INTERESTING RESEARCH GROUPS – 2024-2

Name of the Group/Institution:

STPI Department, Laboratoire de Génie Chimique, Université de Toulouse, France

Head of the Group:

Prof. Karine Loubière

Research profile:

Karine Loubière is Professor at the LGC Laboratory in Toulouse, in the Department Sciences and Technologies of Intensified Processes (STPI). Her research activities focus on understanding transfer phenomena and their coupling within reactors, with the aim of developing methodologies to aid the design, operation and/or extrapolation of intensified processes. Over the past decade, they have been applied to research questions dedicated to mass transfer (reactive or otherwise) across gas-liquid interfaces, usually in confined geometries, and to the engineering of reactors dedicated to preparative photochemistry and its intensification (flow photochemistry). In this latter area, she has developed approaches that combine specific experiments in LED-lit microreactors with photochemical reactor engineering modeling tools. This dual methodology has been used in particular to better understand the coupling between phenomena (light, kinetics and transfer phenomena), to acquire kinetic data, to define optimal operating conditions and strategies with a view to smart scale-up, and all this for a varied spectrum of photochemical syntheses.

Research topics related to PI:

- Microreactors
- Photochemical reactors

Relevance for global challenges and megatrends:

- Sustainability
- Modularization

Recent achievements:

Prof. Loubière has co-authored several contributions to journals, books, and international conferences. Her research activities have led to various national & international collaborations, through projects funded by public institutions (University, OSEO, ANR, EU) and industrial partners (OEMs or end-users). From 2012-2016, she was an elected member of CoNRS Section 10, and from 2016-2021, she was its Scientific Secretary.

Recent publications: (https://orcid.org/0000-0001-6245-2844)

- Lebrun, G.; Schmitt, M.; Oelgemöller, M.; Vedrenne, M.; Blanco, J.-F.; Loubière, K. (2023) Investigating the photochemical reaction of an oxazolone derivative under continuous-flow conditions: from analytical monitoring to implementation in an advanced UVC-LED-driven microreactor. Journal of Flow Chemistry, 13, 413-425, https://doi.org/10.1007/s41981-023-00284-y
- Dedieu, P.; Morand, G.; Loubière, K.; Ognier, S.; Tatoulian, M. (2024) Microreactor designed for efficient plasma-liquid flows. Lab on a Chip, 24, 3898-3908, https://doi.org/10.1039/D4LC00315B

Website or contact:

https://lgc.cnrs.fr/annuaire/loubiere-karine/

Name of the Group/Institution:

Process Systems Engineering (PSE), TU Delft, The Netherlands

Head of the Group:

Prof. Tony Kiss

Research profile:

Tony Kiss is a professor of chemical engineering and biotechnology with a dual industrial-academic expertise in Process Systems Engineering, Process Intensification, and Separation Technology. His main research interests include process design and simulation, optimization and control, intensified chemical processes, fluid separations, biorefineries, biochemical engineering, downstream processing, and heat pumps applications in the chemical and biochemical process industry.
Tony Kiss has over 20 years of academic and industrial experience, having worked for over a decade in the chemical industry, as Senior Project Manager and RD&I Specialist in Chemical Process Technology at AkzoNobel Specialty Chemicals, and afterwards as full professor at The University of Manchester (UK), University of Twente and Delft University of Technology.

Research topics related to PI:

- Reactive separations
- Heat integrated distillation
- Dividing wall columns

Relevance for global challenges and megatrends:

- Sustainability
- Digitalization

Recent achievements:

Prof. Kiss won several prestigious awards such as: Royal Society Wolfson Research Merit Award, Hoogewerff Jongerenprijs, and AkzoNobel Innovation Excellence Award. He is also a Fellow of IChemE, research fellow of The Royal Society, editorial board member of ChERD and JCTB journals, and member of established professional institutions: AIChE, CAPE-WP, EFCE, IChemE, PSE-NL, SCI. Tony has carried out numerous research & industrial projects, published over 20 textbooks and book chapters, 9 patents, and over 200 scientific publications.

