
The British Carbon Group

NEWSLETTER

November 2023



Harry Marsh, 1973, in the optical microscopy laboratory, Newcastle University



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Editorial

Samantha Wilkinson, Secretary of the British Carbon Group

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This issue of the BCG newsletter is dedicated to the late Harry Marsh – an early pioneer of carbon research within the UK. Sadly the group was informed of his passing this September. He had in fact written for the BCG newsletter in 2016 “Memoirs of Emeritus Professor Harry Marsh of the Northern Carbon Research Laboratories, School of Chemistry, University of Newcastle upon Tyne” (<https://britishcarbon.files.wordpress.com/2016/05/whole-newsletter-2nt.pdf>) and also an editorial for Carbon “The road from coal to carbon – A personal history” (Carbon 202 (2023) 591-592) which are well worth a read. Three figures in the carbon field have written tributes to Harry within this autumn edition.

We can also give early notice of the group AGM which will be held in Manchester at the Royce Institute on Wednesday 8th May 2024. Further information about the event will be advertised nearer the time.

Also in this newsletter we have experiences of the NanoteC event held this summer as well as an article from this year’s BCG bursary winner. Finally we have a call for all early researchers to get involved with the BCG.

Early Career Group News

Dr Chris Ewels, Vice-Chair of the British Carbon Group

Are there things you’d like the British Carbon Group to be doing to help Early Career researchers in the UK? Would you like a forum where you could organise events with other Early Career carbon scientists and technologists, share ideas and information, and help build your research network for the future? Do you think Early Career Researchers should have more of a voice in the future direction for Carbon Research in Britain?

The BCG Early Career Researcher Group is for you! We want to establish this new group, with the support and backing of the British Carbon Group committee and membership, to achieve all of these things and more. We have some of our own ideas of things the group could do and achieve, but we want it to be your group, and give you the freedom to develop activities and resources that you think are most useful and relevant.

If this sounds of interest – if you’re an Early Career researcher, or who would like to propose someone from your team – please contact the BCG vice-chair Chris Ewels (chris.ewels@cnsr-immn.fr). We plan to set up a first informal zoom meeting near the start of 2024.

Future Event : 7th EDF-Energy Nuclear Graphite Conference

6-9th May 2024, Manchester

Save the date for this conference which will be at Manchester Conference Centre (located at The Pendulum Hotel, Sackville Street). For further information will be released nearer the time. Any queries please contact Tony Wickham, Nuclear Technology Consultancy, confer@globalnet.co.uk.

Professor Harry Marsh 1926-2023

Professor Brian Rand, Emeritus Professor, University of Leeds

Harry Marsh, Emeritus Professor of Chemistry at The University of Newcastle passed away peacefully on 25 September 2023. He is survived by his wife Audrey, his two children Rosalind and Alistair and grandchildren.

From the nineteen sixties through to the early 21st century he was one of the most important figures in the field of carbon materials science and chemistry. His work covered many of the important aspects of the subject at the time and he leaves a substantial legacy of published work comprising some 250 articles in refereed journals another 250 or so of conference proceedings and 6 edited or co-edited books, all involving some 190 co-workers, many international. This body of work to date has attracted some 8264 citations in 6279 documents (SCOPUS) and a number of prestigious awards. The George Skakel Memorial Award, from The American Carbon Society, was awarded for improving interactions between academia and industry; The Henry H Storch Award, from The American Chemical Society, was in recognition of his role as an outstanding educator and his numerous contributions to the understanding of coal carbonization and the gasification reactions of coke and carbon; The Joseph Becker Award, by the Iron and Steel Society of the American Institute of Mechanical Engineers, was for distinguished achievement in the field of coal carbonization, and the George D. Graffin Award, also awarded by the American Carbon Society, was in recognition of significant ability as a lecturer and communicator in the general area of carbon science. In addition, he was awarded life memberships of the DKG (The German Ceramics Society) and The Coal Research Forum of the United Kingdom. In 2006 he received the Lifetime Achievement Award by the British Carbon Group in association with the Royal Society of Chemistry, The Institute of Physics and the Society of Chemical Industry. It was in recognition of his outstanding contribution to Carbon Science over a period of about 60 years and is an award that he particularly cherished.



