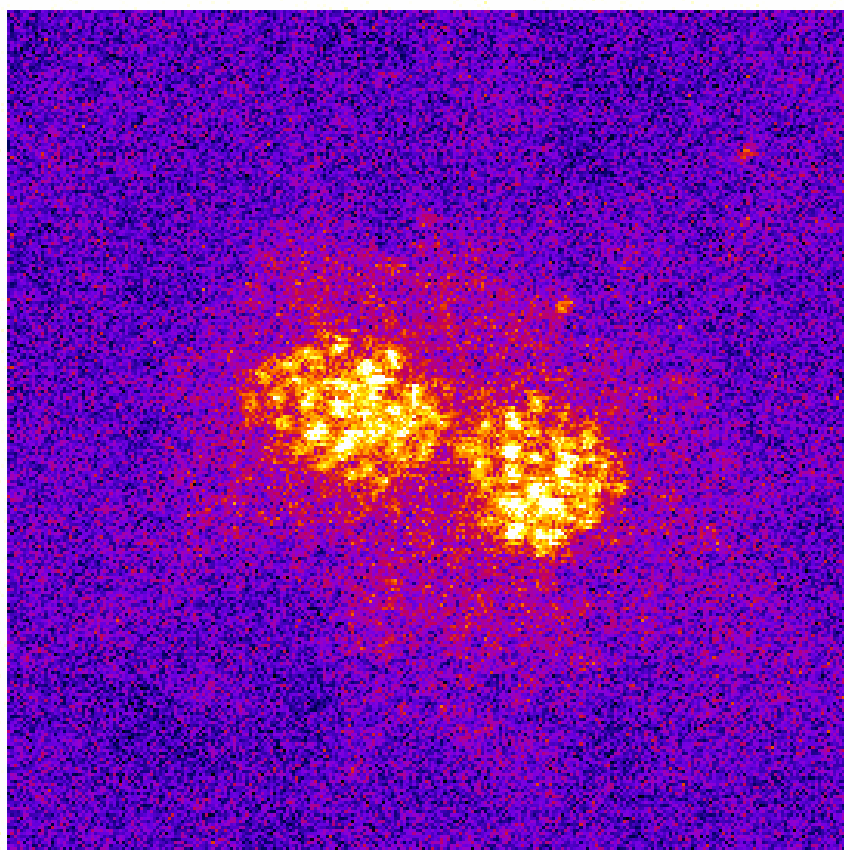


Centre for Doctoral Training in Fuel Cells and their Fuels

**Newsletter
Volume 1
Issue 2
Apr. 2015**



[hfc-cdt-editors@
contacts.bham.ac.uk](mailto:hfc-cdt-editors@contacts.bham.ac.uk)



[@FuelCellsCDT](https://twitter.com/FuelCellsCDT)



CDT Fuel Cells and
their Fuels

UNIVERSITY OF
BIRMINGHAM



Loughborough
University



The University of
Nottingham

Imperial College
London



UCL

Welcome

Welcome to the April 2015 edition of the new newsletter for the Engineering and Physical Sciences Research Council funded Centre for Doctoral Training in Fuel Cells and their Fuels which is a research partnership between the Universities of Birmingham, Nottingham, Loughborough, Imperial College London and University College London.

This newsletter was compiled by University of Birmingham Editors James Walker and Aimee Jackson with contributions from Site Editors Tom Heenan (UCL), Daniel Smith (University of Nottingham), and Sharleigh Talbot (Loughborough University). The editors are grateful to Project Officer John Hooper for his assistance. Readers can contact the editors with comments and contributions at:

hfc-cdt-editors@contacts.bham.ac.uk



Top: Aimee and James.

Bottom: Daniel, Sharleigh and Tom.

Thanks to Caroline Blackmore for our cover image: the spectacular platinum/titanium clusters. Have a look at our publications section for more details. Other highlights in this edition include an insight into the recent STFC Early Career Researchers conference and a round-up of public outreach activities from across our network.

Contents

Events & Activities	Page 3
Outreach	Page 9
Upcoming Events	Page 11
Publications	Page 12
Other Announcements	Page 13

What Have We Been Up To?

Communicating with Policy Makers & Nottingham visit

Some of Birmingham's PhD students joined Nottingham's Dan Smith in attending a workshop in the University of Nottingham Energy Technologies Building (ETB) on Thursday 26th February on 'Communicating with Policy Makers'. The workshop, hosted by Midlands Parliamentary Outreach Officer - Clare Mullin, gave the researchers an insight into how parliament works, and how this might be relevant to their research. Clare provided tips on how best to engage parliamentarians in research in order to bridge gaps in knowledge or legislation. Did you know that the House of Lords actually pass more amendments to legislation than members in the House of Commons? Or that the Chancellor of the Exchequer is the only person allowed to drink alcohol on the House of Commons floor?