Recent publications: (**https://orcid.org/0000-0001-5099-606X**)

- Jankovic, T.; Straathof, A.J.J.; Kiss, A.A. (2024). Adaptable heat pump-assisted dividing-wall column design for intensified downstream processing of bio-propionic acid. Separation and Purification Technology, 350, 127832. https://doi.org/10.1016/j.seppur.2024.127832
- Kiss, A.A.; Muthia, R.; Pazmino-Mayorga, I.; Harmsen, J.; Jobson, M.; Gao, X. (2024). Conceptual methods for synthesis of reactive distillation processes: recent developments and perspectives. Journal of Chemical Technology & Biotechnology, 99, 6, 1263-1290. https://doi.org/10.1002/jctb.7633

Website or contact:

https://www.tudelft.nl/en/faculty-of-applied-sciences/about-faculty/departments/chemical-engineering/principal-investigators/tony-kiss

Name of the Group/Institution:

Department of Chemical Engineering, University College London (UCL), UK

Head of the Group:

Prof. Asterios Gavriilidis

Research profile:

Asterios Gavriilidis has been Professor of Chemical Reaction Engineering at the Department of Chemical Engineering at University College London since 2004. His research focus is on continuous flow reactors, using advanced experimental methodologies and reactor modelling tools. The reactors studied and developed are often multiphase and contain heterogeneous catalysts. The approach is based on fundamental understanding and evaluation of the chemical and catalytic reactions involved and their interaction with hydrodynamics, mass and heat transfer. Thereby, microstructured reactors are used to intensify generation of kinetic and mechanistic information and millifluidic reactors to improve the production of chemicals and nanomaterials in terms of robustness, sustainability and product quality. The reactors have been used to perform various reactions such as catalytic oxidations, hydrogenations, epoxidations, ozonolysis of relevance to the pharmaceutical industry as well as nanomaterials synthesis with healthcare applications. He collaborates with chemists, microbiologists, pharmacists and other engineers to ensure the products fulfill the requirements for the intended applications, which have recently included gold nanoclusters for antimicrobial surfaces and iron oxide nanoparticles for cancer hyperthermia.

Research topics related to PI:

- Microreactors / Advanced flow reactors
- Multifunctional (membrane) reactors
- Nanomaterials

Relevance for global challenges and megatrends:

- New (advanced) materials
- Modularization

Recent achievements:

Prof. Gavriilidis is currently deputy Head for Research and chairs the Departmental Research Committee at UCL. He has been visiting professor in the University of Sydney (2003) and ETH Zurich (2018). He is member of the European Federation of Chemical Engineering (EFCE) Working Party of Chemical Reaction Engineering since 2005, subject Editor of Chemical Engineering Research and Design since 2002, and member of the UK Catalysis Hub Steering Group since 2012.

Recent publications: (**https://orcid.org/0000-0003-3508-5043**)

- Gkogos, G.; Kahil, E.E.; Storozhuk, L.; Thanh, N.T.K., Gavriilidis, A. (2024). Scaling study of miniaturised continuous stirred tank reactors via residence time distribution analysis and application in the production of iron oxide nanoparticles. Chemical Engineering and Processing – Process Intensification, 203, 109880. https://doi.org/10.1016/j.cep.2024.109880
- Venezia, B.; Gavriilidis, A. (2023). Aerobic oxidation of alcohols using a slurry loop membrane reactor. Green Chemistry, 25(14), 5449-5459. https://doi.org/10.1039/D3GC01242E

Website or contact:

https://profiles.ucl.ac.uk/2668-asterios-gavriilidis

Name of the Group/Institution:

Department of Chemical Engineering, Massachusetts Institute of Technology (MIT), Cambridge, MA, USA

Head of the Group:

Prof. Klavs F. Jensen

Research profile:

Klavs Jensen is Warren K. Lewis Professor of Chemical Engineering at MIT. His research interest spans a wide variety of topics including thermal-, electro-, and photochemistry in batch and flow, kinetics and optimization, automation, and machine learning to develop new methods that accelerate chemical discovery and development. With his group, he explores new automated reaction systems integrated with online analytics, robotics, optimization, and machine learning algorithms toward autonomous discovery. In collaboration with colleagues in the MIT consortium for Machine Learning for Chemical Discovery and Synthesis, new algorithms for synthesis planning and process chemistry are developed.

Research topics related to PI:

- Microfluidics & flow chemistry
- Photochemical reactions
- Machine learning and AI for chemical discovery

Relevance for global challenges and megatrends:

- Modularization
- Digitalization

Recent achievements:

Prof. Jensen has received numerous honors and awards including the Neal R. Amundson Award (2023), the John Prausnitz AIChE Institute Lecturer Award (2018), the Corning International Prize for Outstanding Work in Continuous Flow Reactors & Chemistry for a Greener and Safer World (2018), the AIChE Founders Award for Outstanding Contributions to the Field of Chemical Engineering (2016), the IUPAC-ThalesNano International Prize (2012) and AIChE's William H. Walker Award for Excellence in Contributions to Chemical Engineering Literature (2011). He was named Fellow of the National Academy of Inventors, National Academy of Sciences, National Academy of Engineering, American Academy of Arts & Sciences, AIChE, and the Royal Society of Chemistry.

