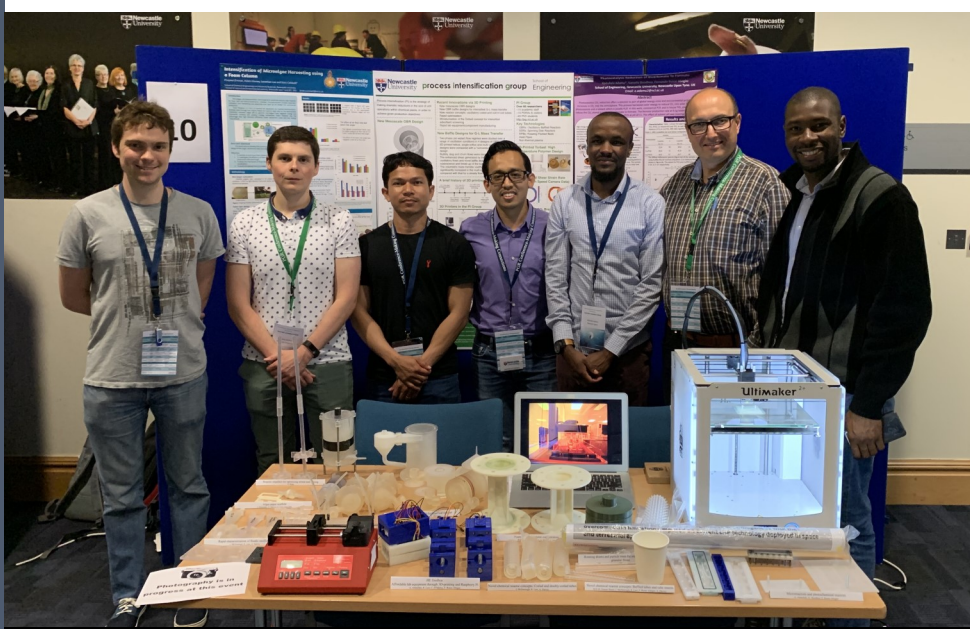


In This Issue

- Making Connections
- UKNHTC Workshop Summary
- New Elsevier Journal
- PIG News
- CHEMUK 2020—PIN Collaboration Opportunity
- PIN and HEXAG Meeting Summaries
- Carbon Capture Workshop
- Vest Grand Challenges International Scholarship
- Other Announcements
- Recent Publications

Making Connections

The **Making Connections** PGR conference took place on Friday 5th July, and saw around 20 research groups from the SAgE faculty at Newcastle University showcase their research in a new networking format designed to develop and support new collaborations. The PI group was represented by Abdullahi Adamu, Akmal Rahim, Prayoon Enmak, James Hockaday and Pawal Szymanski, who showcased the group's 3D printing expertise. This involved a live-demo of the Ultimaker2+ printer and presentation of many of the group's novel 3D-printed reactor prototypes and other recent achievements in applying 3D printing to process intensification. A poster summarizing some of these can be viewed [here](#).



L-R: James Hockaday, Jonathan McDonough, Prayoon Enmak, Akmal Rahim, Abdullahi Adamu, Pawal Szymanski, and Ibrahim Mohammed

Upcoming Conferences

- [IChemE Catalysis SIG: Reactors, Scale-Up and Separations](#) (12 Sep 2019, London, UK)
- [12th European Congress of Chemical Engineering](#) (15-19 Sep 2019, Florence, Italy)
- [CHARMING Summer School: Science & Engineering Education by Immersive Learning](#) (2-4 Oct 2019, Leuven, Belgium)
- [11th Symposium on Continuous Flow Reactor Technology](#) (22-23 Oct 2019, University of Strathclyde, Glasgow, Scotland)
- [2019 AIChE Annual Meeting](#) (10-15 Nov 2019, Orlando, Florida, US)
- [Advances in Process Automation and Control](#) (18-20 Nov 2019, Manchester, UK)

UKNHTC Workshop

The UK National Heat Transfer Committee (UKNHTC) hosted a one-day workshop on: "Heat Transfer Research, Education and Practice in the UK" on 25th April 2019 at the Roundhouse in Derby. The workshop was chaired by Dr Francesco Coletti and co-chaired by Dr Richard Law from PIG. Over 100 participants from industry and academia attended the event. The full programme and more pictures from the event can be viewed [here](#).



New Elsevier Journal

Elsevier has announced a new journal – [**International Journal of Thermal Fluids**](#).

The Editor-in-Chief is Prof Hussam Jouhara at Brunel University London and Prof David Reay is Associate Editor. The journal will publish Open Access papers.

