

## Prof. Dr.-Ing. Andreas Jupke

(\*14.05.1969, married, two children: 2004, 2005)

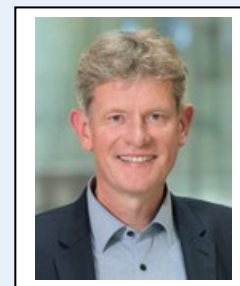
RWTH Aachen University

AVT – Aachener Verfahrenstechnik

Chair of Fluid Process Engineering (AVT.FVT)

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[<https://scholar.google.de/citations?user=IlgOwRYAAAAJ&hl=de&oi=ao> ]

### Working group vision and contribution to catalaix

The research spectrum of the Chair of Fluid Process Technology (AVT.FVT) headed by Prof. Dr.-Ing. Andreas Jupke covers the basic unit operations of the thermal separation processes extraction, crystallization and chromatography as well as multiphase reaction systems. In addition to material conversion, separation technology plays a key role in the transformation to a circular economy. In a OpenLoop circular economy, complex mixtures of substances are produced, and new, robust, and energy-efficient separation processes are required for their purification. A key challenge here is to consider the influence of unknown impurities that accumulate over the various product life cycles in the raw material streams of the multidimensional circular economy or are generated by new catalytic processes. The next generation separation process must therefore be able to respond flexibly to such changes to always ensure stable operation. Our vision is to develop a new generation of unit operations of thermal separation processes that will meet these requirements and thus ensure that processes in a multidimensional OpenLoop circular economy can be operated reliably, ecologically, and economically.

The research group has extensive expertise in the experimental and model-based analysis of fundamental phenomena as well as thermodynamic and kinetic parameters. This knowledge is used to develop new simulation tools for the design of apparatus and the integration of machine-learning methods for plant control and real-time condition diagnostics. There is also extensive experience in the use of reactive separation processes and process intensification through in-situ product separation or electrification of thermal separation processes. Another core competence is the scaling of processes from laboratory to mini plant and pilot plant scale. Accompanied by techno-economic analyses, this enables a targeted translation of scientific innovations into technical implementation. In the past, AVT.FVT has successfully contributed this expertise to various research projects with a thematic connection to catalaix. These include projects that explore bio-based manufacturing routes for currently fossil-based chemicals (e.g. UpRePP), the recycling of waste streams (e.g. Carbon4PUR), or the recycling of polymers from insulation materials (Circular Foam) or textiles (EOL modell). Within catalaix, we advance these topics by applying our knowledge of holistic process development and detailed consideration of individual basic operations in dialog with other disciplines. In addition, the research building "Next Generation Processes and Products - NGP<sup>2</sup>" and the existing equipment with pilot plant scale apparatus offer the possibility to technically scale up developed processes and demonstrate their implementation so that a multidimensional circular economy can be realized on a technical scale.

## Current & Previous Positions

Since 2022	Director at the Institute for Bio- and Geosciences (IBG-2), Research Centre Jülich
Since 2014	Professor (W3) and Head of the Chair of Fluid Process Engineering, RWTH Aachen
2011-2014	Head of Technology Center 'Polyurethane Application Development', Bayer Material Science AG (now Covestro AG)
2009-2011	Manager of the global energy efficiency program of Bayer AG
2006-2011	Head of the Competence Center 'Process Analysis', Bayer Technology Services
2001-2006	Project Manager at the Competence Center 'Conceptual Design', Bayer Technology Serv.
1994-1997	Project manager in the department 'Process Technology & Engineering', Goldschmidt AG (today Evonik AG)

## Education

2003	Dr.-Ing. from TU Dortmund, Chair of Process & Plant Design
1997 – 2001	Research assistant at the Chair of Plant and Process Engineering, TU Dortmund University
1988 – 1994	Studies in Chemical Engineering, Dipl.-Ing., TU Dortmund

## Contributions to the science system

Since 2023	Member of the program management board of the CAT Catalytic Center, RWTH Aachen
Since 2020	Managing director of the AVT Biorefinery, RWTH Aachen
Since 2020	Member of the Steering Committee of the Cluster of Excellence "The Fuel Science Center" (EXC2186) of the German Research Foundation (DFG)
Since 2020	Head of the expert section 'Extraction' of DECHEMA
Since 2018	Member of the board of directors of the Bioeconomy Science Center (BioSC)
Since 2018	Researcher in the DFG Cluster of Excellence 'The Fuel Science Center' (EXC2186).
Since 2016	Researcher in the SFB 985 'Functional Microgels and Microgel Systems' of the DFG
Since 2016	Advisory Board of the expert section 'Process, Apparatus and Plant Engineering', DECHEMA
Since 2016	Advisory Board of the expert section 'Industrial Utilization of Renewable Resources', DECHEMA
Since 2016	Advisory Board of the expert section 'Extraction', DECHEMA

