



# Intensifying a 100 year old process: Control of emulsion polymerisation

Date: 14th and 15th January 2015, Venue: Dechema, Frankfurt

## COOPOL PROJECT PARTNERS:



## INTRODUCTION

COOPOL (Control and Real-Time Optimisation of Intensive Polymerisation Processes) is an EU collaborative research project. Its goal is to achieve a significant increase in the product quality of polymerisation reactions for intensified semi-batch and 'smart-scale' continuous polymerisation processes in the chemical industry.

A collaboration of industrial and academic partners, including BASF, the world's leading chemical company, the project will deliver a significant advance in the state of the art in model-based predictive control. The new processes developed will be benchmarked against current industrial processes, including technological, economic, risk and environmental factors leading to the rapid transfer of research into innovation.

The COOPOL Project, in partnership with Dechema are proud to deliver this unique two day international symposium on the topic of emulsion polymerisation process control.

## Welcome to Frankfurt!



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## PROGRAMME

### Day 1 - Wednesday 14 January 2015

Time	Agenda
13.00 - 13.30	Registration
13.30 - 14.00	Plenary Session - <b>Prof. David Haddleton</b> , University of Warwick, UK (COOPOL)
14.00 - 14.45	<b>Prof. José M. Asua</b> , University of the Basque Country UPV/EHU, Spain  Presentation: <i>Opportunities and Challenges in Continuous Production of Emulsion Polymers</i>
14.45 - 15.15	<b>Prof. Dr. Ing. Juraj Kosek</b> , Institute of Chemical Technology Prague (VSCHT), Czech Republic (COOPOL)  Presentation: <i>Modelling of Emulsion Copolymerisation Reactors: from Kinetics and Thermodynamics to the Dispersion Stability</i>
15.15 - 15.35	Break
15.35 - 16.20	<b>Prof. Dr. Volker Hessel</b> , Eindhoven University of Technology TU, Netherlands  Presentation: <i>Flow Chemistry Activation, Flow Polyreactions and Flow-Made Polymer Particles</i>
16.20 - 16.50	<b>Prof. Alexander Mitsos</b> , RWTH Aachen University, Germany (COOPOL)  Presentation: <i>From Sensor Tips to State and Parameter Estimates</i>
16.50 - 19.20	Poster Exhibition, sponsored by Macromolecular Journals, Wiley-VCH and Networking Session (with finger buffet)

## PROGRAMME

### Day 2 - Thursday 15 January 2015

Time	Agenda
08.30 - 09.00	Registration
09.00 - 09.15	Welcome words - <b>Prof. Klaus Dieter Hungenberg</b> , BASF, Germany (COOPOL)
09.15 - 10.00	<b>Prof. Massimo Morbidelli</b> , ETH Zürich, Switzerland  Presentation: <i>Polymer Colloid Engineering</i>
10.00 - 10.45	<b>Dr. John Tsavalas</b> , University of New Hampshire, USA  Presentation: <i>Semi-Batch Emulsion Polymerisation: Influence of Carboxylic Acid and Divinyl Monomers on Kinetics and Morphology Control</i>
10.45 - 11.05	Break
11.05 - 11.35	<b>Dr. Ing. Peter Singstad</b> , Cybernetica, Norway (COOPOL)  Presentation: <i>Robust Optimisation-Based Control for Process Intensification</i>
11.35 - 12.20	<b>Prof. Dr. Ir. Stefan Bon</b> , University of Warwick, UK  Presentation: <i>Supracolloidal Polymer Chemistry: Hybrid Polymer Latexes and Responsive Microgels</i>
12.20 - 13.20	Lunch and Networking
13.20 - 13.50	<b>Prof. Dr. Hans-Ulrich Moritz</b> , University of Hamburg, Germany (COOPOL)  Presentation: <i>Process Intensification of Continuous Emulsion Polymerisation</i>
13.50 - 14.35	<b>Prof. Dr. Ing. Sebastian Engell</b> , TU Dortmund (Process Dynamics and Operations Group, Biochemical and Chemical Engineering Department ), Germany  Presentation: <i>Robust Optimising Control of Chemical Processes</i>
14.35 - 14.50	Break
14.50 - 15.20	<b>Mr. Omar Naeem</b> , BASF, Germany (COOPOL)  Presentation: <i>Intensification of Semi-Batch Emulsion Polymerisation Processes – A Demonstration Case Study at BASF</i>
15.20 - 15.50	<b>Mr. Sébastien Mortier</b> , Research Programme Officer at European Commission - DG-RTD  Presentation: <i>The Role of Process Intensification within the European Union Spire Programme and EU Funding Possibilities To Further Research</i>
15.50 - 16.00	Closing Remarks