Inaugural 'Travel Selfie'



Prof Adam Harvey and Dr Kui Zhang are currently at the Danish Technology Institute in Aarhus conducting experiments on particulate emissions from biomass boilers

PIG News

- Dr Steven Wang and Dr Valentine Eze have now officially left the group. Steven is currently working at the City University of Hong Kong whilst Valentine is training to become a secondary school teacher in the North East of England. The image below was taken at their 'farewell' meal on the 13th June. Here the group also said goodbye to many of the PhD students who have recently passed their vivas. The group wishes everyone luck in their future endeavors.
- Congratulations to Dr Anh Phan who has been promoted to the position of Senior Lecturer.
- The Chemical Engineering PGR conference took place on 24th June. Each year prizes are awarded for the best Stage 1 posters and best Stage 2/3 presentations. As in previous years, the PI group was quite successful. Congratulations to the following students:

1st Year Posters

3rd—Prayoon Enmak

2nd Year Presentations

1st—Guanqi Wang

2nd—Abdullahi Adamu

3rd Year Presentations

1st—Pichaya In-Na

3rd—Aumber Abbas

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





The **CHEMUK EXPO** & Speaker Programme brings together the UK's chemicals, biochemical, chemicals processing & chemical product formulation industries in pursuit of:

- **Supply-Chain Sourcing**—leading partners and suppliers providing process plant, equipment, ancillaries, technologies and services, plus supply-chain chemicals & ingredients
- **Innovation Insight, Intelligence Gathering & Best Practice**—latest innovations & enablers, crucial trends, markets, regulatory changes, case studies, compliance, etc.
- **Business Networking**—designed to introduce new relationships and strengthen existing ones throughout the intersecting layers of the UK's 'chemical sector'

Building on the success of the 2019 meeting, as part of the 2020 event the **Process Intensification Network (PIN)** has been invited to participate. At this stage, the format of the input is currently being decided, but input via daily sessions could take one of the following forms:

- 30-minute feature sessions hosted by (or associated with) PIN
- Back-to-back 10-12 min presentations followed by a short Q&A
- A 30-minute panel session

This opportunity will allow the network to discuss the most topical themes, extend the profile of the network and provide 'takeaways' of ideas/intelligence/insight into the use of PI to a wide industry audience. Input from organizations related to PIN, such as the **Heat Exchanger Action Group (HEXAG)**, **Heat Transfer Society (HTS)** and **UK National Heat Transfer Committee (UKNHTC)** would also be welcome.

In addition, CHEMUK would provide wider collaborative support:

- **Complimentary Display Stand** (3m x 2m) for use by PIN and related organizations (if being shared by HEXAG, HTS and UKNHTC, each organization can have an individual show guide/website listing & profile)
- **Marketing support behind any PIN session input**
 - a. Focus on website/programme announcements
 - b. Inclusion in the 'show news' countdown programme—electronic news alerts, social media announcements (LinkedIn & Twitter), as well as physical show news publications & issued press releases
 - c. Feature timetabled 'pre-event' interview (written Q&A exchanger), for sharing through available networks/media
- **Recognition of PIN as an official supporting industry partner**
 - a. PIN logo on all marketing collateral
 - b. Partner profile (as part of the '**partners**' page on the website)
 - c. Inclusion in 'Thanking our Partners' page on the official show guide

NOTE: these would be extended to HEXAG, HTS and UKNHTC if they were to also join

The PI group are currently liaising with the CHEMUK organizers to decide on the most suitable route for collaboration. Final decisions will be advertised/circulated to PIN in due course.

Summary of the 36th HEXAG Meeting

The Heat Exchanger Action Group meeting this year moved south to Brunel University London, where almost 50 delegates heard a wide variety of presentations, including eight Technical Presentations and six *impromptu* talks.

Theoretical, modelling and experimental topics were covered, the former including a presentation from Fluor Ltd. In The Netherlands on finned tube heat transfer and work at QMUL by Dr. Huasheng Wang (who will host the next HEXAG meeting in 2020) on multi-pass parallel flow condensers. Thomas Werner, working at Aavid Thermacore and Nottingham University, presented the challenges of finding working fluids able to be used in high temperature heat pipes (>350°C), while additive-manufactured heat pipes for spacecraft electronics thermal management were detailed by Dr. Ryan McGlen, also of Aavid Thermacore. Ryan obtained his PhD in our Chemical Engineering Department, as did Dr. Ahmad Mustaffar, who fascinated us with his talk on Artificial Intelligence for data mining – related specifically to its use for retrieving data from heat transfer publications.

Talks from the Brunel Institute of Energy Futures included smart BIPV (Building Integrated Photovoltaic) systems and heat recovery in the ceramics industry, many being related to their portfolio of FP7 and HORIZON 2020 projects.

