

# pig MONTHLY

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## In This Issue

- IPIC<sup>2</sup>
- Fluidization XVI Conference
- Upcoming Conferences
- Chem Eng Day
- Workshop on Sustainable Biodiesel Production
- Viva Successes
- PIG News
- PIN & HEXAG Meetings
- Announcements
- Recent Publications
- Recent Seminars
- Group Photo 2019

**ipic<sup>2</sup>**

27 – 29 may 2019 • Leuven, Belgium

THE SECOND INTERNATIONAL PROCESS INTENSIFICATION CONFERENCE

The 2<sup>nd</sup> International Process Intensification Conference (IPIC<sup>2</sup>) was recently held in Leuven, Belgium, and saw 160 participants from 20 countries come together to discuss the latest results from academia and industry concerning PI in a wide variety of applications. This is the first time that the conference operating under the International title has been run as a standalone event; the previous IPIC event and several previous European iterations of the PI conference series were mostly run in conjunction with either the European or World Congresses of Chemical Engineering. The main topics discussed at IPIC<sup>2</sup> were: Scale-Up, Ultrasound, Microreactors, Multifunctional/Hybrid Reactors, HiGee, Batch to Continuous, Microwave/Plasma Energy Activation, Light Activation, Novel Equipment Concepts and 3D Printing. The full programme, including links to the abstracts, can be viewed [here](#). The PI group was represented at the conference by 7 researchers: Prof Adam Harvey, Dr Kamelia Boodhoo, Dr Vladimir Zivkovic, Dr James Hendry, Dr Jonathan McDonough, Abdullahi Adamu and Faisal Saleem, who each presented either oral or poster presentations at the conference (details on the next page). Prof Adam Harvey also chaired a session on Batch to Continuous processing. Additionally, four round table discussions took place on Tuesday 28<sup>th</sup> May focused on Microreactors, Multifunctional Processes, Alternative Energy Sources and 3D Printing. The latter of these was attended by Vladimir Zivkovic and Jonathan McDonough, who discussed with other academics and industrialists, what the current challenges were for 3D printing, and what some of the current applications in chemical engineering might be.

In keeping with the new International motif of the PI conference series, the next location for IPIC will be Beijing, and will take place towards the end of May, 2021.

# IPIC<sup>2</sup> Presentations

- K. Boodhoo, T. Ekins-Coward, S. Velasquez-Orta, M. Flickinger | *Development of a microalgae biocomposite-integrated Spinning Disc Bioreactor (SDBR) for bioprocess intensification of light-driven CO<sub>2</sub> absorption* | Poster
- A. Adamu, F. Russo Abegão, K. Boodhoo | *Process Intensification of CO<sub>2</sub> Photocatalytic Reduction* | OC | Monday 27<sup>th</sup> May | *Microreactors* (13:30-15:10), Chair: Simon Kuhn
- J. Hendry, J.G.M. Lee, P. Attidekou, T. Kolawole | *Pressure Drop in Rotating Packed Beds* | Tuesday 28<sup>th</sup> May | OC | *HiGee* (09:45-10:45), Chair: John van der Schaaf
- A.P. Harvey | *Adventures with Mesoscale Oscillatory Baffled Reactors* | OC | Tuesday 28<sup>th</sup> May | *Batch to Continuous* (11:15-12:40), Chair: Adam Harvey
- F. Saleem, K. Zhang, A. Harvey | *Removal of a tar analogue from mixture of product gas using a non-thermal plasma dielectric barrier discharge reactor* | OC | Wednesday 29<sup>th</sup> May | *Energy Activation (Microwave-Plasma)* (09:45-10:45), Chair: Georgios Stefanidis
- J. McDonough, R. Law, D. Reay, V. Zivkovic | *Intensified carbon capture using swirling fluidized beds: Hydrodynamics investigation and sorbent screening* | OC | Wednesday 29<sup>th</sup> May | *3D Printing* (11:15-12:35), Chair: Simon Kuhn