Recent publications: (https://orcid.org/0000-0001-7192-580X)

- Koscher, B.A.; Canty, R.B.; McDonald, M.A.; Greenman, K.P.; McGill, C.J.; Bilodeau, C.L.; Jin, W.; Wu, H.; Vermeire, F.H.; Jin, B.; Hart, T.; Kulesza, T.; Li, S.-C.; Jaakkola, T.S.; Barzilay, R.; Gomez-Bombarelli, R.; Green, W.H.; Jensen, K.F. (2023). Autonomous, multiproperty-driven molecular discovery: From predictions to measurements and back. Science 382, eadi1407. https://doi.org/10.1126/science.adi1407
- Zheng, Z.; Florit, F.; Brooke, J.; Wu, H.; Li, S.-C.; Nandiwale, K.Y.; Salazar, C.A.; Mustakis, J.G.; Green, W.H.; Jensen, K.F. (2024). Integrating Machine Learning and Large Language Models to Advance Exploration of Electrochemical Reactions. Angewandte Chemie International Edition e202418074. https://doi.org/10.1002/anie.202418074

Website or contact:

https://cheme.mit.edu/profile/klavs-f-jensen/

Name of the Group/Institution:

Faculty of Technology and Metallurgy, University of Belgrade, Serbia

Head of the Group:

Prof. Nikola Nikačević

Research profile:

Nikola Nikačević is a Full Professor of Chemical Engineering at the University of Belgrade, leading a research group and teaching courses in process modelling, optimization and intensification of energy and biochemical systems. His professional passions are scientific research, digital innovation and university education, which he combines in the quest for sustainability. His research interests focus on Process Intensification, Process Systems Engineering, Chemical Reaction Engineering, Multiphase Flows, and Environmental and Energy Engineering. He is also founder and CEO of Eon+, which develops digital expert systems and software for sustainable development projects.

Research topics related to PI:

- Micro- and Millireactors
- Oscillatory flow reactors
- Forced periodic operation
- Multiscale modeling

Relevance for global challenges and megatrends:

- Sustainability
- Modularization
- Digitalization

Recent achievements:

Prof. Nikačević is founder and executive director of the company Eon+, which develops digital expert systems and software for sustainable development. Together with his colleagues, he strives to transform Environmental and Social Impact Assessments (ESIA) with their digital platform Envigo. Envigo supports all parties and stakeholders involved in ESIA – investors of development projects, environmental and social specialists, financial and governmental decision-makers and the public, to obtain more sustainable projects.

Recent publications: (**https://orcid.org/0000-0003-1135-5336**)

- Todić, B.; Pravilović, R.; Nikačević, N. (2024). Design and simulations of a helical oscillatory baffled reactor for biochemical reactions. Chemical Engineering and Processing – Process Intensification 203, 109895. https://doi.org/10.1016/j.cep.2024.109895
- Tomić, A.; Pomeroy, B.; Todić, B.; Likozar, B.; Nikačević, N. (2024). Catalytic hydrogenation reaction micro-kinetic model for dibenzyltoluene as liquid organic hydrogen carrier. Applied Energy 365, 123262. https://doi.org/10.1016/j.apenergy.2024.123262

Website or contact:

https://www.tmf.bg.ac.rs/en/fis/zaposlen/312#gsc.tab=0

Name of the Group/Institution:

School of Engineering, Chemical Engineering, The University of Warwick, UK & Energy Intensified Chemical Reaction Engineering, TU Eindhoven, The Netherlands

Head of the Group:

Prof. Evgeny Rebrov

Research profile:

Evgeny Rebrov is Full Professor and Chair of Chemical Engineering at the University of Warwick as well as part-time Full Professor at TU Eindhoven, leading the research group Energy Intensified Chemical Reaction Engineering. The main field of research is the development of structured multiphase catalytic reactors, in particular hydrogenation reactors for fine chemical synthesis and their scale-up to capacities of 50 kg per day and beyond. His research focuses on the optimization of the regular microscopic structure of the reactor internals, to maximize process selectivity and the radial convective heat transfer rate. Another research line is devoted to the utilization of energy-intensified reaction conditions in chemical reactors by the application of nonconventional energy sources, such as microwave, induction heating, radiofrequency fields, non-thermal plasma and UV light, to activate catalysts and to intensify reaction and transport processes. The research is focused on the understanding and controlling of the interaction of physical transport and reaction processes at all relevant time and length scales in the realization and testing of these chemical reactors for a wide range of applications and processes. In the framework of the ERC Synergy project SCOPE, tailor-made catalytic reactors are developed to increase the plasma-catalyst interaction. Among these are plasma fluidized bed reactors for the production of ethylene from natural gas. Furthermore, Rebrov is involved with the development of advanced operational protocols allowing transient operation of chemical reactors.

Research topics related to PI:

- Structured catalysts and reactors
- Plasma reactors
- Electrification

Relevance for global challenges and megatrends:

- Sustainability
- New (advanced) materials

Recent achievements:

Prof. Rebrov has published over 170 peer-reviewed research papers and has more than 20 years of experience in catalyst development in collaboration with industrial companies such as DSM, SABIC, Avantium, Adisseo, Airbus, and others. He is a recipient of four of the highest EU awards: ERC Starting grant (2011), ERC Proof of Concept grant (2015), ERC Synergy grant (2018), and SME Stage2 Instrument grant (2019).

Recent publications: (**https://orcid.org/0000-0001-6056-9520**)

- De Felice, G.; Li, S.; Chung, Y.; Busqueta, J.C.; Ma, Z.; Gallucci, F.; Rebrov, E. (2025). Vertical baffles in a fluidized bed reactor: Hydraulic assessment with a numerical and experimental approach. Chemical Engineering Science, 302, 120805. https://doi.org/10.1016/j.ces.2024.120805.
- De Felice, G.; Li, S.; Anello, G.; Petit, C.; Gallucci, F.; Rebrov, E. (2024). Plasma assisted non-oxidative methane coupling over Ni-Fe mixed metal oxides. Catalysis Today, 440, 114832. https://doi.org/10.1016/j.cattod.2024.114832.

Website or contact:

https://warwick.ac.uk/fac/sci/eng/people/evgeny_rebrov/ & https://www.tue.nl/en/research/researchers/evgeny-rebrov

Name of the Group/Institution:

Laboratory for Chemical Technology, Ghent University, Belgium

Head of the Group:

Prof. Yi Ouyang

Research profile:

Yi Ouyang is an Assistant Professor at the Laboratory for Chemical Technology of Ghent University. He is a former FWO postdoctoral researcher focusing on the process intensification of CO2 capture. His main research interests lie in process intensification in general and in particular the development of process intensification technologies aided by multi-scale computation and modelling. This includes but is not limited to: development of novel reactors, visualization of transport phenomena, mixing/heat/mass transfer performance assessment, computational fluid dynamics simulation (multiphase flow, turbulence flow and reactive flow, etc.), process simulation, scale-up and optimization. He has extensive expertise in the development of vortex units and rotating packing beds targeting various applications.

Research topics related to PI:

- Multiscale modeling and simulation
- Intensified (multiphase) reactors
- Vortex reactors

Relevance for global challenges and megatrends:

- Sustainability
- Digitalization

Recent achievements:

- Assistant Professor, Ghent University (since 2022)
- Guest Professor, KU Leuven (since 2024)
- Visiting Research Fellow, University College London (2023)
- Editor, Chemical Engineering Research and Design (since 2024)
- Editorial Board Member, Chemical Engineering Journal (since 2024)
- Early Career Advisory Board Member, Chemical Engineering and Processing - Process Intensification (since 2024)

Recent publications: (https://orcid.org/0000-0002-1950-4538)

- Kourou, A.; Chen, S.; Ouyang, Y. (2024). Gas-liquid and liquid-liquid vortex technology for process intensification. Current Opinion in Chemical Engineering 46, 101056. https://doi.org/10.1016/j.coche.2024.101056
- Dutta, S.; Roy, S.; Lang, X.; Chen, S.; Kumar, R.; Loha, C.; Verspeelt, T.; Van Geem, K.M.; Heynderickx, G.J.; Ouyang, Y. (2024). Process Intensification of CO2 Desorption in a Gas–Liquid Vortex Reactor. Industrial & Engineering Chemistry Research 63(24), 10544-10553. https://doi.org/10.1021/acs.iecr.4c00904

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https://www.lct.ugent.be/people/yi-ouyang