Of potential interest to StUBrew was the talk by Curtis Paxman on his ‘Cool Tube’ highly compact heat exchanger for chilling beer on the way to the tap! We are now looking at applications in chemical engineering for the unit.

Some of the HEXAG talks will soon be uploaded onto the [website](#)

Summary of the 27th PIN Meeting

The 27th Process Intensification Network (PIN) meeting was held at Newcastle University on Friday 21st June at the new Boiler House facility on the campus. Around 40 delegates attended the meeting, which featured seven technical presentations and two *impromptu* talks.

Adam Harvey (Head of the PIG, Newcastle University) kicked-off the talks by providing an update on the current PI activities at Newcastle. This was followed by a talk from Adam Buttress (Nottingham University) on the use of microwave-heated reactors for polymer manufacturing and then a presentation on the opportunities for PI investment in China by Hong-bo Liu (representing Advanced Energy Technology, Inc.). Following a short break, Gary Leeke (Birmingham University) described the use of solar concentrators for pyrolysis and Kejun Wu (Leeds University) talked about the synthesis of nanomaterials in continuous microreactors. The afternoon session saw two more technical presentations. The first was from Dag Eimer (University of Southern Norway) on the intensification of CO₂ ad- and desorption, whilst the second was from James Hendry (PIG, Newcastle) on solvent-based CO₂ capture using rotating packed beds.

In the afternoon, Chris O'Malley hosted a beer tasting that showcased some of the craft beers that have recently been produced by [StuBrew](#).

The talks from this event will soon be uploaded to the [website](#).

Industrial Decarbonisation Workshop

A joint academic-industry workshop was recently held at the Royal Society of Edinburgh focused on industrial decarbonisation through the integration of materials and processes. The workshop is one of the outcomes of a collaborative EPSRC project in which the PI Group (represented by Prof David Reay, Dr Vladimir Zivkovic, Dr Richard Law and Dr Jonathan McDonough) is one of the project partners: “**Novel adsorbents applied to integrated energy-efficient industrial CO₂ capture**”. The purpose of the workshop was two-fold: to disseminate some of the findings of the project, and to promote discussion regarding the materials and processing requirements required for capturing CO₂ from industrial processes. The talks were presented by a mix of academic and industry guest speakers, which were split into three different sessions chaired by different CO₂-I’s from the project: (1) Industrial CO₂ Adsorption Capture (chaired by Dr Susana Garcia), (2) Processes for Industrial CO₂ Capture (chaired by Prof David Reay), and (3) System Integration & Industrial Perspectives (chaired by Prof Meihong Wang). The full programme for the workshop and bios for all of the speakers can be viewed [here](#).



Vest Grand Challenges International Scholarships

Newcastle University engineering graduate students are encouraged to apply for the Charles M. Vest NAE Grand Challenges for Engineering International Scholarships. The Vest Scholarships, announced at the 2013 Global Grand Challenges Summit, provide a valuable opportunity for international graduate students to pursue research addressing a global Grand Challenge at a leading United States university-with all expenses paid for a year of travel and study. The program is designed to build international ties among engineers dedicated to addressing societal challenges that affect us all. In the past couple of years, Vest Scholars have conducted research at our partner institutions in the US in important areas such as providing access to clean water, improving urban infrastructure, and engineering the tools of scientific discovery. The application deadline is November 4th, 2019. More information can be found on the Vest Scholars website [here](#).

Other Announcements

- The **Applications of Ion Transport Group** have launched a new YouTube channel run by Dr Greg Mutch: **#LiveInTheLab**. The most **recent video** is a tour of the group's lab, led by Prof Ian Metcalfe. In the coming weeks, they will post a new lab tour and interview with Dr Marloes Peeters, including a demonstration of her bespoke apparatus for measuring properties of polymeric films. If anyone from the PI group is interested in being interviewed (PhD students, post-docs, lecturers, professors... open to anyone), or if anyone would like to give a lab tour/demonstration, please get in touch with Greg. Warm In-Na from PIG has also been central in editing the videos and adding music
- The **MATCORE group** will be hosting a seminar with **Prof Ben Anthony** (Professor of Energy Process Systems at the Centre for Climate and Environmental Protection, Cranfield University). The title of the talk is: "*The future of calcium and chemical looping: climate change mitigation and energy storage*". The seminar will take place on Tuesday 10th September at 3pm in The Buttery, 4th Floor, Merz Court, Newcastle University. The seminar is free to attend and includes refreshments. Members of the PI group are encouraged to attend by signing up **here**
- A 1-day meeting on "**Reactors, scale-up and separations: Process intensification, integration and multifunctionality**" will take place on Thursday 12th Sep 2019. The event is being organized by SCI's Fine Chemicals Group and IChemE's Catalysis Special Interest Group. Dr Kamelia Boodhoo is one of the confirmed speakers for the event, who will be giving a talk on "*Nature-inspired engineering: Exploiting thin film flow processing for chemical and bioprocess intensification*"
- Dr Jonathan McDonough and Prof David Reay are attending the **UK Heat Transfer Conference** at Nottingham University on 8-10 September. Jonathan is presenting and invited Keynote on Additive Manufacturing in Process Engineering and David is talking on an AM Heat Exchanger in a Solar-powered High Altitude Aircraft and also on the Heat Transfer Challenges in Carbon Capture. There are 250 talks/posters tabled and the Conference Chairman is Professor Yuying Yan of Nottingham University.
- Freeman Technology and Malvern Panalytical will be hosting an 'Understanding Powders for Additive Manufacturing' seminar on 24th Sep 2019 at the Hilton Birmingham Metropole, UK. The one-day event will provide an introduction to the principles of powder rheology and how the associated methodologies can be applied to understand and optimize additive manufacturing applications. The full agenda can be viewed **here**.