L-R: Vladimir, Faisal, Adam, Kamelia, Jonathan, Abdullahi, and James





IPIC-themed Belgian chocolates



University Library



Leuven University Library and Bell Tower



Leuven City Hall at dusk



View of Leuven from the Bell Tower



## Upcoming Conferences

- [13th International Workshop on Polymer Reaction Engineering](#) (11-14 June 2019, Hamburg, Germany). [Programme](#)
- [European Symposium on Computer Aided Process Engineering \(ESCAPE-29\)](#) (16-19 June 2019, Eindhoven, The Netherlands). [Programme](#)
- [9th International Conference on Algal Biomass, Biofuels & Bioproducts](#) (17-19 June, Boulder, CO, USA) | [Programme](#)
- [18th International Conference on Sustainable Energy Technologies \(SET27\)](#) (20-22 Aug 2019, Kuala Lumpur)
- [IChemE Catalysis SIG: Reactors, Scale-Up and Separations](#) (12 Sep 2019, London, UK). Early registration deadline: 2<sup>nd</sup> Aug 2019 | [Programme](#)
- [12th European Congress of Chemical Engineering](#) (15-19 Sep 2019, Florence, Italy). Early registration deadline: 15<sup>th</sup> July 2019
- [2019 AIChE Annual Meeting](#) (10-15 Nov 2019, Orlando, Florida, US)
- [Advances in Process Automation and Control](#) (18-20 Nov 2019, Manchester, UK). Early registration deadline: 21<sup>st</sup> June 2019



The Fluidization XVI conference, hosted by the AIChE, also took place at the end of May. The focus of this conference was to bridge the gaps between fundamental research on fluidization and emerging applications of fluidization and novel fluidization technologies. The programme is available [here](#). The PI group was represented by Yi Zhang, a PhD student supervised by Dr Vladimir Zivkovic, who presented two talks. The first of these was made on behalf of Vladimir Zivkovic who was attending IPIC<sup>2</sup>, and the second covered research from his own PhD project:

- V. Zivkovic, J. McDonough, R. Law, D. Reay (Presented by Y. Zhang) | [Fluidization in Small-Scale Gas-Solid 3D-Printed Fluidized Beds](#) | Session 1B: [Fundamentals of Fluidization](#) (13:30-15:00) | 27<sup>th</sup> May
- [Y. Zhang](#), V. Zivkovic | [Fluidization of fungal pellets using miniaturized 3D-printed fluidized bed](#) | Session 5A: [Fundamentals of Fluidization](#) (08:30-10:30) | 29<sup>th</sup> May