Harry began his research career under the supervision of Prof Lord Wynne-Jones and Herbert Blayden at King's College, University of Durham, later to become Newcastle University, on the structure of coal. He then became a lecturer in the university working in the Northern Coke Research Laboratories where he could develop his own studies. This early research work was mainly concerned with the fundamentals of oxidation of carbon with emphasis on the role of chemisorption and that continued with some significant studies of the reaction with atomic oxygen. Reactivity of carbon was a topic he returned to over the years many times. Soon his work turned to the topic of activated carbon and the nature of adsorption in microporous carbons and coals, which in later years led to the co-editing of two books on the subject. This work focussed partly on the understanding the pore development of such materials and significantly on the problems of analysis of adsorption isotherms which led to the use and interpretation of the Dubinin methods of analysis and emphasising the use of carbon dioxide as an adsorptive for such nano-porous materials. The next topic to excite his interest was the nature of the optical texture of cokes and carbons as elucidated by polarised light microscopy and specifically the role of the carbonaceous mesophase in controlling this structure. This became a major area of research and his group produced many seminal papers in this field and he lectured on it widely.

The Northern Coke Research Laboratories had been funded by annual grants from The British Coke Research Laboratories but when these laboratories closed Harry had to turn to other resources. He turned to industry as well as national bodies to support his activities and in this he was remarkably successful. As testified by the awards he received, he was remarkably able to identify and address the key scientific aspects of industrial processes that were amenable to investigation making his work extremely relevant and topical. Harry's many areas of investigation can thus be summarised as:

Coal

- Effects of igneous intrusions into coal seams.
- Microporosity in coals: critical assessments of adsorption phenomena in all ranks of coals.
- Surface functionality in coals.
- Macro-molecular structure of coals.
- Combustion of coal
- Coal carbonization and co-carbonization (hydrogen transfer theory and the concept of liquid crystals).
- Effects of coal charge pre-heating in cokeries.

Carbon and Graphite

- Carbonization theory of coals, pitches, resins and woods.
- Adsorption and surface chemistry: porosity and surface functionality of coals, activated carbons and graphites.
- Gasification/oxidation/Hydrogasification: kinetics and surface topography of gasification by oxygen, carbon dioxide, hydrogen and atomic oxygen.
- Structural analyses by X-ray and electron diffraction, optical texture, transmission electron microscopy and scanning electron microscopy.
- Composites: including metallurgical cokes, carbon-fibre systems, including carbon-carbon brakes.

Harry's work attracted students from all corners of the globe and he had many friends and colleagues with whom he collaborated. He spent many summers in the laboratories of Prof. PL Walker of Penn State University and his other main interactions were with Prof. Isao Mochida of Kyushu University in Japan, with Prof. Federico Rodriguez-Reinosos of Alicante University and with Dr Rosa Menendez of INCAR (Oviedo). He was an outstanding teacher and communicator of his research findings and was greatly loved and respected by his many students and collaborators who will remember him with affection.



*Harry Marsh with Stanislaus ("Stack") Mrozowski
(The 'father' of nuclear graphite research)*

Professor Harry Marsh : Personal Thoughts

Dr Steve Ragan, Senior R&D Adviser, Jacobi Carbons Group

In my view it is difficult to isolate any particular aspect of carbon science at the core of HM's career. As was recited at his cremation his professional output encompassed 503 papers, 5 books, 49 post graduate students, 81 visiting colleagues from 18 countries etc., etc.