New Publications

Ahmad Z., Kadir N.N.A., Bahadori A., [Zhang J.](#) *Optimization study on the CO₂ and H₂S removal in natural gas using primary, secondary, tertiary and mixed amine*. AIP Conference Proceedings **2085**(1) (2019) 020060

[Al-Hatrooshi A.S.](#), [Eze V.C.](#), [Harvey A.P.](#) *Production of biodiesel from waste shark liver oil for biofuel applications*. Renewable Energy **145** (2020) 99-105

[Al-Saadi L.S.](#), [Eze V.C.](#), [Harvey A.P.](#) *A reactive coupling process for co-production of sol-ketal and biodiesel*. Green Processing and Synthesis **8**(1) (2019) 516-524

Cong L.W., Bahadori A., [Zhang J.](#), Ahmad Z. *Prediction of Water Quality Index (WQI) using Support Vector Machine (SVM) and Least Square-Support Vector Machine (LS-SVM)*. International Journal of River Basin Management (2019) 1-15

Díaz V.H.G., [Willis M.J.](#) *Ethanol production using Zymomonas mobilis: Development of a kinetic model describing glucose and xylose co-fermentation*. Biomass and Bioenergy **123** (2019) 41-50

[Duong L.T.](#), [Prasertcharoensuk P.](#), [Phan A.N.](#) *Biofuel Production from Lignocellulosic Feedstock via Thermochemical Routes*. Liquid Biofuel Production (2019) 89-166

Durkin A., Tapytgin I., Kong Q., [Gunam Resul M.F.M.](#), [Rehman A.](#), [Fernandez M.L.](#), [Harvey A.P.](#), Shah N., Guo M. *Scale-up and Sustainability Evaluation of Biopolymer Production from Citrus Waste Offering Carbon Capture and Utilisation Pathway* [Front Cover]. Chemistry Open **8**(6) (2019) 668-688

[McDonough J.R.](#), [Ahmed S.M.R.](#), [Phan A.N.](#), [Harvey A.P.](#) *The development of helical vortex pairs in oscillatory flows—A numerical and experimental study*. Chemical Engineering and Processing-Process Intensification **143** (2019) 107588

[Rehman A.](#), [Gunam Resul M.F.M.](#), [Eze V.C.](#), [Harvey A.](#) *A kinetic study of Zn halide/TBAB-catalysed fixation of CO₂ with styrene oxide in propylene carbonate*. Green Processing and Synthesis **8**(1) (2019) 719-729

[Saleem F.](#), [Harvey A.](#), [Zhang K.](#) *Low temperature conversion of toluene to methane using dielectric barrier discharge reactor*. Fuel **248** (2019) 258-261

[Saleem F.](#), Kennedy J., Dahiru U.H., [Zhang K.](#), [Harvey A.](#) *Methane conversion to H₂ and higher hydrocarbons using Non-thermal plasma dielectric barrier discharge reactor*. Chemical Engineering and Processing-Process Intensification (2019) 107557

[Saleem F.](#), [Zhang K.](#), [Harvey A.](#) *Direct Conversion of Benzene as a Tar Analogue to Methane Using Non-thermal Plasma*. Energy & fuels **33**(3) (2019) 2598-2601

Tian Y., [Zhang J.](#), Chen L., Geng Y., Wang X. *Selective Ensemble Based on Extreme Learning Machine for Sensor-Based Human Activity Recognition*. Sensors **19**(16) (2019) 3468

Walls L.E., [Velasquez-Orta S.B.](#), Romero-Frasca E., Leary P., Noguez I.Y. Orta Ledesma M.T. *Non-sterile heterotrophic cultivation of native wastewater yeast and microalgae for integrated municipal wastewater treatment and bioethanol production*. Biochemical Engineering Journal **151** (2019) 107319