# Cooperations

# Current Projects (Selection)

## SFB Transregio 63: InPROMPT

Energy-efficient purification of long-chain aldehydes using hybrid processes consisting of distillation, organophilic nanofiltration and crystallisation.

## EuroBioRef

Development and implementation of multilevel integrated biorefinery processes, with focus on the production of biofuels and high value chemicals.

## F3-Factory

"Flexible, fast and future factory", a module-based, continuously operated factory constituted of convenient standardised processes and interfaces.

## CLIB-Graduate Cluster

A joint doctoral programme in the field of industrial biotechnology at three universities in close cooperation with the industry, coordinated by CLIB 2021.

## MoBiDik

Towards a paradigm shift to a modular, flexible, continuous and single-use bioprocess technology - cooperation between industry and academia.

Ministerium für Innovation, Wissenschaft und Forschung des Landes Nordrhein-Westfalen

# How To Reach Us

## Public Transport

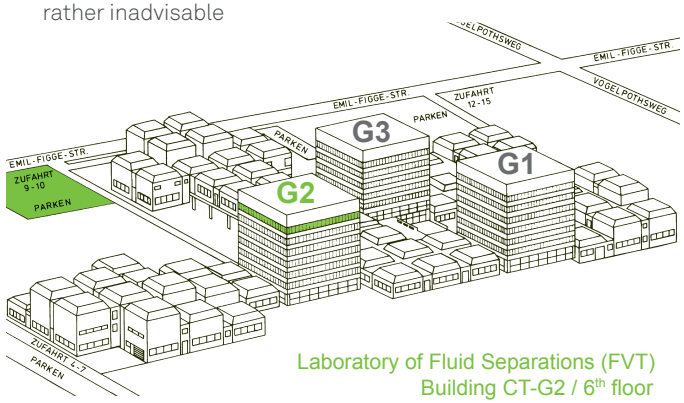
- From Dortmund Central Station: take S-Bahn line S1 in direction of Düsseldorf/Bochum, get off at "Dortmund Universität"
- From Düsseldorf, Essen or Bochum Cental Station: take S-Bahn line S1 in direction of Dortmund, get off at "Dortmund Universität"

## Directions by car

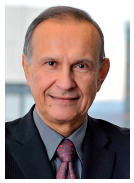
- From West/East: Ruhrschnellweg (A40/B1), exit Dortmund-Dorstfeld/Universität
- From North/South: Sauerlandlinie (A45), exit Dortmund-Eichlinghofen/Universität

## Airports

- Düsseldorf Airport: take S-Bahn line S1 in direction of Dortmund, get off at "Dortmund Universität"
- Dortmund Airport: take a taxi or a car - public transport is rather inadvisable




Laboratory of Fluid Separations (FVT)
Building CT-G2 / 6th floor

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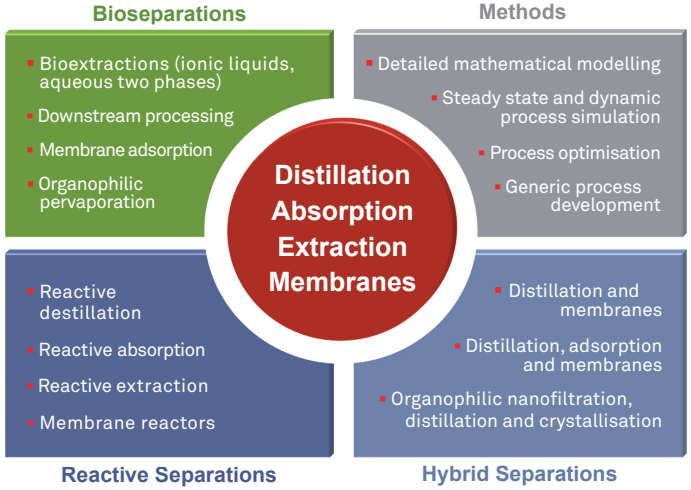
technische universität dortmund

Laboratory of

# Fluid Separations

Prof. Dr.-Ing. Andrzej Górak




# Research Topics

Department of Biochemical and Chemical Engineering

# Research Topics - Processes

## Conventional Fluid Separations

- Distillation, absorption and extraction
- Mass & heat transfer in multicomponent systems
- Experimental determination of model parameters
- Rigorous modelling and simulation (cont. & batch)