This said, in my involvement with him, two things reverberate, "Mesophase" and "Contacts". The repeated theme of work upon coals, coal & petroleum liquids, their liquid crystal form during carbonisation and the resultant properties of coke or graphite made up the largest "theme" in my experience. He utilised the research work of his students, teamed with the expertise of overseas visitors to fully characterise this phase. Initially using in house optical and electron microscopy combined with the skills of visiting "contacts" such as Mochida-San he began description of the liquid crystal phase and resultant coke properties. Introducing new techniques, such as proton NMR, through contacts such as Yokono-san, he led description of the chemistry of this phase. He characterised the graphitising products through XRD (Oya-San), LEED, Auger, EDX and Transmission electron microscopy, in house, creating a continuum structural model for carbon from early solid phase to graphite. To optimise output, he used injections of knowledge from visiting experts outside of the group from coal science – Goodharzi, Crelling etc., through to industrial graphite manufacture, e.g., Ed Heintz, supplementing the knowledge base. He exploited any, and all, sources of funding he could to support this teamwork, ECSC, Wolfson, Ashland Oil to name a few. Throughout there was development of students attending and publishing at all the major conferences to identify new skills and contacts that could later become visitors.

So, perhaps, it was this battle for finance to pay for it all that was his greatest achievement in carbon science, some ~£4 million at his "retirement" in 1991.

My Memories of Prof. Harry Marsh

Norman Parkyns, Former BCG committee member

I was sad to hear that Harry had died but on the other hand he had had a long and active life, certainly filling each unforgiving minute of it. Others will no doubt fill in the gaps of his wide-ranging activities in the fields of coal and carbon science, so I'll confine myself to how I got drawn into his orbit. My memory is showing the alarming

gaps of old age, so any dates are a matter of guesswork as I have got rid of most of material relevant to this memoir, first when I retired and then after I moved house. What follows comes from an increasingly misty past. I did have a tenuous early link with carbon but not with Harry by my PhD studies underneath the aegis of Prof A R Ubbelohde in the Chemical Engineering Department of Imperial College. Although I worked in the Carbon Research Lab there, I wasn't actually engaged on graphite research like my colleagues, although a lot of what they were doing must have entered my thinking by a sort of process of mental osmosis. I left there in 1960 to work in the research labs at Fulham of the nationalized Gas Industry. Most of my work there was related heterogenous catalysis in which carbon generally plays little part except as a ***** nuisance (I hope Steve Tension will forgive this provocative statement).

Things moved on and not only did I become more senior in the lab management structure but the industry changed radically. Natural gas came along and we morphed into the British Gas Corporation. Naturally, research into gas manufacture took a back seat until the World got the two big Energy shocks in the 1970s and the era of cheap oil disappeared. Indeed, at that time a major worry was that oil reserves would run out by the end of the century. Coal, the hitherto despised and dirty fuel, was the future. I have of course to remind younger readers that at this time the greenhouse effect was well below the horizon of planning for the future of energy. British Gas, because of the major North Sea discoveries was just phasing out the last of its coal gas generators but research going back well before the War led by Dr F J Dent, had suggested that a radically new type of reactor using steam and oxygen at high pressure to make gas from coal was the way forward. The Americans were genuinely worried about the possible short fall in oil production and having large reserves of coal used for electricity, decided to fund new technology on big scale and we were recipients of a grant to build this reactor at Westfield in Scotland, using Dent's forgotten process. In the end, we took this work into our own programme so that, should natural gas start running out we had a fallback position to cover future gas supplies.

It was therefore around this time that my path and Harry's finally crossed. My group was tasked with fundamental work on characterizing coal in which Mark Thomas took a leading part and I had to mug up the subject in a hurry. British Gas already had a longstanding connection in fuel technology with Leeds University but we quickly found out that there was another major university group at the Northern Carbon Research Laboratory within Newcastle University, so off I went. Harry's name was not unknown to me because my PhD supervisor had founded the SCI Carbon and Graphite group in which Harry became very active and finally its Chair. I had also read some papers on gas/solid adsorption on carbon surfaces in which his name figured prominently so I was quite interested to see what he was like in the flesh. I found very quickly that he was not someone you forgot in a hurry. He was the complete obverse of the absent-minded professor of popular imagination. He was smartly but conventionally dressed, although he favoured wearing bow ties rather than the conventional fishtail ones. He was not someone to let grass grow under his feet and we had an in-depth tour of the lab. I think he smelled possible research funding and after all, why not?