Before the workshop the group were treated to a tour of the building organised by Richard Davies who works in the Power Electronics, Machines and Control Group on grid balancing research. The tour encompassed an insight into the fossil fuel research

ongoing in the Centre for Doctoral Training in Carbon Capture and Storage and Cleaner Fossil Fuel's labs, and ended with a visit to the ETB's hydrogen refuelling station. The refueller, pictured, contains an electrolyser, dehumidifying membrane and storage tanks sufficient to store up to 25 kg of hydrogen. The gas is used to supply fuel cell powered vans which operate on campus.

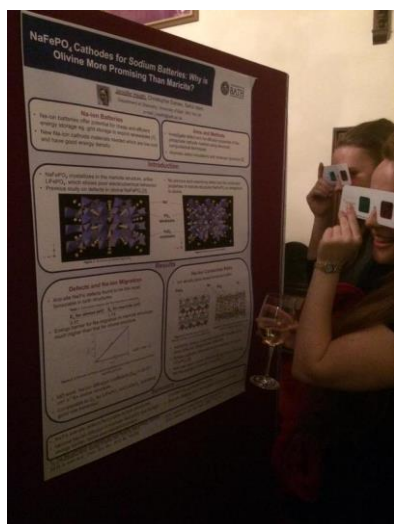


Left to right: Lois, James, Daniel E.L., Daniel S., Aimee and Laura.

STFC ECRC Conference

March saw the launch of the first STFC Early Career Researchers Conference (ECRC) at Coseners House, Abingdon, attended by CDT students from UCL and Birmingham. Over the two days, 30 speakers and 18 posters were presented, covering a large range of topics encompassing all electrochemical devices, including fuel cells, batteries and supercapacitors; from fundamental

DFT modelling through materials and characterisation all the way to pilot plant studies. Plenary speakers included Prof Bill David (University of Oxford, STFC Senior Fellow at ISIS), Dr. Kevin Fahey (CEO, Zeiss), and Dr. Ralph Clague (Head of Systems and Architecture at Intelligent Energy). The conference has been set up specifically to provide the opportunity for researchers at the early stages of their careers to meet up to share their experience of research in this interdisciplinary field.



Aimee and Laura enjoyed the winning poster's use of 3D.



Delegates standing outside the venue. Photo courtesy of UCell.

Aberdeen Hydrogen Launch

On the 11th of March, James Walker, headed home to Scotland to attend the launch event for H₂ Aberdeen's hydrogen production and refuelling station. The Aberdeen Hydrogen Project contributes to efforts under the European Fuel Cells and Hydrogen Joint Undertaking and the project attracted funding from the EU, Scottish Government and Innovate UK. With this funding the city has invested in a fleet of ten Van Hool fuel cell buses, to be operated on key commuter routes across Aberdeen, and electrolysis and storage facilities to keep the buses fuelled with hydrogen.



Aberdeen's hydrogen refuelling station.

Guests at the launch event were given a

tour of the production site where operators BOC are working with utility provider Scottish and Southern Energy to evaluate the correlation between peak hydrogen demand and electricity generation from wind with a view to integrating renewable generation into the project's infrastructure. At the launch event Aberdeen City Council Leader Jenny Laing reflected on the international significance of bringing the biggest fleet of fuel cell buses to 'Europe's Energy Capital' and laid out her vision for the city's transition towards becoming a "smart hydrogen city" of the future.

Low Emission Transport London: the Role of Hydrogen

Current first year CDT students, Lois and Laura, enjoyed a day in London at the "Low Emission Transport: The Role of Hydrogen Event" held at City Hall. The event brought together industries, government representatives and people from research institutes to discuss the developments being made in sustainable travel around London.

Hydrogen London hosted a fantastic event which saw talks from H2 Aberdeen, Transport for London, Element Energy, Hyundai and Intelligent Energy. Lois and Laura were caught out

by Intelligent Energy paparazzi and featured on their Twitter feed observing a demonstration of the Upp: their portable fuel cell mobile phone recharging unit.

The event closed with the signing of two



Laura and Lois snapped while enjoying a demonstration at Intelligent Energy's stand.

new memoranda of understanding, one of which is between Hydrogen London and the Scottish Hydrogen and Fuel Cell Association, which aims to increase collaboration between the organisations. The second, signed between Microcab and Cinque International, seeks to bring a fleet of hydrogen fuel cell vehicles to an Italian car club. It is hoped that these memoranda will encourage greater synergy in the hydrogen communities in the UK and further afield.