## Reactive Separations

- Reactive distillation, absorption and extraction
- Modelling, simulation and experimental investigation
- Process design and optimisation

## Membrane Separations

- Pervaporation, vapour permeation, organic solvent nanofiltration and membrane reactors
- Detailed modelling and simulation
- Experimental determination of model parameters

## Hybrid Separations

- Combination of conventional fluid separations
- Membrane assisted separation processes
- Modelling, simulation, optimisation and experimental investigation

## Process Intensification

- Using reactive and hybrid separations
- Combining membranes with reactive separations
- Investigation of rotating packed bed separations
- Influence of microwaves and ultrasound on reactions and separations

## Bioseparations

- Aqueous two phase extraction of biomolecules
- Application of ionic liquids for bioextraction
- Membrane adsorption of pharmaceuticals
- Bioalcohol separation by organophilic membranes
- Optimisation of downstream processing

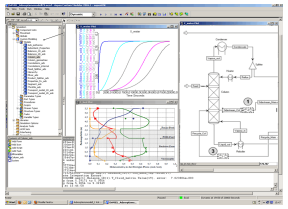
# Experiments & Methods

## Experimental Facilities and Investigations

- Non-reactive, reactive, hybrid and membrane separations
- Model validation in our own labs and pilot-plant facilities as well as in cooperation with industrial partners

- Experimental determination of parameters for process models (mass transfer, reaction kinetics)
- Membrane adsorption for purification of bioproducts

## Process Simulation, Analysis & Optimisation



- Development of rate-based models for conventional, reactive and hybrid separations
- Simulation and optimisation of membrane and bioseparation processes

# Technical Services

Our experimental and analytical equipment allows a complete investigation of your separation problem. The equipment consists of:

- Lab & pilot-scale columns for distillation (catalytic and non-cat. internals) and absorption
- Lab & pilot-scale membrane plants (PV, VP, OSN)
- Stirred cell reactor (gas-liquid reaction kinetics)
- Mixer-settler devices for solvent screening
- Rotating packed bed (HIGEE) for (reactive) distillation
- Analytics: 3x GC (FID, TCD), 2x HPLC (RI, UV, ELSD), ion chromatography, gelelectrophoresis, UV spectrophotometer, microplate photometer, 2x KF-titration and 1x automatic titration
- Cleanbench and autoclave

# Selected Publications

## Papers


- T. Keller, A. Górak: Modelling of homogeneously catalysed reactive distillation processes in packed columns: Experimental model validation. Comput. Chem. Eng. 48 (2013), 74-88.
- P. Schmidt, T. Köse, P. Lutze: Characterisation of organic solvent nanofiltration membranes in multi-component mixtures: Membrane rejection maps and membrane selectivity maps for conceptual process design. J. Membr. Sci. 429 (2013), 103-120.
- A. Prinz, T. Zeiner, T. Vössing, I. Schüttmann, H. Zorn, A. Górak: Experimental investigation of laccase purification using aqueous two-phase extraction. Chem. Eng. Trans. 27 (2012), 349-354.
- J. Holtbrügge, P. Lutze, A. Górak: Modeling, Simulation and Experimental Investigation of a Reactive Hybrid Process for the Production of Dimethyl Carbonate. Comput. Aided Chem. Eng. 31 (2012) 1241-1245.
- A. Górak, A. Stankiewicz: Intensified Reaction and Separation Systems. Annu. Rev. Chem. Biomol. Eng. 2 (2011), 431-451.


## Patents


- W.R. Pitner, M. Schulte, A. Górak, F. Santangelo, A.E. Wentink: Use of ionic liquids with tetracyanoborate anions as a solvent for extraction of alcohols from aqueous solutions. WO 2009152906.
- P. van Beijeren, P. Kreis, C. Frerick, A. Górak, R. Faber, W. Demmer: Device and method for separating and isolating substances. DE 10 2009 005 497.0.


# Teaching

## Compulsory & Elective Courses

- Transportprozesse
- Thermische Verfahrenstechnik I & II
- Introduction to Fluid Separations & Fluid Separations
- Grundlagen der Dimensionierung & Dimensionierung thermischer Trennapparate
- Membranverfahren und hybride Trennverfahren

## Lab Courses

- Including mass & heat transfer, distillation, crystallisation, absorption, extraction, etc.