After that, we met fairly regularly and supported the NCRL through the CASE studentship scheme. Coal was now firmly on the agenda in national planning for future energy supplies and the newly created Department of Energy became increasingly important. Meetings on coal science multiplied and Harry with his entourage of students never took a back seat. He didn't actually wave a banner but he made it clear he and they had had a stake in this field and the NCRL had important things to say, as indeed, it did. He always had the sign-off line that included somehow the Kingdom of Northumbria. He was of course by birth and temperament, a very proud son of the North-East of England.

Things had changed elsewhere as well. The main fuel industries, coal, gas and electricity were still nationalized, this being pre-Thatcher days, and even BP was then 50% owned by the UK government. Amazingly (or not perhaps) there didn't seem to have been any formal way in which research programmes were coordinated at a working level between the nationalized industries. Thus, it was that the National Coal Board (NCB) and British Gas finally realized that we had things in common to discuss about what sort of coal worked best in our new process, and I was nominated to represent British Gas on a working party to make sure we were marching in step. Harry was not directly involved in this but I saw no reason why I shouldn't discuss the proceedings with him: after all, he had been doing this sort of work for years and was well known to the NCB researchers. In any case, we published a resume of our workings a bit later in the journal "Fuel" so there was no secrecy about it.

The other thing that arose from these meetings was the realization that there a general need for an organization where all those who worked with coal either in research or in its utilization, could meet to discuss ideas and simply to exchange useful information. Harry took this idea up with characteristic energy and we set up a meeting inviting all those interested in any way to come along and say what they thought. I played a modest role in this by arranging the venue on British Gas premises while Harry, assisted by Jim Harrison, who was director of the NCB's Stoke Orchard labs., drove the meeting on to form what became the Coal Research Forum. This did a very good job in providing the forum of the title.

As ever, times change. Oil is now in abundant supply, realization of the deleterious effect of CO₂ emissions is now well-established, coal is again yesterday's fuel but the Forum still exists as the Fuel and Energy Forum, something that would have caused Harry great satisfaction.

Harry subsequently invited me to become a member of the NCRL's supervisory committee. I realize now that that was something of an honour, the other members being people like Dr Joe Gibson who had been director of research for the NCB. The NCRL was nominally part of the Department of Chemistry of Newcastle University so Prof. David Whiffen as head of the department was also involved. David was a distinguished physical chemist but I suspect that he would not have included coal science as one of his scientific interests, so the relations between him and Harry must have been interesting when it came to sharing out Departmental revenues. Harry never let on if this caused problems but it has to be said that Harry's reputation was such that he had no difficulty in attracting funding from both the UK and overseas. Many distinguished scientists from all over the World beat a path to the door of his laboratory.

Harry was also a senior editor of "Fuel". This journal had been founded in the 1920s as part of the general realization that Britain needed a much stronger scientific base to support its industries. Coal was of course one of them at that time and the new journal had the backing of the foremost academic fuel technologists. The successive oil crises of the 1970s put coal back in the forefront of thinking about energy matters and Harry with characteristic energy, seized the chance to put Fuel well to the fore. I was bombarded with requests to referee papers from all corners of the World, of pretty variable quality I have to say and even served on the editorial board at his invitation.

I think I'll stop there. Many of you knew Harry and don't need me to say anything more.

BCG Bursary Recipient: American Chemical Society Fall 2023 Report

Simon Wikeley, University of Bath

ACS Fall 2023 took place between 13-17th August at the Moscone Centre in San Francisco. The conference was attended by approximately 12000 people, including representatives from industry and academia (including two of the three current Nobel prize holders in chemistry). I presented my research on the first day in the 'Advances in Electrochemistry' session. My presentation, entitled 'Polymer Indicator Displacement Assays in Electrochemical Sensing' was well received, with several audience members engaging in interesting discussion about my talk both during the audience questions segment at the end of my talk and afterwards too. Several other interesting talks were given in the session, including a talk from Eric Bakker (University of Geneva) on using capacitance methods to reduce the potential drift when detecting ion concentrations in river and lake samples.