Loughborough Visit



Old and new students admiring Loughborough's plane.

In March the new CDT students from Birmingham and Nottingham made a trip to visit their peers in Loughborough. The visit began with a presentation from each of the participating students, explaining where they were up to in their projects, and their plans for future work. This was followed by tours around the aeronautical engineering and chemistry labs used by the students at Loughborough. The day finished with a tour around the Intelligent Energy labs, hosted by some of the Doctoral Training Centre's previous students. This was the first of the student tours of our partner institutions for the new cohort.

Tales from the Institute of Transportation Studies, UC Davis

Scott is currently working as a visiting scholar in the Institute of Transportation

Studies (ITS), at UC Davis in California. The ITS is a global leader in emerging transportation issues, the centre has 120 post-graduate students, and 60 researchers and faculty. The visit is being conducted as part of the CDTs socio-economic research, this research is looking to understand who the early adopters of fuel cell vehicles will be, and why they will adopt them. Scott has been interviewing owners of Tesla electric vehicles in the San Francisco Bay area and Sacramento area. In addition to this research Scott has been to the California Fuel Cell Partnership and has spoken with Honda, Hyundai and Daimler about their fuel cell vehicle roll out strategies.



Scott with the Honda Clarity at Linde's hydrogen filling station in Sacramento.

When asked about his activities, Scott had this to say: “the future for fuel cell vehicles in California looks bright, the state government is building a network of 100 hydrogen fuelling stations, and automotive OEMs, particularly Honda, Daimler, Hyundai and Toyota are very supportive of fuel cell vehicles”.

He went on to add that “California is nice.”

Photochemistry and Solar fuels Workshop

On the 1st of April, students from Loughborough and Birmingham attended the first Photochemistry and Solar Fuels Workshop held at Imperial College. The day was highly interesting, with talks by some of the most notable people within the field, including James Durrant, and Junwang Tang. All of the talks were specific to the solar to fuels field, which is a rare treat for researchers in this promising niche area. They did however cover a range of topics such as kinetics, charge separation and transfer, and electrode synthesis.

Nottingham Lecture

In March, Imperial College’s Professor Nigel Brandon OBE FREng delivered a

lecture at the University of Nottingham entitled “The role of fuel cells and energy storage in low carbon energy systems.” This formed part of a series of talks organised by the Midlands Energy Consortium.



Professor Brandon’s presentation.
Photo courtesy of MEC.

Points of focus included the annually incremental targets for improvement in fuel cell technology and the UK’s 2050 CO₂ reduction target which equates to a vehicular CO₂ release, if the target is to be met, of 20 g CO₂ per Km or below. Professor Brandon informed the audience of the hydrogen-powered Route 52 bus which travels through Covent Garden and is a fully operational example of hydrogen fuel cell technology being successfully integrated into the public transport network. Also presented were stationary fuel cell applications for use in homes, the importance of combinations of technologies being used to meet the UK’s energy challenges, and a rather

exciting around-the-world hydrogen fuel cell-powered yacht project. Thanks to Professor Brandon and the Midlands Energy Consortium for organising this informative and enjoyable talk.

Brass in Concert

Congratulations are in order for Nottingham CDT student, Daniel E. Smith! On Friday 20th of March a 12 minute composition for brass band, written by Daniel, was given its first performance in a concert at the Elgar Concert Hall by the University of Birmingham Music Society Brass Band under conductor Stuart Birnie. The piece, entitled 'Reflection and Celebration', was composed in three movements and was selected as a winning composition in the University of Birmingham Music Society's Composition Competition 2014. The concert was very well attended by students, staff and members of the public. Daniel was very pleased with the premiere and is grateful for its enthusiastic reception by the audience. He hopes to have the piece published.

Daniel is a keen conductor, composer, pianist and chorister, and will be performing as part of the chorus in two BBC Proms concerts at the Royal Albert

Hall this summer, one on Sunday July 19th with the CBSO and the other on Friday September 11th with the Vienna Philharmonic Orchestra.



Daniel introducing 'Reflection and Celebration'.