## INVITED SPEAKERS AND PROJECT PRESENTERS - DAY 1



**Prof. David. M. Haddleton, Warwick University, UK**

David M. Haddleton obtained a PhD in 1986 at The University of York, and went on to work at The University of Toronto a year later. Returning to the UK in 1993 to commence as a Lecturer, and then Senior Lecturer at The University of Warwick. In 2001, he became CEO and Founder of 'Warwick Effect Polymers Ltd'. Professor Haddleton is Editor-in-Chief for the Polymer Chemistry RSC Journal, and the European Polymer Journal. He is currently Head of Inorganic and Materials Section of Chemistry Department at Warwick University. Research interests include Polymers for Healthcare and Therapeutics, and Controlled Free Radical Polymerisation.

**Prof. Dr. José M. Asua, University of the Basque Country, SPAIN**

José M. Asua is Professor of Chemical Engineering and Director of the Research Institute for Polymer Materials (POLYMAT) of the University of the Basque Country at Donostia-San Sebastián, Spain. He earned his BS in Chemistry and MS in Chemical Engineering from the University of Bilbao and the PhD in Chemical Engineering from the University of Zaragoza (catalyst deactivation). He did postdoctoral research at the University of Liege (Belgium) working on hydrodynamics of Trickle Bed Reactors. "Novel Process Windows" (2010). He is Editor-in-Chief of the "Green Processing and Synthesis" journal.



**Prof. Dr. Ing. Juraj Kosek, Institute of Chemical Technology, CZECH REPUBLIC**

Juraj Kosek obtained PhD in chemical engineering at the Institute of Chemical Technology Prague in 1995 for the work on spatiotemporal patterns in ionic chemical systems and then spent his post-doc at University of Wisconsin in Madison, where he worked on computer-aided design of catalytic polymerisation of olefins. The research group of Juraj Kosek was established in 2000 in Prague. The main research topics are polymers morphology and thermodynamics (primarily for polyolefins) and in recent years also the energy storage.

**Prof. Dr. Volker Hessel, Eindhoven University of Technology TU/e, THE NETHERLANDS**

Prof. Dr. Volker Hessel studied chemistry at Mainz University. In 1994 he joined the Institut für Mikrotechnik Mainz GmbH, and became Director R&D in 2007. In 2005, he was appointed as part-time and, in 2011, as full professor at Eindhoven University of Technology (honorary professor at the Technical University of Darmstadt). He has published over 280 peer-reviewed papers and 8 books. He received the AIChE Award "Excellence in Process Development Research" (2007) and the ERC Advanced Grant "Novel Process Windows" (2010). He is Editor-in-Chief of the "Green Processing and Synthesis" journal.



**Prof. Alexander Mitsos, RWTH Aachen University, GERMANY**

Alexander Mitsos is a Full Professor (W3) in RWTH Aachen University, and the Director of the Laboratory for Process Systems Engineering (AVT.SVT), comprising 40 research and administrative staff. Mitsos received his Dipl-Ing from University of Karlsruhe in 1999 and his Ph.D. from MIT in 2006, both in Chemical Engineering. Prior appointments include military service, free-lance engineering, involvement in a start-up company, a junior research group leader position in the Aachen Institute of Computational Engineering Science and the Rockwell International Assistant Professorship at MIT. Mitsos has over 60 publications in peer-reviewed journals and has received a number of awards.



## INVITED SPEAKERS AND PROJECT PRESENTERS - DAY 2



**Prof. Klaus Dieter Hungenberg, BASF, GERMANY**

K.-D. Hungenberg studied Chemistry at the University of Essen where he received his Diploma and PhD in 1979 and 1982. Until 1987 he worked as a Research Chemist with Boehringer Mannheim in the development of blood diagnostic devices. In 1987 he joined BASF's Polymer Research where he held various positions as Chemist, Plant Manager, Research Director and Vice President. His main research emphasis is polymer reaction engineering and modeling, simulation and optimisation of polymer processes. He is (co-)author of about 100 scientific articles and patents. In 2012, Hungenberg received an Honorary Professorship at the University of Paderborn. He retired from BASF in 2013, but is still continuing his academic activities.

