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Final Industrial CO₂ Capture Meeting

The final meeting of the “**Novel adsorbents applied to integrated energy-efficient industrial CO₂ capture**” project took place at Newcastle University on 23rd Jan 2020. This was a multidisciplinary collaborative project that investigated the use of tailored hydrotalcite solid sorbents for CO₂ capture from the industrial sector via the use of intensified fluidized bed technology. The project was led by Prof Mercedes Maroto-Valer at Heriot Watt, and also involved collaboration with Prof Meihong Wang at University of Sheffield. PIG’s role in this project was to intensify the adsorption process by using commercially available intensified fluidization concepts. This involved using the group’s 3D printing expertise to fabricate novel micro fluidized beds and novel miniature swirling fluidized beds. Torftech, the industrial collaborator, recently shared some of this 3D printing work on their [website](#).



Upcoming Conferences

- [2020 AIChE Spring Meeting](#) (29 March—1 April 2020, Houston, Texas)
- [International Conference on Sustainable Energy and Environmental Protection for Industry, ISEEP](#) (30 March—1st April 2020, Berkeley, UK)
- [ChemEngDay 2020](#) (7-8 April 2020, The University of Bradford, UK)
- [2nd International Conference on Sustainable Production and Consumption](#) (24-25 June 2020, Edinburgh, UK)
- [HANDS ON Workshop in Continuous Powder Processing](#) (25-26 June 2020, University of Sheffield, UK)
- [Heat Transfer, Fluid Mechanics and Thermodynamics \(HEFAT\)](#) (20-22 July 2020, Amsterdam, The Netherlands). Abstract Submission Deadline: [28th February](#)
- [23rd Conference on Process Integration, Modelling and Optimization for Energy Saving and Pollution Reduction \(PRES'20\)](#) (17-21 August 2020, Xi'an, China)
- [2nd International Sustainable Energy Conference \(ISEC\)](#) (14-16 Oct 2020, Graz, Austria). Abstract Submission Deadline: [20th March 2020](#)

PIG News

- Congratulations to Dr Kamelia Boodhoo and Dr Fernando Russo-Abegão for their recent successful European proposal—details to follow in subsequent newsletters
- Congratulations to Prof Adam Harvey who has been awarded a new CASE award in collaboration with Sterling Pharmaceuticals (total value: ~£106k). Dr Fernando Russo-Abegão and Dr Jonathan McDonough will co-supervise the project, which will involve developing flow chemistry processes and photoreactors for various case studies
- In a recent [#LiveInTheLab](#) video (run by Dr Greg Mutch), Dr Jonathan McDonough provides a short lab tour showcasing the group's current [3D printing capabilities](#)
- Congratulations to Ahmed Al-Hatrooshi, Tolu Kolawole, Orlando do Nascimento and Phuet Prasertcharoensuk who all graduated with their PhD's on Thursday 5th Dec 2019
- Congratulations to Dr Vladimir Zivkovic who was nominated for the Staff Coordinator of the year
- Congratulations to Dr Jonathan McDonough who has been promoted to the position of Lecturer. One of Jonathan's research aims will be to apply 3D printing to create 'next-gen' flow reactor concepts
- On 4th December 2019, students from all three faculties showcased the achievements of their summer research scholarships in the Great North Museum. The PIG was represented at the event by [Daniel Codd](#), a 2nd year UG student who worked with Vlad and Jonathan during the summer of 2019 on the intensification of CO₂ capture using 3D-printed swirling fluidized beds. A summary of the event can be read [here](#)
- The PIG would like to welcome new PhD student Awad Alamri who will be supervised by Vlad and Jonathan. Awad's research will apply micro-fluidized bed technology to the screening of adsorbents for CO₂ capture.

Other Announcements

- The **full schedule** of chemistry research seminars for the coming semester is now available. A range of internal and external guest speakers will present.
- Newcastle University's Insights Public Lectures are free and open to all, and aim to offer a programme that will inform, stimulate, entertain and excite. The upcoming lectures for **February—March 2020** have now been announced—they usually take place from 17:30 in the Curtis Auditorium on Tuesdays/Thursdays.
- ChemEngDayUK 2020 will be hosted by the University of Bradford. The objective of this 2-day event is to provide a platform for new collaboration opportunities and establish a dialogue between academics and industrialists to develop new links between university and industry. This is achieved through a combination of distinguished plenary speakers, technical sessions with oral presentations from academics, research staff and research students, and interactive poster sessions. PhD research students are particularly encouraged to submit abstracts before the deadline: Monday 2nd March 2020. Further information is available [here](#).
- The second call is now open for the NUAcT (Newcastle University Academic Track) Fellowship scheme for both internal and external candidates. NUAcTs are five year research fellowships in any discipline leading to open ended contracts (subject to review). Further information can be found [here](#); the deadline is 6th March 2020
- The 7th International Conference on Micro and Nano Flows (MNF2020) will be held at Imperial College London from 14-16 September 2020. As with previous events, the focus of MNF2020 will be on all aspects of thermal and fluid phenomena on the micro and nano scale, covering theory, computations, experiments and applications and encompassing thermofluids engineering and biomedical fluid mechanics among other areas. More details including key dates, local information and details about the programme can be found at the conference [website](#).
- A half-day event will take place on Wednesday 26th Feb that will provide an opportunity to hear about and discuss advanced technologies and innovative approaches towards strategic sustainability assessment in the area of plastics recycling. Further information about this *Circular Future of Plastics* event can be read [here](#).
- Eight conference travel grants are available to full-time PhD students who can demonstrate academic excellence through the quality of their research. These grants have been provided by Professor Terry Payne, and will cover the conference registration fee PLUS £500 towards attending the 19th International Conference on Sustainable Energy Technologies. Further details are available [here](#).
- SUN-ERGY is a proposal for a European large-scale research initiative in the area of fossil-free fuels and chemicals. The initiative will be launched with the objective to complement existing European partnerships and enable the full decoupling of economic growth from the utilization of fossil resources. Further details available [here](#).