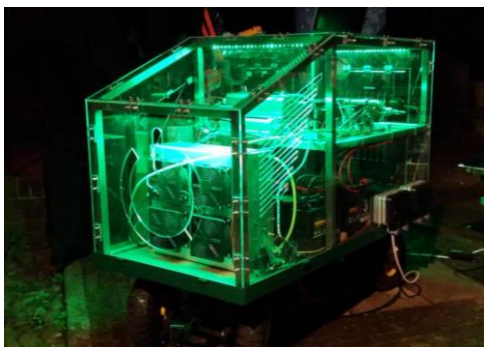
Outreach Activities

Cambridge Science Festival

At this year's Cambridge Science Festival, UCell presented an array of fuel cell technologies in the Chemistry Department and demonstrated a number of experiments from different fields of chemistry.

UCell at the STFC Conference

Heated drinks were provided by UCell's fuel cell during poster presentations at the STFC Batteries Early Careers Researchers Conference. The newly lit green fuel cell promoted discussion on



UCell's fuel cell outside the venue.

the applications of ongoing research and the importance of public outreach.

Demonstrations in Lebanon

UCell researcher Dina Ibrahim visited the American University of Beirut and Lebanese Baccalaureate High School to give a benchtop fuel cell demo and a discussion on hydrogen technologies.

Ingenious Public Engagement Grant

UCell won funding to engage audiences with engineering from the Royal Academy of Engineering's Ingenious Public Engagement Grant. This is fantastic news, and will enable them to continue with their outreach at many events.

Elutec Visit

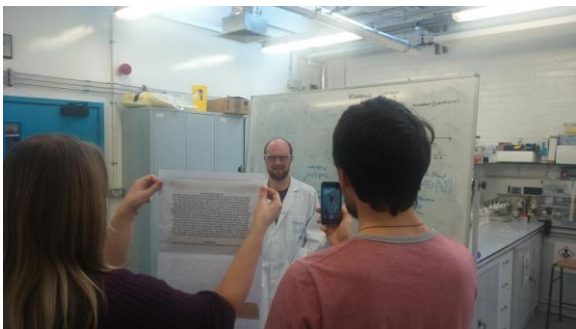
The UCell team visited Elutec College of Design and Engineering for a second consecutive year to showcase electrochemical energy and some of UCL's research. Potential students to the technical college enjoyed many different presentations about different facets of science, technology, and engineering.



The UCell team.

Shawlands Primary School Movie Makers

With a bit of technical assistance from some colleagues, James Walker recorded some movie clips to be incorporated into a film that some pupils at Shawlands Primary in Glasgow are making on the theme of climate change and renewable energy. For their competition entry the pupils are making a video exploring the effects that climate change might have on their community in the future, and the ways and means to improve the situation. James tentatively played the role of “climate change scientific expert”. We wish the pupils well for the competition!



James filming in the lab with glamorous assistants Lois and Hal.

Visible Women

Laura visited St Paul's School for Girls as part of the Annual Careers Festival for Women and Girls in the UK in March to answer questions from pupils about her STEM career thus far. The focus of the event was to encourage the female

pupils to consider the breadth of opportunities available to them. Other speakers included a successful businesswoman and a politician.



Laura, left, and fellow speakers at the event.

Loughborough science family fun day

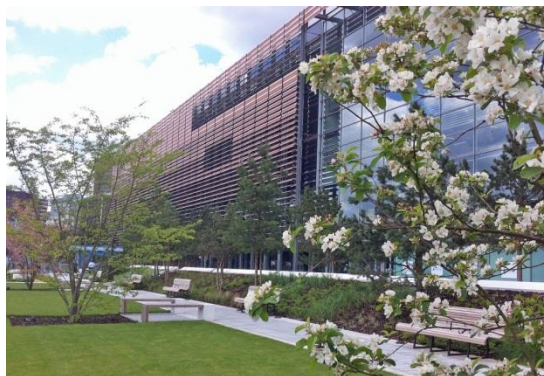
On the 21st of March, some of the CDT students from Loughborough took part in a science fun day, which introduced children to the world of science. There were fun activities for the children to take part in such as using remote control hovercrafts, making DNA from sweets and learning about the engineering of cars.

Upcoming Events

FCH2 2015: Fuel Cell and Hydrogen Technical Conference

Coming to Millennium Point in Birmingham between the 19th and 21st of May, FCH2 promises to be an excellent opportunity for students from across the Centre for Doctoral Training's network to come together to discuss recent developments in their research with leading academics and key industrial players in the sector. With technical, research-focussed presentations and posters, and opportunities for networking in the coffee breaks and at the conference dinner, FCH2 looks set to be a highlight of our calendar of events this year. Aside from the technical presentations and poster sessions that delegates can expect, there will also be a public outreach element to the event and Hitachi are bringing along a table top SEM to give students and school pupils an insight into the utility of microscopy techniques. Confirmed keynote speakers include Celia Greeves, Synogy Ltd. and UK Hydrogen and Fuel Cell Association, David Hart from consultancy firm E4Tech and Robert Evans, CENEX. Further details on the programme for the conference can be found @FCH2Conference on Twitter or at

www.FCH2.co.uk. We look forward to welcoming everyone to Millennium Point in May.