**Prof. Massimo Morbidelli, ETH Zürich, SWITZERLAND**

Massimo Morbidelli received his Laurea in Chemical Engineering at the Politecnico di Milano in 1977, and his PhD in Chemical Engineering at the University of Notre Dame in 1986. After his first appointments as Professor at the University of Cagliari (Italy) and then at the Politecnico di Milano, he is, since 1997, Professor of Chemical Reaction Engineering at the Institute for Chemical and Bioengineering at ETH Zurich (Switzerland). His main research interests are in Chemical Reaction Engineering, with particular emphasis on polymer reactions and reaction-separation processes based on continuous chromatography. Massimo Morbidelli is co-author of more than 300 papers, 11 international patents and four books.



**Dr. John Tsavalas, University of New Hampshire, USA**

John Tsavalas is the Director of the Nanostructured Polymers Research Center and an Assistant Professor of Materials Science at the University of New Hampshire. He received his PhD degree in Chemical Engineering from The Georgia Institute of Technology (Atlanta, GA, USA) after which he was a Senior Research Scientist in The Dow Chemical Company (Midland, MI USA). In industry he worked on a wide variety of polymer colloid related R&D with particular emphasis on nanostructured latex particles. Now at the University of New Hampshire, one of Professor Tsavalas' current active areas of research is colloidal nanostructure morphology development.

**Dr. Peter Singstad, Cybernetica AS, NORWAY**

Peter Singstad received his MSc and PhD degrees in Engineering Cybernetics at the Norwegian Institute of Technology in 1982 and 1992, respectively. In the period 1983-2000 he held positions as Scientist, Research Manager and Research Director at the Norwegian research foundation SINTEF. He is a co-founder of Cybernetica and has been Managing Director of the company since the start-up in 2000. Research interests include modelling of polymerisation processes, model based predictive control and industrial applications thereof.



**Prof. Dr. ir. Stefan A. F. Bon, University of Warwick, UK**

Stefan A. F. Bon is a full Professor in the Department of Chemistry at the University of Warwick (UK). His research focuses on supracolloidal chemical engineering. In the BonLab, colloidal systems in which molecular and/or colloidal entities can be assembled into more complex supracolloidal structures are studied. Professor Bon and his team are interested in the synthesis of particles and macromolecules with a design tailored to trigger and control motility and assembly, the development of methods to (self)-organise colloidal matter, the understanding of the interactions involved between molecular and colloidal building blocks and macroscopic

## INVITED SPEAKERS AND PROJECT PRESENTERS - DAY 2



**Prof. Dr. Hans-Ulrich Moritz, University of Hamburg, GERMANY**

Hans-Ulrich Moritz is a full Professor at the Institute of Technical and Macromolecular Chemistry in the Department of Chemistry at the University of Hamburg. In October 1990 he joined the Department of Chemistry at the University of Paderborn as Professor for technical chemistry and chemical engineering. After the German reunification, Hans-Ulrich Moritz received a call from the Technical University of Dresden in 1993 and in 1995 from the University of Hamburg, where he moved in 1996. Prof. Moritz' main research interests are polymer reaction engineering and polymer reactor safety, in particular optimisation of polymer reaction processes.

**Prof. Dr. Ing. Sebastian Engell, Technical University Dortmund, GERMANY**

Sebastian Engell obtained the Dr.-Ing. degree and the *venia legendi* in Automatic Control from Universität Duisburg, Germany, in 1981 and 1987. In the period 1986 to 1990 he was the head of an R&D group at the Fraunhofer Institute IITB in Karlsruhe, Germany. He was then appointed to his present position as Full Professor of Process Dynamics and Operations in the Department of Biochemical and Chemical Engineering at TU Dortmund. In 2008 he was a Visiting Professor at Carnegie Mellon University, Pittsburgh, USA. He became Department Chairman in 1996-1999 and in 2011-2014 and Vice-Rector for Research and International Relations of TU Dortmund 2002-2006.



**Omar Naeem, BASF, GERMANY**

Omar Naeem studied Mechanical Engineering in University of Engineering and Technology Lahore, Pakistan from 1999-2002. He graduated in Chemical Process Engineering from Magdeburg University, in Germany in 2005. His thesis focused mainly on polymerisation process modeling and optimisation. He moved to Technical University Delft in the group of systems and control for his PhD studies in 2006. His research work concentrated on model reduction methods for real time process control of chemical processes. Since August 2010, he has been working in Polymer Reaction Engineering group in BASF SE, mainly working in the field of process optimisation and control of polymerisation processes.