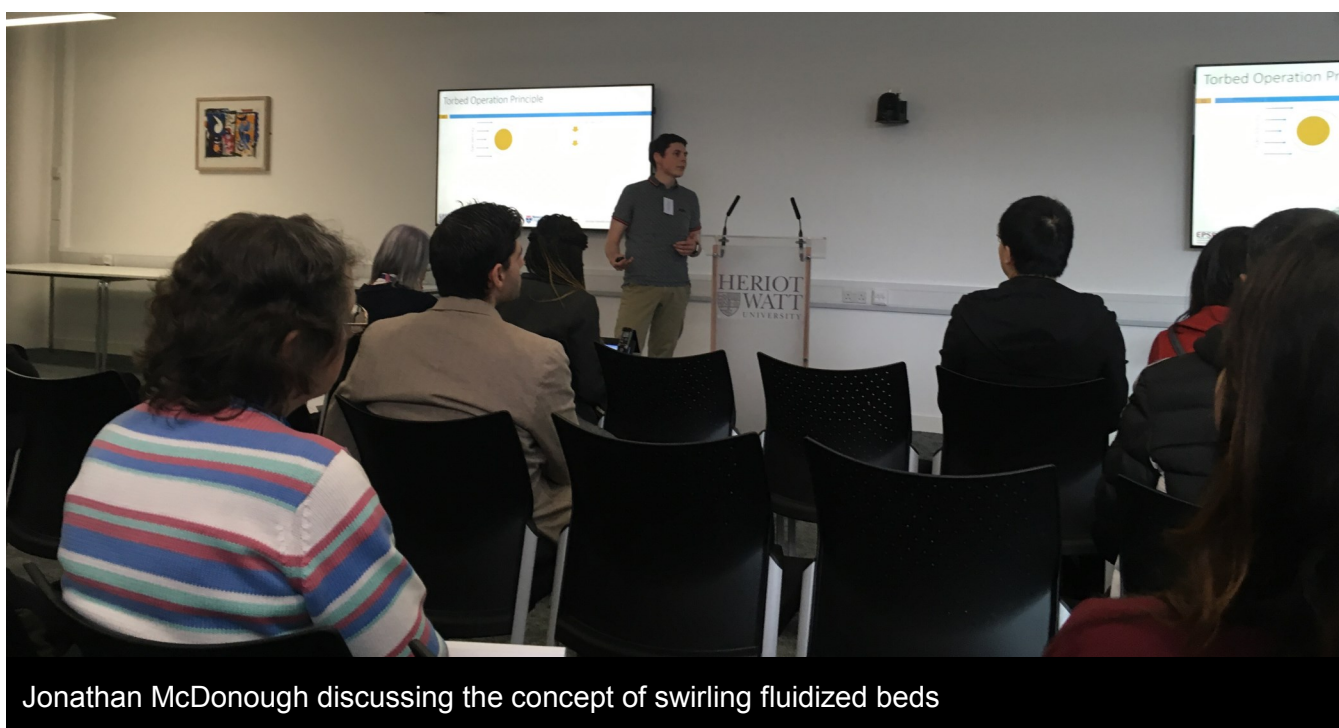


Yi Zhang delivering a talk on fluidization in 3D-printed fluidized beds



Chem Eng Day is an annual conference series backed by the IChemE that is hosted at various Chemical Engineering schools throughout the UK that aims to bring together academics, industry partners and other guests to discuss the latest technological advances in chemical engineering and related professions. This year, Chem Eng Day was hosted at Heriot Watt University on 8-9<sup>th</sup> April at the James Watt II Conference Centre. The session topics were: Energy Systems, Generation and Utilisation; Particle Systems; Modelling; Reactions, Catalysts and Kinetics; Bioinspired Engineering; Sustainable Industry; and Separations in Pharma. A summary of the full programme, including abstracts, is available [here](#). The PIG was represented by Dr Fernando Russo Abegão, Dr Sharon Velasquez-Orta and Dr Jonathan McDonough. The following talks were presented from PIG:

- J. McDonough, R. Law, D. Reay, Z. Zivkovic | **Intensified carbon capture using swirling fluidized beds** | 8<sup>th</sup> April | **Particle Systems** (14:15-15:20)
- F. Russo Abegão, M. Venn-Wycherley, A. Vasilchenko, M. Dyson, C. O'Malley, R. Law, H. Adamson, S. Joyce, R. Norman, J. Goss, M. Devlin | **Teaching students how to code using physical computing tools** | 9<sup>th</sup> April | **Education Special Interest Group** (11:30-12:30)



Jonathan McDonough discussing the concept of swirling fluidized beds



# Workshop on Sustainable Biodiesel Production

A two day workshop on sustainable biodiesel production took place from 24-25<sup>th</sup> April at London South Bank University. Funded by The British Council, the workshop showcased invited talks from leading researchers to provide insight into emerging technologies to promote the discussion of novel solutions to the current obstacles faced in bringing biodiesel to the market. In attendance from PIG were Prof Adam Harvey, Dr Valentine Eze, Luma Al-Saadi and Ibrahim Mohammed. Adam was the first keynote speaker in the workshop, whilst Valentine, Ibrahim and Luma provided a mix of oral, flash and poster presentations. Ibrahim's poster (**Process Intensification of Biodiesel Production by Conversion of Glycerol to Higher Added Value Products**) won the second place prize (pictured below).