Later in the conference I had the opportunity to attend a talk by Nobel prize winner Dr Carolyn Bertozzi (Stanford) entitled 'Targeting the glycocalyx for cancer therapy'. While this topic may not have been directly relevant to my current area of research, I found it to be a very engaging and thought-provoking talk about an avenue of cancer treatment I was not previously aware of, involving the specific targeting and removal of sialic acids on the cancer cell glycocalyx (a layer of multifunctional glycans covering the cell surface of both normal and cancer cells) to enable immune cells to kill the desilaylated tumour cells. Dr Bertozzi is an excellent public speaker, and listening to her talk gave me some pointers as to how I could improve my presenting skills.

During the conference I had the opportunity to attend three separate networking events, the Graduate student reception, Analytical division reception and International welcome reception, which provided a further chance to discuss my research with academics from many backgrounds, and generally learn more about different academic career paths and options. At the Analytical division reception, I talked to Professor Renato Zenobi (ETH Zurich) about his work on Tip-Enhanced Raman Spectroscopy (TERS), which he had presented during the Analytical division awards session earlier in the day. The opportunity to make these contacts and discuss research with distinguished academics was both interesting and potentially useful in both my current and possibly future academic pursuits.

In summary, the ACS Fall 2023 San Francisco conference was a great and enjoyable experience. I benefitted significantly from the networking opportunities, interesting talks and the chance to present and discuss my work with fellow researchers in electrochemical sensing.

NanoteC 23: A Review

Our flagship annual nanocarbon conference **NanoteC'23** ran successfully again this year from 29th August to 1st September, this time hosted by Sussex University. The BCG are very grateful to Prof. Alan Dalton and all his group for the excellent organisation (particularly to Hannah and Chris, who were juggling conference organisation with PhD vivas!), stellar speaker line-up, and fantastic social programme, that notably included a memorable no-holds-barred game of cricket (complete with NanoteC umpire hats!) Thanks to the conference sponsors (Advanced Materials Development, Beilstein Journal of Nanotechnology, and Attonuclei), there were two poster prizes this year, which were won by Raquel Cano Cordero and Gabriel Coulter. We include here a brief write-up from Raquel and Gabriel's winning poster.



Many thanks to the Materials Physics group at Sussex for organising NanoteC23!

*Date for the diary – **NanoteC'24** will be in Nantes, France at the end of August 2024!*



NanoteC 23: A Winning Poster

Raquel Cano Cordero, University of Sussex

I'm so grateful to have been given the opportunity to write some words for the BCG Newsletter; I think this is the final touch of a hectic month, which started with NanoteC23, and from which I will remember the amazing people I had the opportunity to meet. I feel incredibly privileged to have attended this congress as part of the organising research group. The congress made sure that everything went perfectly, not only in the scientific field, but also ensured that all the attendees had a memorable time (I'm sure no one will forget that karaoke night at The Swan Inn or the cricket match).

Without a doubt, what I appreciate most about events like this is not only having the opportunity to attend lectures by experts in the field and appreciate their career-long work, but also to meet other students who experience the same joys and struggles during their research, and with whom to exchange advice and experiences.

At NanoteC23 I had the chance to present my poster "Next-generation nanocomposite strain sensors", where I talk about the work I did during my first year as a PhD student in collaboration with NASA. This project involves developing nanocomposite strain sensors utilising liquid-exfoliated graphene nanosheets and commercially available silicones. The graphene network is structured via emulsification to produce graphene-coated silicone droplets called G-Balls, enabling high conductivity at relatively low graphene loadings.

When combined with a highly elastic, flexible silicone matrix, this yields excellent electromechanical properties with a robust exponential response to applied strain. These emulsion-templated composites are robust to more than 500 cycles up to 100% strain and at a strain rate of 100%/s. The sensors exhibits good ohmic conduction, featuring an extremely high relative resistance change of 2×10^5 and a Gauge Factor of ~ 75 . Moreover, these composites exhibit minimal hysteresis when deposited on a substrate during cyclic strain, providing wide range of real-world application potential in the medical, aerospace, automotive and other industries. To conclude, I'd like to thank Chris Brown, Hannah Wood, and Alan Dalton for organizing such an amazing conference, and to the poster juries that selected me as one of the winners. See you all at NanoteC24 in Nantes!

