarbons, Organic and Biological Electrochemistry, Physical and Analytical Electrochemistry, Sensor) were conducted More than 1000 participants from all over the world attended, presented and discussed their remarkable research findings covering all the major research fields such as nanomaterial synthesis and processing, electrochemical methods, electrochemical and electronics sensors, technology exploration, 2D material based device technology, sensors and electronic devices, observations of novel physical phenomenon that answers many fundamental question with advanced materials and their applications in real word etc.

Meeting highlights

- Plenary/ECS Lecture: A highly appreciated plenary lecturer, Miguel Nicolelis, MD, PhD, Distinguished Professor of Neuroscience at Duke University and founder of Duke's Center for Neuroengineering) delivered his talk "Linking Brains to Machines: From Basic Science to Neurological Neurorehabilitation." He pioneered and perfected the development of a new neurophysiological method, known today as chronic, multi-site, multi-electrode recordings. He discussed in detail about his approach in a variety of animal species, as well as in intra-operative procedures in human patients, which aims at measuring the concurrent activity and interactions of large populations of single neurons throughout the brain. His research has influenced basic and applied research in computer science, robotics, and biomedical engineering.

- Short Courses: The conference organizers conducted three short courses on topics; Advanced Impedance Spectroscopy, Rechargeable Battery Materials and Electrodeposition Fundamentals and Applications, which where were the main attraction for the graduate students.

- Professional developments: Of the other main interest for both students and early career researchers was the professional development workshop on Essential Elements for Employment Success, Resume Review, Managing and Leading Teams, Grant Writing and An Introduction to Intellectual Property.

- Invited & Oral talks/ Poster presentations: Each and every symposium had several invited speakers, oral contributions, and 4h posters sessions in the afternoon from 14th-17th May. I presented my talk in Sensor division and I enjoyed other speakers' talks and gained lot of knowledge and information.

Personal benefits:

After delivering a talk on Graphene Membrane based sensors for ultrasensitive detection of neurotransmitters and VOCs in ECS platform for the first time, I gained confidence and was complemented for talking a challenging research topic for PhD thesis. I received many questions related to my work, which I believe would help me to improve my research methodology. The graduate students from other institutions were interested in my research work and interacted right after the talk to know more about my graphene sensor. They show specific interest in using my sensors for biological molecules detection, which was really interesting for me too to explore other potential applications of the sensors we developed in UOM. Besides these, I interacted with researchers working in Graphene based sensors, especially with Prof. Peter J. Hesketh from Georgia Institute of technology, USA, and proposed a collaborative research work with him on graphene sensors for VOCs and gases etc. I also met my ex-supervisor Dr. Jessica Kohene, NASA-Ames Research Center, Ca, USA and planned for future visits and collaborative work with her research group.

In summary, a significant amount of knowledge and information for my Ph.D. research work, which I believe, has been the key benefit of this conference.

Acknowledgements: I am very thankful to UK British Carbon Group (BCG) for providing me financial help under student travel grants, which enabled me to attend 233rd ECS meeting and to get highly beneficial and amazing experiences.

Event: 6th EdF-Energy Nuclear Graphite Conference 2018

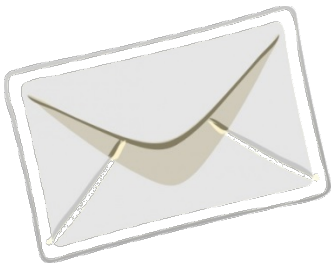
Samantha Wilkinson

The annual EdF-Energy graphite conference was held at the Castle Green Hotel in Kendal from the 13th to 18th October 2018. This was the latest in an important series of gatherings where work performed on and in relation to nuclear graphite in order to support the continuing operation of the Advanced Gas-Cooled Reactors in the UK is presented and subjected to peer review from other British and international expertise. The theme of the conference was “Achieving the Right Balance between Conservatism, Complexity and Confidence to Secure a Safe and Extended AGR Lifetime”. It saw presentations from academia and several supply chain companies covering a range of topics from whole core modelling to microstructural characterisation of graphite. There were also three breakout sessions titled “Managing conservatism in modelling”, “Reducing the complexity of arguments” and “Maximising confidence in predictions”. Conference attendees were free to move between all three breakout sessions to discuss differing points of view and ways of thinking. The chairs of each session then fed back to all at the end of the conference.

It was during this conference that the British carbon Group’s 2018 AGM was held on the 15th October. For full minutes of the meeting please go to:

https://britishcarbon.org/links/introduction/constitution/

Letters to the Group



The BCG welcomes letters from its members, so please get in touch with us if you attended one of our events and it sparked an idea, you have been involved in a particularly interesting project or have any other thoughts which might be of interest to the rest of the group!

Please submit any thoughts to pcminshall@gmail.com

Items for the next newsletter – Submit an Article

We’d like to hear what you’re doing, what you think of the British Carbon Group, any ideas you may have for networking opportunities or anything else you think would be of interest to the rest of the Group. We plan to publish the next Newsletter in Spring 2020.