Ibrahim being presented with the second place poster prize



Adam Harvey wrapping up the keynote

Valentine Eze discussing an OBR setup

## PIG Viva Successes

In the last 2 months, a record-breaking number of PhD students in the group successfully defended their theses in their vivas. Congratulations to all 5 students:

- **Luma Al-Saadi** | [Intensified biodiesel synthesis through reactive coupling](#) | Supervisors: Prof Adam Harvey & Dr Valentine Eze | Viva Date: Friday 12<sup>th</sup> April
- **Abdul Rehman** | [Synthesis of Limonene and Styrene Carbonate via CO<sub>2</sub> Cycloaddition](#) | Supervisors: Prof Adam Harvey & Dr Valentine Eze | Viva Date: Tuesday 30<sup>th</sup> April
- **Faisal Saleem** | [Treatment of Biomass Gasification Tars with Non-Thermal Plasmas](#) | Supervisors: Prof Adam Harvey & Dr Kui Zhang | Viva Date: Tuesday 14<sup>th</sup> May
- **David Okot** | [Briquetting and Torrefaction of Agricultural Residues for Energy Production](#) | Supervisors: Dr Anh Phan & Dr Paul Bilsborrow | Viva Date: Friday 31<sup>st</sup> May
- **Orlando Lopes do Nascimento** | [Hydrodynamics study of liquid-solid micro-circulating fluidized bed](#) | Supervisors: Dr Vladimir Zivkovic & Prof David Reay | Viva Date: Friday 31<sup>st</sup> May

## PIG News

- Dr Steven Wang has become the international advisor for a newly established research centre at the Graduate School of Engineering, Kobe University. The name of the centre is "[Social Implementation of Renewable Energy Research \(SIREC\)](#)"
- Dr Steven Wang has also accepted a new Lectureship position at the School of Mechanical Engineering at the City University of Hong Kong, and will be leaving Newcastle in June. Steven will continue to collaborate with several group members, but the PI Group would still like to wish Steven good luck in the new position
- Dr Valentine Eze will be leaving the PI Group and academia this month, and will be pursuing a new career in teaching. The PI Group would like to wish Valentine good luck
- Congratulations to Akmal Rahim, who ran the London Marathon this year
- The PIG now has a [dedicated Google Scholar](#) profile to track collective impact
- Dr Greg Mutch, from the Applications of Ion Transport Group, runs a series of outreach interviews that aim to 'demystify' academic research at Newcastle University. In the latest of these (on 17<sup>th</sup> April), Greg spoke with Jonathan McDonough from the PI Group about the general day-to-day work of a post-doc RA. All previous interviews can be viewed on the Applications of Ion Transport group [Facebook page](#). If anyone in the group is interested in appearing in a future video interview, they can contact Greg directly



# Process Intensification Network27

The 27<sup>th</sup> PIN meeting (PIN27) will be held at Newcastle University on Friday 21<sup>st</sup> June 2019 at the [Boiler House](#). Registration and coffee on the day will take place from 09:15-10:00, with the technical presentations running from 10:00-13:00 and 14:20-15:20. 'Impromptu' talks will take place following any follow-on discussions from the afternoon technical session. Posters are also welcome and the [programme](#) has now been confirmed.

Following the meeting on Friday there will be a tour of the Process Intensification Group labs and Newcastle University's "StuBrew", including a beer tasting (details to follow). Additionally, there will be an evening meal the night before (Thursday 20<sup>th</sup>) for those arriving early (at own expense). The programme will be sent out shortly, and registration/payment can now be confirmed through [eventbrite](#).



The next HEXAG meeting will be held on Wednesday 10<sup>th</sup> July in the Auditorium in the Eastern Gateway Building at Brunel University London, Uxbridge, hosted by Professor Tassos Karayiannis, Professor of Thermal Engineering. The event will start at 9:15 (registration & coffee/tea), with talks commencing at 10:00 and finishing by 16:00. The provisional agenda and registration details are available [here](#). Registration can also be confirmed through [eventbrite](#).