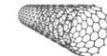
Reductive processing towards versatile, graphene-based, functional inks

Gabriel Coulter,^a Noelia Rubio Carrero,^c and Milo S. P. Shaffer^{a,b,*}

Department of ^aChemistry, ^bMaterials, Imperial College London, UK; ^cDepartment of Organic and Inorganic Chemistry, University of Alcala, Spain
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Introduction & Motivation

Graphene and other 2D materials hold promise for a variety of applications. Use at scale requires robust & versatile synthesis, modification, and processing techniques.

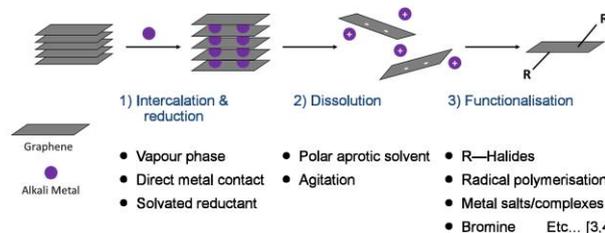
State of the art top-down, liquid-phase techniques are often low in monolayer yield, requiring post-processing steps and additives for effective processing.[1]

Charge-based, reductive processing techniques can address these issues:

- High monolayer yields of many 2D materials at appreciable concentrations.[2]
- Reduced nature offers a simple route for further modification/[3,4]

Reductive dissolution and functionalisation of graphene is explored, towards functional ink applications.

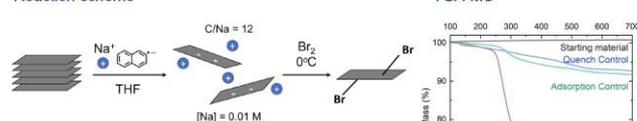
Reductive dissolution and functionalisation



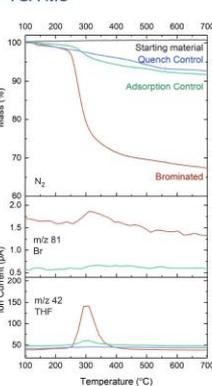
Functionalisation

Versatile brominated intermediate (air-stable)

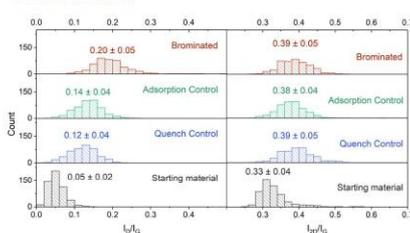
Reaction scheme



TGA-MS



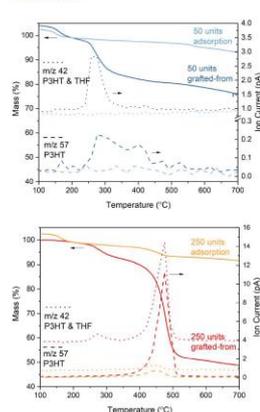
Statistical Raman



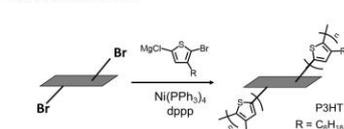
Graft-from of conjugated polymer P3HT

- Well-studied, conjugated polymer system - potential optoelectronic applications.

TGA-MS



Reaction Scheme



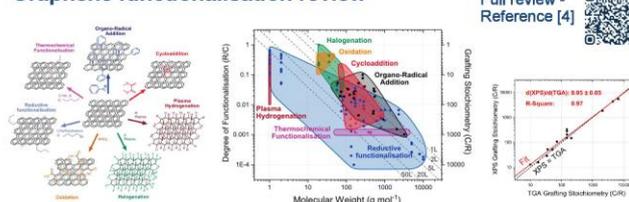
XPS

Table — Functionalisation summary data, as calculated from TGA-MS and XPS analyses. a) Calculated from XPS atomic %. b) Calculated using control mixture TGA-MS peak area analysis. c) Estimated using wt% and monomer unit Mw.