Millenium Point, Birmingham.

Photo courtesy of Millenium Point.



Confirmed speakers and exhibitors.

Your Publications

Here's a summary of some of the work that's been published from across our network in the last few months. Well done to everyone involved! Remember to keep John Hooper (J.C.Hooper@bham.ac.uk) updated with all of your publications.

1. Elmer, T.; Worall, M.; Wu, S.; Riffat, S. B., Fuel cell technology for domestic built environment applications: State of-the-art review. *Renewable and Sustainable Energy Reviews* **2015**, *42* (0), 913-931.
2. Hardman, S.; Shiu, E.; Steinberger-Wilckens, R., Changing the fate of Fuel Cell Vehicles: Can lessons be learnt from Tesla Motors? *International Journal of Hydrogen Energy* **2015**, *40* (4), 1625-1638.
3. Whiteley, M.; Leigh, J.; Fly, A.; Jackson, L. M.; Dunnett, S. J. In *Using Petri-Net analysis for advanced reliability analysis of polymer electrolyte membrane fuel cells*, Safety and Reliability: Methodology and Applications - Proceedings of the European Safety and Reliability Conference, ESREL 2014, 2015; pp 2147-2154.
4. Blackmore, C. E.; Rees, N. V.; Palmer, R. E., Modular construction of size-selected multiple-core Pt-TiO₂ nanoclusters for electro-catalysis. *Physical Chemistry Chemical Physics* **2015**.
5. Kannan, R.; Silva, A. A.; Cardoso, F. M.; Gupta, G.; Aslam, Z. P.; Sharma, S.; Steinberger-Wilckens, R., Study of FePt deposited reduced graphene oxide's utility as a catalyst towards oxygen reduction and methanol oxidation reactions. *RSC Advances* **2015**.
6. Davies, R.A.; Anderson, P.A., Synthesis and characterization of two new amide chloride compounds: Potential H₂ storage materials. *International Journal of Hydrogen Energy*, **2015**, *40*, 3001
7. Davies, R.A.; Hewett, D.R.; Anderson, P.A., .Enhancing ionic conductivity in lithium amide for improved energy storage materials, *Advances in Natural Sciences: Nanoscience and Nanotechnology*, **2015**, *6*, 1
8. Brack, P.; Sagu, J. S.; Peiris, T. A. N.; McInnes, A.; Senili, M.; Wijayantha, K. G. U.; Marken, F.; Selli, E., Aerosol-Assisted CVD of Bismuth Vanadate Thin Films and Their Photoelectrochemical Properties. *Chemical Vapor Deposition* **2015**, *21* (1-2-3), 41-45.
9. Hardman, S.; Chandan, A.; Steinberger-Wilckens, R., Fuel cell added value for early market applications. *Journal of Power Sources* **2015**, *287* (0), 297-306.

Other Announcements

STFC Futures Early Career Award Scheme – Deadline 15th May 2015!

The STFC Global Challenge Network in Batteries and Electrochemical Energy Devices has launched the Early Career Award Scheme for funding to promote collaboration between world class users and developers of large scale research facilities. Two awards are available: the STFC Futures Early Career Plus Award; and the STFC Futures Follow On Award.

STFC Futures Early Career Plus Award

Eligibility: PhD students, PDRAs and early-career academics

Amount: £2000 for mobility
(e.g. to conduct experiments at large scale facilities; facilitate mobility between institutions for research purposes; to engage with industrial users of large scale facilities)
+ up to an extra £1500 for research consumables
(must be directly associated with the application)

STFC Futures Follow On Award

Eligibility: Previous recipients of an STFC Futures Early Career Award

Amount: £ 1500 to disseminate findings
(e.g. to present findings at a conference)

More details of both schemes can be found here:

<http://stfcbatteries.org/funding-opportunities/stfc-early-career-award>

Applications should be submitted by e-mail to p.shearing@ucl.ac.uk by 15th May 2015

Closing Remarks

Thanks for reading! Any comments, captions or contributions to the next edition can be sent to the editors at hfc-cdt-editors@contacts.bham.ac.uk or tweet us at @FuelCellsCDT. You'll also find us on Facebook as 'Fuel Cells and their Fuels CDT'.

We look forward to seeing you all at FCH2 in May.