## Other Announcements

- Prof David Reay has been invited to be a member of the scientific committee of the [12th European Conference on Industrial Furnaces and Boilers \(INFUB-12\)](#), which will this time be held in Porto, Portugal, from 14-17<sup>th</sup> April 2020. The main objective of this conference series is to provide an up-to-date understanding of the fundamentals/principles/practices concerning the design and operation of industrial furnaces and boilers. From a broader perspective, the conference also addresses processes that generate, transform or use thermal energy from combustion, and previous meetings have included topics on fluidized beds
- The PI Group have had an abstract accepted for the [“Making Connections”](#) PGR faculty conference that will take place on Friday 5<sup>th</sup> July. The purpose of this event is to foster new contacts/collaborations with other academic and industrial researchers, with much of the emphasis being focused on PhD researchers. Four PhD students, Abdullahi Adamu, James Hockaday, Prayoon Enmak and Akmal Rahim, will present a stand showcasing the PI Group’s work with 3D printing. During this two hour showcase, they plan to have a live demo of one of the group’s 3D printers, and will also display some of the group’s novel applications of printing for achieving process intensification. Registration for the event is free and can be completed [here](#)
- The AIChE have released a new PI journal: *Journal of Advanced Manufacturing and Processing*. More information about the journal is available [here](#)
- A [3D printing expo](#) will be taking place on the 25<sup>th</sup> June at the Marshall Area, Milton Keynes. Attendance is free, and will provide the opportunity for networking and demonstrations from industry experts. Some of the topics for discussion at the expo include: the role of 3D printing with increased digitalization, materials innovation and job roles in the printing market. The sectors being represented at the expo are: manufacturing, construction, food, healthcare, transportation, aerospace, tech and design
- Lorena Grima from Zaragoza, Spain, is currently visiting the Applications of Ion Transport Group (led by Prof Ian Metcalfe), and is working on molten salt membranes.

## New Publications

- Miao P., Cheng K., Li H., Gu J., Chen K., [Wang S.](#), Wang D., Liu T., Xu B. and Kong J. Poly (dimethylsilylene)diacetylene-guided ZIF-based heterostructures of full Ku-band electromagnetic wave adsorption. *ACS Applied Materials & Interfaces* 11 (2019) 19
- [Prasertcharoensuk P.](#), Bull S.J., [Phan A.N.](#) Gasification of waste biomass for hydrogen production: Effects of pyrolysis parameters. *Renewable Energy* 143 (2019) 112-120
- [Okot D.](#), Bilsborrow P.E., [Phan A.N.](#) Briquetting characteristics of bean straw-maize cob blend. *Biomass and Bioenergy* 126 (2019) 150-158

## Recent PIG Seminars

- **Paulius Rasiukas** | 31<sup>st</sup> May  
“A novel method for the parameter identification of large-scale hybrid semi-parametric models”
- **Ibrahim Mohammed** | 24<sup>th</sup> May  
“Reactive coupling of polyglycerol and biodiesel”
- **Sreepathy Sridhar** | Northumbria University | 17<sup>th</sup> May  
“A Soft Energy Harvester”
- **Prof Ian Wilson** | Cambridge University | 8<sup>th</sup> May  
“Tank cleaning by impinging water jets: A case of coupled flows and complex fluids”
- **Kai Liu** | 3<sup>rd</sup> May  
“Dynamic modelling of nonlinear industrial processes using advanced neural networks”
- **Zakariah Adejoh** | 26<sup>th</sup> Apr  
“Mitigation of Particulate Emissions from a Biomass Boiler using a Novel Non-thermal Plasma Ionizer”
- **Changhao Zhu** | 12<sup>th</sup> Apr  
“Inferential Estimation of Polymer Melt Index using Bootstrap Aggregated Deep Belief Networks”
- **Dr Greg Mutch** | Applications of Ion Transport Group | 5<sup>th</sup> Apr  
“Exploiting non-equilibrium conditions for efficient carbon dioxide separation”

## 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](mailto:jonathan.mcdonough@ncl.ac.uk)

## Group Photo 2019

