Centre for Nuclear Engineering
Newsletter

May 2014

Welcome to the 4th Centre for Nuclear Engineering newsletter.

This is an occasional letter to bring you up to date on recent developments in the CNE.

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New CDT and Updates

by Emma J. Warriss and Edoardo Giorgi

EPSRC Sponsor new CDT in Nuclear Energy at IC

The Centre for Nuclear Engineering based in the Department of Materials with the University of Cambridge and The Open University has been awarded over £4M by the EPSRC to set up a Centre for Doctoral Training (CDT) in Nuclear Energy. Building on world-leading modelling and experimental capabilities the research performed in the ICO (Imperial Cambridge Open universities, pronounced ECO) nuclear energy CDT will enable future reactors to be developed, new reactors to be built and operated more safely and current reactors to operate for longer. At the same time ICO research will support the clean-up and decommissioning of the UK's contaminated nuclear sites and moves towards Geological Disposal in the UK and World-wide. ICO research aims to place the UK at the forefront of international programmes on future reactors for electricity and civil marine power. By doing so it will provide highly skilled and trained cohorts of PhDs with a global vision and international outlook for the UK nuclear industry, regulators, government and academia. To find out more visit www.imperial.ac.uk/nuclearcdt.

Professor Moji Moatamedi joins CNE as Technical Manager

Professor Moji Moatamedi has joined Imperial College London as the Technical Manager for the CNE and CDT. Moji completed his BSc, MSc and PhD at Sheffield University as well as an MBA at Manchester Business School. Prior to joining Imperial he was the Founding Director of High North Technology Centre in Norway. Previously, he was the Director of Motorsport Engineering and Management at Cranfield University, and Director of the Centre for Engineering Materials as well as the Director of Aerospace Engineering at Salford University. His research is in the field of multiphysics simulations with an extensive experience in nuclear severe accident modelling. He is currently the President of The International Society of Multiphysics and Editor-in-Chief of their associated journal.

Imperial College and EDF sign New General Framework Agreement

The new General Framework Agreement between Imperial and EDF covers R&D, Education and Training on nuclear engineering and also technologies related to electrical energy transmission and end use.

The new 5-year agreement includes EDF Energy and all current and future subsidiaries of EDF created for the new nuclear build programme.

Prof. Jeff Magee (Principle of the Faculty of Engineering) signs the new framework agreement EDF representatives.

Humphrey Cadoux-Hudson EDF Lecture

Humphrey Cadoux-Hudson, MD Nuclear New Build gave the 4th EDF Annual Lecture updating on progress at Hinkley Point C. He discussed plans to build the UK's first new nuclear power plant in 20 years. The government and energy company EDF Group forged an agreement over the station, to be called Hinkley Point C, in October 2013.

The lecture was attended by in excess of 300 internal and external guests and we look forward to hosting the popular event next year.

Two new JRF's in Nuclear at Imperial

Dr Na Ni has joined Imperial's Materials Department as a Junior Research Fellow. Na started at Imperial College in 2011 as a Research Associate from the University of Oxford. Her PhD was titled 'Study of Oxidation Mechanisms of Zirconium Alloys by Electron Microscopy'.

Dr Joy H. Farnaby joins our Chemistry Dept. in October as a Junior Research Fellow in Chemistry on a project entitled, 'New routes to multi-metallic nono- and bulk materials containing f-block elements.' Her research interests are in the bonding, structure and magnetism of the lanthanides and actinides and in the design, development and applications of new materials containing these elements. Joy has an MChem in Chemistry from Sussex University with European Studies (German), and a DPhil in Organometallic Chemistry. She subsequently was a postdoc in the USA at Yale and University of California Irvine and in the UK at Edinburgh.

Risk Communication Workshop in Tokyo

by Prof. Gerry Thomas

The public perception of the health risks of exposure to radiation from a nuclear power plant accident is driven by reports in the mass media and can differ significantly from the scientific evidence – and no more so than in Japan. To stimulate a better interaction between scientists and the media, the Foreign and Commonwealth Office held a two-day workshop at the British Embassy in Tokyo on Risk Communication. Although many of the discussions centred on the health effects of the events of March 2011 in Japan, the general application of risk management strategies was also discussed. The workshop was moderated by Nick Ross, and was well attended by academics, journalists, and included senior representation from both Japanese government departments and the nuclear industry in Japan. Session 3, which focused on risk communication and the Fukushima Daiichi incident, is available to view over the following link:

http://www.ustream.tv/recorded/43747982

CNE Visit NNL Central Labs (Sellafield)

by Ben Britton

Michael Rushton, Ben Britton, Zoltan Hiezl, Dimitri Pletser and Charlie Hutchinson visit Mike Angus and his team at the NNL Central Labs in Cumbria. In the sunny northern Sellafield site the industrial centre of much of the UK nuclear community. Here NNL have their central research labs and house one part of the new national nuclear user facility (NNUF). Mike Angus led the day, joined by many of his colleagues including Dominic Rhodes, Scott Owens, and Mike Harrison. The Imperial and NNL group discussed the developing plans of NNL, and their future interactions with the UK and global nuclear community. After a warm welcome, the group explored the soon to be commissioned 'phase two' active labs, including behind the scenes access to the exciting modular hot-cells. Lively discussion at lunch followed, after which we were talked through vitrification of waste at the Sellafield and then guided through the full-scale process at the non-active Vitrification Test Rig (VTR). Here we were able to see the process up close, including inspection of a recently exchanged calciner – a large rotary kiln used to calcine the (simulant) highly active liquor. The VTR facility is unique in being an almost perfect copy of the facilities available within the waste processing facilities in the Sellafield plants and has driven forth change and innovation in the hard to access active lines. We hope that this tour is one of many to come as we develop our links with NNL and act together to bolster the UK nuclear community.