Other Information

- Full contact details and research profiles for the PI group members can be found at the website: <http://pig.ncl.ac.uk>
- For enquires about collaborations or PhD study, see the website: <http://pig.ncl.ac.uk>
- If anyone would like to contribute any articles, or if anyone has any ideas regarding the newsletter please contact Jonathan McDonough: jonathan.mcdonough@ncl.ac.uk

New Publications

Adamu A., Russo-Abegão F., Boodhoo K. *Process intensification technologies for CO₂ capture and conversion—a review*. BMC Chemical Engineering **2**(1) (2020) 1-18

Al-Abduly A., Christensen P., **Harvey A.** *The characterisation of a packed bed plasma reactor for ozone generation*. Plasma Sources Science and Technology (2020) doi: 10.1088/1361-6595/ab6c82

Al-Saadi L., Eze V.C., Harvey A. *Experimental determination of optimal conditions for reactive coupling of biodiesel production with in situ glycerol carbonate formation in a tri-glyceride transesterification process*. Frontiers in Chemistry (2018) doi: 10.3389/fchem.2018.00625

Al-Saadi L., Eze V.C., Harvey A. *Techno-economic analysis of glycerol valorisation via catalytic applications of sulphonated acid-functionalised copolymer beads*. Frontiers in Chemistry **7** (2020) 882

Buchmaier J., Brunner C., Griesbacher U., **Phan A.N., Harvey A.P.,** Krishna Gudimanchi R., Nidetzky B., Muster B. *Oscillatory Flow Bioreactor (OFB) Applied in Enzymatic Hydrolysis at High Solid Loadings*. Chem. Biochem. Eng. Q. **33**(4) (2019) 459-470

ElMezain A., Saleh M., **Zhang J.,** Soliman A., Fateen S. *Optimal control of batch processes via a deterministic Q-learning method*. ArXiv (2019) 1904.03654

González-Balderas R.M., **Velásquez-Orta S.B.,** Valdez-Vazquez I., Orta Ledesma M.T. *Intensified recovery of lipids, proteins, and carbohydrates from wastewater-grown microalgae *Desmodesmus* sp. by using ultrasound or ozone*. Ultrasonics Sonochemistry **62** (2019) 104852

Liu K., Zhang J. *Nonlinear Process Modelling Using Echo State Networks Optimised by Covariance Matrix Adaption Evolutionary Strategy*. Computers and Chemical Engineering **135** (2020) 106730

McDonough J.R., Armet J., **Law R., Harvey A.P.** *Coil-in-Coil Reactor: Augmenting Plug Flow Performance by Combining Different Geometric Features Using 3D Printing*. Industrial & Engineering Chemistry Research **58**(47) (2019) 21363-21371

Qi R., Zhang J., *Process Fault Detection and Reconstruction by Principal Component Analysis*. 24th International Conference on Methods and Models in Automation and Robotics (MMAR) (2019)

Qiang Z.D., Wang B.D., Li R., Chen Q., Zheng G., **Zivkovic V.,** Yang H. *The surface structure and the active layer depth of the irregular sand particles in a continuously avalanching flow*. Powder Technology **360** (2020) 1037-1046

Qiu W., Xiong Z., **Zhang J.,** Hong Y., Li, W. *Integrated predictive learning control based on updating reference trajectory for point-to-point tracking*. Journal of Process Control **85** (2020) 41-51

Saleem F., Umer J., Rehman A., Zhang K., Harvey A. *Effect of methane as an additive in the product gas towards the formation of lower hydrocarbons during the decomposition of tar analogue*. Energy & Fuels (2019) doi: 10.1021/acs.energyfuels.9b02309

Vasilchenko A., Venn-Wycherley M., Dyson M., Russo-Abegão F. *Engaging Science and Engineering Students in Computing Education through Learner-Created Videos and Physical Computing Tools*. In: 4th Conference in Computing Education Practice CEP 2020, Durham, UK: ACM (2020)

Wang S., Zhang J. *An Intelligent Process Fault Diagnosis System Integrating Andrews Plot, PCA and Neural Networks*. 25th International Conference on Automation and Computing (ICAC) (2019)

Zhang P., Zhang J. Hu B., Long Y. *Optimization control of a fed-batch process using an improved reinforcement learning algorithm*. IEEE Conference on Control Technology and Applications (CCTA) (2019)

Zhang P., Zhang J., Long Y., Hu B. *An improved reinforcement learning control strategy for batch processes*. 24th International Conference on Methods and Models in Automation and Robotics (MMAR) (2019)

Zhu C., Zhang J. *Developing Robust Nonlinear Models through Bootstrap Aggregated Deep Belief Networks*. 25th International Conference on Automation and Computing (ICAC) (2019)