**Mr. Sébastien Mortier, European Commission, BELGIUM**

Sébastien Mortier is a Research Programme Officer in the Unit "Advanced Manufacturing Systems and Biotechnologies" at the European Commission (DG Research). He deals both with policy aspects of research, and implementation related questions, regarding FP7 and H2020 funding schemes. Sébastien has a background in mechanical engineering (University of Liège – Belgium), and worked on large industrial projects in the Nuclear and Process Industries, and on Advanced Nuclear Technologies and their related mechanical aspects. He is experienced in the construction phases of projects for large nuclear power plants, and has also worked as a calculation engineer on non-linear finite elements methods, for the Aerospace and Steel Industries. Coupled with his background in science, Sébastien also possesses a Masters in Management (Solvay Brussels School).



## POSTER TITLES

### **The Adsorption of Microparticles at Liquid-Liquid Interface**

Hamza Al-Shehria, Tommy S. Horozova, and Vesselin N. Paunov - UNIVERSITY OF HULL

### **Diffusion of Ethanol in Polyethylene Vinyl Acetate: Modelisation and Experimentation**

Rachid Atmani, M'hammed Elkouali, Mohammed Talbi, Abdelhak El Brouzi, Nadia Amardo, Mona Bouamrani, Samia Yousfi - UNIVERSITY HASSAN II

### **Particle Size Monitoring of Batch and Semi-Batch Emulsion Polymerisations by using RAMAN- and Turbidity Sensors**

Peter Broege, Werner Pauer, Hans-Ulrich Moritz - UNIVERSITY OF HAMBURG

### **Copolymer Nanoparticles via RAFT Emulsion Polymerisation: Synthesis, Characterisation and Interfacial Activity**

Victoria J. Cunningham, Abdullah M. Alswieleh, Kate L. Thompson, Mark Williams, Graham J. Leggett and Steven P. Armes - UNIVERSITY OF SHEFFIELD

### **Improved Simulation of Miniemulsion NMP of Acrylates: Relevance of Partitioning and Short Chain Branch Formation**

Dagmar R. D'hooge, Paul H. M. Van Steenberge, Marie-Françoise Reyniers, Michael F. Cunningham, Guy B. Marin - GHENT UNIVERSITY

### **Online Monitoring of Emulsion Polymerisations using Raman Spectroscopy**

Claudia Houben, Alexei Lapkin - UNIVERSITY OF CAMBRIDGE

### **Influence of Buffer Concentration and Type on Poly (vinyl chloride) Resins Properties Produced by Suspension Polymerisation**

Nima Jafari Boroujeni, Mohsen Nasr Esfahany - ISFAHAN UNIVERSITY OF TECHNOLOGY

### **Effect of Sensor Network Configuration on Identifiability and Observability of Semi-batch Emulsion Polymerisation Processes**

Preet Joy, Adel Mhamdi, Alexander Mitsos - RWTH AACHEN UNIVERSITY

### **Modeling, Parameter and State Estimation of a Continuous Emulsion Polymerisation Process**

Falco Jung, Preet Joy, Adel Mhamdi, Alexander Mitsos - RWTH AACHEN UNIVERSITY

### **Coagulation and Fouling in Sheared Emulsions: Modeling by Discrete Element Method**

Martin Kroupa, Michal Vonka, Juraj Kosek - INSTITUTE OF CHEMICAL TECHNOLOGY PRAGUE

### **Optimised Process Properties of a Smart Scale Tubular Reactor for Emulsion Polymerisation**

Fabian Lueth, Werner Pauer, Hans-Ulrich Moritz - UNIVERSITY OF HAMBURG

### **Mathematical Modeling of Emulsion Copolymerisation in a Smart-Scale Tubular Reactor**

Richard Pokorný, Alexandr Zubov, Juraj Kosek - INSTITUTE OF CHEMICAL TECHNOLOGY PRAGUE

### **Robust Dynamic Real-Time Optimisation of the Semi-Batch Emulsion Polymerisation Process with Uncertainties in the Parameter Values**

Jennifer Puschke, Alexander Mitsos - RWTH AACHEN UNIVERSITY



**Preparation of Poly(methylmethacrylate) Nanoparticles by Emulsion Polymerisation Process for the Development of Pharmaceutical Formulation**