## Selected Projects

2024-2028	CIRCON - Innovation platform for the continuous production of circular plastics with subsequent testing of the product life cycle; Volkswagen Foundation
2023-2025	Re.Solution - Technology transfer of chemical processes for recycling used polyester-containing textiles; BMWK (Exist spin-off project)
2023-2025	ECOYIELD - Electrochemical processing of fumaric acid with CO <sub>2</sub> recycling to increase biotechnological carbon yield; BMEL
2022-2025	BioPlasticCycle - Development of a circular economy for bioplastics; BioSC
2022-2024	EOl modell - process modeling and life cycle analysis of end-of-life scenarios for textile waste streams; AiF
2021-2025	Circular Foam - Recycling of rigid polyurethane foam using chemolysis and pyrolysis; EU Horizon 2020
2020-2024	MIX-UP - Biodegradation of mixed plastics and upcycling by microbial cultures; EU Horizon 2020.
2020-2024	Carbon2Chem - Conceptual process and reactor development for the production of polycarbonate from metallurgical gases; BMBF
2018-2025	The Fuel Science Center (EXC2186) - Clusters of Excellence, DFG
2019-2021	UpRePP - Upcycling of regional residues to produce platform chemicals; BMBF
2017-2020	Carbon4PUR - Conversion of industrial waste gases (CO/CO <sub>2</sub> ) into intermediates for polyurethane plastics; EU Horizon 2020
2016-2024	SFB 985 - Functional Microgels and Microgel Systems; DFG

## Most important scientific contributions

1. Gausmann, Marcel; Kocks, Christian; Doeker, Moritz; Eggert, Armin; Maßmann, Tim; Jupke, Andreas (2020): Recovery of succinic acid by integrated multi-phase electrochemical pH-shift extraction and crystallization. In: *Separation and Purification Technology* 240, S. 116489.
  - Environmentally friendly purification strategy of succinic acid by electrochemically induced extraction and crystallization.
2. Eggert, Armin; Maßmann, Tim; Kreyenschulte, Dirk; Becker, Moritz; Heyman, Benedikt; Büchs, Jochen; Jupke, Andreas (2019): Integrated in-situ product removal process concept for itaconic acid by reactive extraction, pH-shift back extraction and purification by pH-shift crystallization. In: *Separation and Purification Technology* 215, S. 463–472.
  - Recovery of itaconic acid from diluted aqueous fermentation broths by in situ product separation and crystallization.
3. Kaiser, Teresa; Rathgeb, Andrea; Gertig, Christoph; Bardow, André; Leonhard, Kai; Jupke, Andreas (2018): Carbon2Polymer – Conceptual Design of a CO<sub>2</sub> -Based Process for the Production of Isocyanates. In: *Chemie Ingenieur Technik* 90 (10), S. 1497–1503.
  - Process concept for CO<sub>2</sub>-based production of main starting materials of polyurethane plastic and discussion of important process parameters.
4. Faulde, Miriam; Siemes, Eric; Wöll, Dominik; Jupke, Andreas (2018): Fluid Dynamics of Microgel-Covered Drops Reveal Impact on Interfacial Conditions. In: *Polymers* 10 (8).
  - Experimental investigation of the influence of microgels on the sedimentation behavior of droplets.
5. Aigner, Maximilian; Roth, Daniel; Rußkamp, Julia; Klankermayer, Jürgen; Jupke, Andreas (2020): Model-based equipment design for the biphasic production of 5-hydroxymethylfurfural in a tubular reactor. In: *AIChE J* 66 (4).
  - Development of a reactor and separation concept for the production of 5-hydroxymethylfurfural.
6. Conen, Niclas; Fuchs, Martin; Hoffmann, Alexander; Herres-Pawlis, Sonja; Jupke, Andreas (2023): Taking the Next Step—Model-Based Analysis of Robust and Non-Toxic Zn Catalysts for the Ring Opening Polymerization of Lactide in the Polymer Melt. In: *Advanced Sustainable Systems* 7 (2), Artikel 2200359.
  - Modeling the kinetics of polymerization processes for the future design of alternative non-toxic catalysts.
7. Bachmann, Rolf; Klinger, Marcel; Jupke, Andreas (2021): Molecular Weight Distribution in Di Metal Cyanide Catalyzed Polymerization 1: Fundamental Distribution for Length Dependent Propagation Constant and Segments. In: *Macro Theory & Simulations* 30 (5), Artikel 2100012. DOI: 10.1002/mats.202100012.
  - Mathematical description of polymer size distributions.
8. Reifsteck, Rafael A.; Zhai, Song; Gausmann, Marcel; Ballerstedt, Hendrik; Tiso, Till; Blank, Lars M.; Jupke, Andreas (2023): Techno-Economic Comparison of Bio-Cycling Processes for Mixed Plastic Waste Valorization. In: *Chemie Ingenieur Technik* 95 (8), S. 1247–1258. DOI: 10.1002/cite.202300021.
  - Analysis of the potential of biotechnology for the conversion of mixed plastic waste into environmentally friendly chemicals.

## Patents

1. A.Eggert, S. Sibirtsev, A. Jupke: Vorrichtung und Verfahren zur Untersuchung und/oder Durchführung einer Reaktion von wenigstens zwei Phasen im Zentrifugalfeld, Patent DE102016012649A1, Offenlegung 26.04.2018
2. A. Eggert, M. Gausmann, A. Jupke, T. Massmann: Transferring a target substance between two liquid phases, Patent US 11,471,787 B2, Offenlegung 01.08.2019