CNE PhD Students attend UNTF2014 hosted by University of Oxford

by Dimitri Pletser

On the 14-16 April the annual Universities Nuclear Technology Forum (UNTF) was held in Oxford. A delegation, including a large group from the CNE headed by Dr. Mark Wenman, attended. This 2.5 day conference is meant for doctoral students to present their work to each other and to enable them to meet and network with their peers. The conference kicked off on Monday afternoon after warm welcoming words from the conference organizer and chair, Oxford's Professor James Marrow. In the first two sessions on Monday afternoon a range of topics was covered including excellent talks from the Imperial contingent. After this we were shown to our accommodation, in the beautiful Mansfield College and were left to explore Oxford for ourselves. The next day, after a grand breakfast served in the College Chapel, we heard many more talks on a variety of topics. The numerous coffee and poster breaks allowed time to interact with our peers and talk about our research and results. The last session of the day was dominated by Imperial College, with 3 excellent speakers back to back from the CNE. This session perfectly showcased the high level of the talks in general and the depth and breadth of the Imperial delegation, along with the University of Manchester the largest delegation present. That evening the conference reception and dinner were held at Mansfield College and its Chapel and these grandiose surroundings set the stage for a wonderful night (and a rough morning). The next morning was set aside for the final set of speakers and the presentation of the prize for best talk. This conference was a great success in that it allowed nuclear postgraduates at every stage of their research, whether they were 3 months in or already writing up, to meet and share their experiences and results. This annual conference is an excellent opportunity to keep the ties in the UK nuclear academic community strong and is one that the CNE will continue to attend.

CNE members at UNTF 2014.

Other CNE News

Imperial Festival

by Dimitri Pletser, Fred Sebilleau, Ben Britton and Michael Rushton

A large team of students and staff from the CNE took the theme "Is nuclear safe?" to the Imperial Festival. The 3rd Imperial Festival was open to the general public showcasing the depth and variety of work performed throughout the College. The CNE used the Festival as an opportunity to reach out to the public and engage with them on nuclear issues. Over twenty volunteers were involved in the project, led by Ben Britton, Dimitri Pletser and Frederic Sebilleau, making new props and manning the stall on the three days of the festival. Our stall rephrased our question and clearly presented "Why nuclear is safe" through a range of interactive demonstrations, from understanding radiation dose effects, through to the engineering story behind nuclear fuel and reactor safety. Our stall featured many exhibits, but our pride and joy is a 1:350 scale model of a Siemens-KWU pressurised water reactor carefully constructed by Michael Rushton and a team from the CNE (now on permanent display on the ground floor of the RSM). This model provides a real look into the heart of a nuclear reactor and offered us the opportunity to go into the engineering of a large industrial nuclear complex, as well as discussing design and safety issues such as "defence-in-depth". The festival attracted ~12,000 visitors this year, and our stand was one of the busiest and well received within the research zone. On the whole the public were supportive of the revival in nuclear and were especially interested in the nuclear fuel cycle (cradle to grave), as well as the implications of eating a handful of Brazil nuts! All those involved on the stand were enthused about the whole project and keen to get involved with outreach and we've already started planning next year's outing.

NIRAB

Professor Bill Lee and Professor Robin Grimes (in his capacity as Chief Scientific Advisor for the Foreign and Commonwealth Office) have become members of the Nuclear Innovation and Research Advisory Board (NIRAB) which is chaired by Dame Sue Ion (Visiting Professor in the Department of Materials). NIRAB's remit is to advise Ministers, Government Departments and Agencies on issues relating to nuclear research and innovation in the UK.

(Left) The CNE stand at the Imperial Festival, (right) 1:350 scale model of Siemens-KWU pressurised water. Photo credit – Claudia Gasparrini and Michael Rushton.

Publications

Point Defects and Non-stoichiometry in Li_2TiO_3
S. T. Murphy, N. D. M. Hine
Chemistry of Materials 26, 1629–1638 (2014).

Pipe diffusion at dislocations in UO_2
S. T. Murphy, E. E. Jay, R. W. Grimes
Journal of Nuclear Materials 447, 143 – 149 (2014).

An immersed body method for coupled neutron transport and thermal hydraulic simulations of PWR assemblies
S. Jewer, A. G. Buchan, C. C. Pain, D. G. Cacuci
Annals of Nuclear Energy 68, 124 – 135 (2014).

Encapsulation of aluminium in geopolymers produced from metakaolin
C. Kuenzel, T.P. Neville, T. Omakowski, L. Vandeperre, A.R. Boccaccini, J. Bensted, S.J.R. Simons, C.R. Cheeseman
Journal of Nuclear Materials 447, 208 – 214 (2014).

Propagation of input model uncertainties with different marginal distributions using a hybrid polynomial chaos expansion
D. Ayres, S. Park, M. Eaton
Annals of Nuclear Energy 66, 1 – 4 (2014).

The immersed body supermeshing method for modelling reactor physics problems with complex internal structures
A.G. Buchan, P.E. Farrell, G.J. Gorman, A.J.H. Goddard, M.D. Eaton, E.T. Nygaard, P.L. Angelo, R.P. Smedley-Stevenson, S.R. Merton, P.N. Smith
Annals of Nuclear Energy 63, 399 – 408 (2014).

Solution of the two dimensional diffusion and transport equations in a rectangular lattice with an elliptical fuel element using Fourier transform methods: One and two group cases
M. Williams, S. Hall, M. Eaton
Annals of Nuclear Energy 63, 146 – 156 (2014).

A many-body potential approach to modelling the thermomechanical properties of actinide oxides
M. W. D. Cooper, M. J. D. Rushton, R. W. Grimes
Journal of Physics: Condensed Matter 26, 105401 (2014).

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