Santhanam Ramesh, E.P.Kumar, A.Anton Smith - NEHRU COLLEGE OF PHARMACY

**Preparation of Conductive Polyaniline/Fe<sub>3</sub>O<sub>4</sub>/polypyrrole Nanocomposites via Ultrasound Aided Situ Emulsion Polymerisation and Environmental Application**

Nabila Rauf Naz - SEJONG UNIVERSITY, SEOUL SOUTH KOREA

**Influence of Parameter Variation on Chemical Properties of Copolymers Produced in a Continuous Smart Scale Reactor**

Katrina Rossow, Fabian Lueth, Werner Pauer, Hans-Ulrich Moritz - UNIVERSITY OF HAMBURG

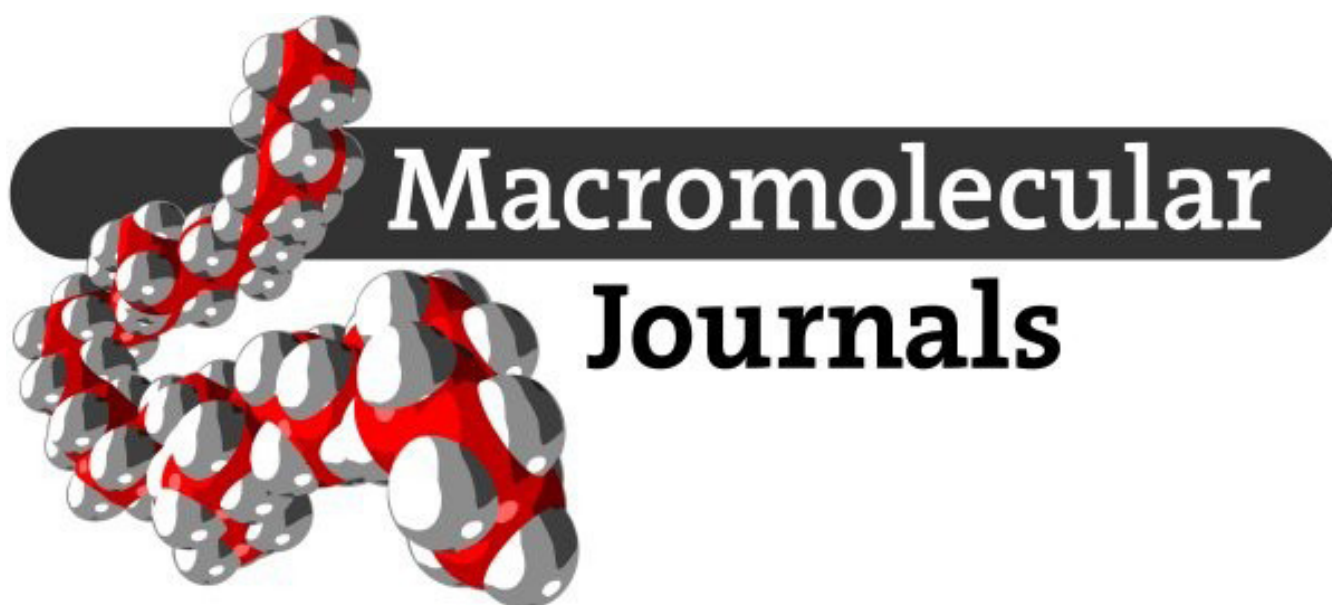
**Elastomeric Opal Films by Convenient Emulsion Polymerisation and Melt-Shear-Ordering**

Daniel Scheid and Markus Gallei - TECHNICAL UNIVERSITY DARMSTADT

**Dynamic Model and On-line Monitoring of 4-Monomer Emulsion Copolymerisation in Semi-Batch Reactor**

Alexandr Zubov, Richard Pokorný, Petr Matuška, Juraj Kosek - INSTITUTE OF CHEMICAL TECHNOLOGY PRAGUE

**This Poster Session is Sponsored by the Macromolecular Journals.**



The Macromolecular Journals regularly sponsor prizes for the best poster or oral presentations at selected international conferences, preferably awarded to aspiring younger scientists. The prizes encompass vouchers for books from the Wiley/Wiley-VCH program and free subscriptions to the Macromolecular Journals. A voucher for books to the value of 150 Euros and a one year free online subscription to Macromol Reaction Engineering prize will be awarded to the best poster.

We will also feature the winner at <http://macroawards.materialsviews.com>.

# DECHEMA FLOORPLAN



## NOTES

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