Sample	C/R ^a	wt% P3HT ^b	Length ^c (3HT units)	C/S _{TGA}	C/S _{XPS}
G-Br	263	-	-	-	-
G-P3HT ₅₀	526	10.0	~5	116	71
G-P3HT ₂₅₀	526	38.4	~27	29	31

- Air-stable brominated graphene intermediate synthesised: C/Br = 263.
- Relatively small disturbance to graphene framework.
- Controllable, subsequent functionalisation of π-conjugated P3HT demonstrated, grafting ~5 and ~27 3HT units to the graphene surface.

Graphene functionalisation review



Survey of graphene grafting reactions.

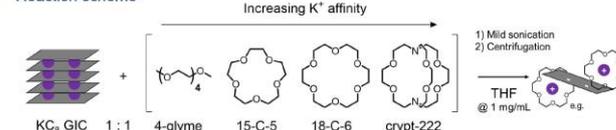
- Clear dependence of functionalisation degree on functional group Mw.
- Good agreement XPS and TGA.
- Highlights importance of exfoliation.

Dissolution

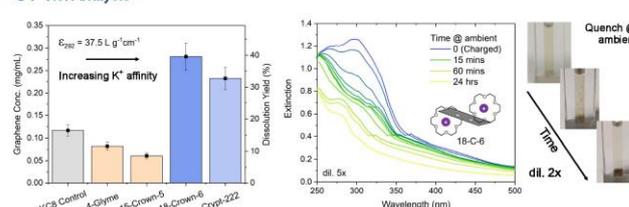
Controlling counterion solvation

- Macrocycles with correct cavity size can improve cation solubility.
- Should assist grapheneide dissolution and stability — solution thermo. and DLVO.

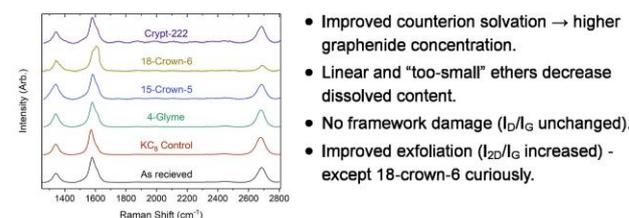
Reaction scheme



UV-Vis. Analysis



Raman Spectroscopy — Statistical map averages



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Acknowledgements

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Connect



Carbon 23: A Review

Dr Natalia Martsinovich, Treasurer of the British Carbon Group

Carbon 2023 – The World Conference on Carbon – took place on 16th – 21st July 2023 in Mexico, in the fantastic location in Cancun / Riviera Maya. The conference was a success, with over 300 attendees from 30 countries in the Americas, Europe, and Asia, with 166 oral presentations, 168 posters, and a great selection of plenary talks.



Prof Sir Andre Geim talked about how his scientific curiosity led him to be awarded the Nobel Prize in Physics, as well as the igNobel Prize. Prof Alberto Bianco from CNRS Strasbourg in France presented his research on the applications of carbon nanotubes and graphene-based materials in nanomedicine. Prof. Magda Titirici from Imperial College London, UK, talked about her research on obtaining value chemicals from biomass, and about novel applications of carbon in batteries. Dr Olga Shenderova from Adamas Nanotechnologies Inc. in the USA talked about developing fluorescent diamond particles for imaging and sensing. Prof. Hirotomo Nishihara from Tohoku University, Japan, discussed template carbonization for functional materials.



Environmental applications of carbon were one of the key themes of the conference, highlighting how carbon and carbon-based materials can be used for sensors, CO₂ capture, hydrogen storage, removal and degradation of pollutants. Several talks reported activated carbons produced using natural sources, such as seaweed and agave plant. For me as a computational chemist studying graphene-based materials, the sessions on graphene and graphite were of particular interest, for example Prof. Artem Mischenko from Manchester presenting intriguing electronic properties of multilayers of graphite on hexagonal boron nitride, Dr Bruno Camargo from Warsaw talking about electronic properties of

graphite nanobelts, and Dr Jacob Martin from Curtin University in Australia presenting computational modelling of adsorption of hydrogen in nanoporous carbon, and mechanism of graphitisation of organic precursors. Nuclear graphite was also discussed, with Prof. Ke Shen from China discussing characterisation of nuclear graphite, and Dr Alex Theodosiou from the University of Manchester and the British Carbon group presenting a pilot study of decommissioning nuclear graphite.

The highlight of the social programme was the show in the Xcaret adventure park, which showcased the culture and history of Mexico from the Maya to the present day. Big thanks to the organisers for making sure that conference participants got to and from the show without getting lost in the crowds in the adventure park, and overall for organising a very interesting and enjoyable conference!



INGSM 23: A Review

James McGladdery, National Nuclear Laboratory

The 23rd International Nuclear Graphite Specialists Meeting... in 2023!? Yes you read that right, for all its hardships one of the silver linings of COVID was the alignment of the number of INGSMs with the year it takes place! It was also the first time the conference has been held in person this decade, meaning it was as first for many of its attendees. Situated in the cultural phenomenon of Aachen Germany, delegates were treated to the late summer sunshine and ample opportunity to visit Germany's first UNESCO world heritage site; Aachen Cathedral in the centre of the city's old town.

The world's only conference dedicated to nuclear graphite summoned speakers from all over the globe, where, over the next 4-days, a story of graphite's past, present and future was told. Starting with the present, modelling

the performance of graphite in the UK advanced-gas cooled reactor was a familiar theme for the first session. After an overview presentation from EDF's Jim Reed, the detail quickly developed after a flurry of excellent presentations given by Frazer-Nash, NRG Petten and PhD students from the University of Manchester, who claimed the title of the conference's largest cohort of delegates.

The second session was chaired the local hosts of the Julich research centre. Concentrating on the theme of waste and reprocessing, the audience were treated to insights from the decommissioning of the Arbeitsgemeinschaft Versuchsreaktor (AVR) - Germany's pebble-bed test reactor. Designed and operated just a few miles up the road, the AVR has created a lasting alignment between the town and nuclear graphite. So much so in fact, that the surrogate pebbles manufactured at the research facility can now be found as a centre piece in one of the city's many art installations.

The remaining sessions were heavily themed on future challenges in graphite and its application in future reactors. Presentations on microstructural characterisation demonstrated how much is still unknown about graphite, and it was the first time ever that atomic resolution electron microscopy images were presented by China's Professor Ke Shen that illustrated the interstitial irradiation damage of graphite atoms. Remaining topics were focussed on the performance of graphite in the new higher temperature reactors, from irradiation performance and thermal oxidation to phenomena in molten-salt reactors and even "matrix graphite" – an area of discussion that has only grown in recent years.

It was evident that while INGSM underwent its brief, virtual interlude, that it had returned in full force in 2023. Reinvigorated and experienced stewards prompted thoughtful discussion in every talk, and the diverse range of new delegates brought an equally matched level of creativity and new topics. Many will have made fond memories in Aachen as their first in-person INGSM, and for a little town on the western border of Germany, it has certainly left some big shoes to be filled by next year's conference in San Fransico, USA.

Future Event : ChemOnTubes Conference

7-11th April 2024, Strasbourg, France

This conference (organized every two years) aims at providing an international forum on the chemistry, (nano)technology and applications of carbon nanoforms and other low-dimensional materials, including carbon nanotubes, graphene-based materials, fullerenes and (graphene) carbon dots. The conference will showcase the latest developments at the multidisciplinary frontier of nanostructured materials and devices.

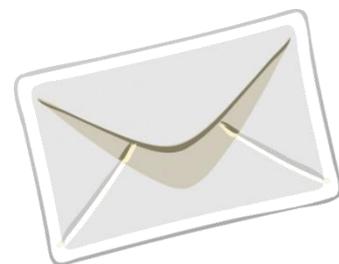
The conference will cover all areas related to carbon nanotubes and related graphitic material chemistry spanning their synthesis as well as their functionalization, using covalent and non-covalent approaches, for composites, gels, coatings, membranes, (bio)sensing, electro- and photocatalysis, energy conversion, electronic devices, biomaterials, biomedicine, computational studies and artificial intelligence.

All key information and the registration link will be found soon on the website of the Congress: <https://chemontubes2024.sciencesconf.org/>

Contact to the Group

The BCG welcomes feedback 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 samantha.wilkinson@uknnl.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 2024.
