

Prof. Dr.-Ing. Matthias Wessling

(*10.03.1963, married, two children: 2000, 2004)

RWTH Aachen University

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Working group vision and contribution to catalaix

The main focus of the Chair of Chemical Process Engineering (AVT.CVT) at RWTH Aachen University is the development and design of reactors for various applications. In particular, the optimization of flow conditions influences the effective transport of reactants and products in the reactor and allows to maximize the efficiency of the catalysts and thus the reaction. We have applied our reactor concepts and designs to polymerization and depolymerization reactors in chemocatalytic, electrochemical and biological reactors. The materials we synthesize range from classical polymers to interactive materials such as microgels and membranes, for the synthesis of which we have developed dedicated equipment in the past. We accompany this practical development with modeling from the micro scale of interfaces up to the macro scale of reactors and the integration into process chains.

We intend to use these competences in tailor-made reactor concepts for the success of Catalaix and make a decisive contribution to it. Our reactors will make it possible to integrate novel catalysts and reactions into a continuous process and thus enable circular value chains in the chemical industry.

Current & Previous Positions

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| Since 2018 | Vice-Rector Research and Structure at RWTH Aachen University |
| Since 2010 | Alexander-von-Humboldt Professor at Chair of Chemical Process Engineering, RWTH Aachen University |
| Since 2010 | Member Scientific Board DWI at Leibniz -Institute for Interactive Materials, Aachen |
| 2015 - 2018 | Vice-Director at DWI Leibniz-Institute for Interactive Material Science, Aachen |
| 2014 - 2018 | Vice-Dean Strategy at Faculty of Mechanical Engineering RWTH Aachen University |
| 2014 | Visiting professor at Stanford University, USA |
| 2007 - 2009 | Dean Faculty of Science and Technology at University of Twente, Netherlands |
| 2007 | Visiting professor at Bio-X at Stanford University, USA |
| 1999 - 2009 | Full Professor at Membrane Science and Technology, University of Twente, Netherlands |
| 1997 - 1999 | Department Head Separation Process Engineering at Akzo Nobel Chemicals Research, Netherlands |
| 1995 - 1997 | Assistant Professor at University of Twente, Netherlands |
| 1993 - 1994 | Senior Research Scientist at MTR Inc, CA, USA |

Education

- 1989 - 1994 **Doctor of Engineering** in chemical process engineering at University of Twente (Professor Smolders)
- 1989 **Diploma of Chemical Engineering** at Technical University Dortmund and University of Cincinnati, OH, USA
- 1983 - 1987 **Studies** chemical engineering at Technical University Dortmund

Fellowships and Awards

- 2019 **Prizewinner of the Gottfried Wilhelm Leibniz Prize**
- 2016 **ERC Advanced Investigator Grant ConFluReM**
- 2010 **Alexander von Humboldt-Professor Award**
- 1994 **Best Ph.D. Thesis Award**, European Membrane Society

Contributions to the science system

- Since 2022 Member of the German National Academy of Sciences Leopoldina
- Since 2020 Member of the **Advisory Board** of the University of Twente
- Since 2020 Member of the **Scientific Advisory Board** of Leibniz Institut für Polymerforschung Dresden e.V.
- Since 2019 Member of the **Scientific Advisory Board** of Max Planck Institute for Complex Technical Systems in Magdeburg
- Editorial Board "Scientific Reports"**, open Access Journal of the Nature Publishing Group; expertise area: Chemical Physics

Selected Projects

- 2023 - 2026 **APRICOT**: Advanced Bipolar Membranes for Energy and Electrodialysis Technology (DFG)
- 2022 - 2026 **TriggerINK**: Development of materials and strategies for articular cartilage treatment (WSS)
- 2022 - 2023 Forschungstransfer **BioThrust**: Membrane-based gassing solutions for bioreactors (BMWK)
- 2022 - 2023 Umfassende Auslegung eines membranbasierten Polymerisationsreaktors für Gas-Flüssig-Feststoff Reaktionssysteme (DFG)
- 2021 - 2025 **DERIEL**: Elucidating degradation in PEM water electrolysis (BMBF)
- 2021 - 2025 **Prometh2eus**: Additive manufacture of anodes for oxygen evolution reaction (BMBF)
- 2021 - 2025 **SEGIWA**: Scalable fabrication of membrane electrode assemblies (BMBF)
- 2021 - 2024 **iNEW2.0**: Novel electrolysis processes for power-to-X value chains (BMBF)
- 2021 - 2024 **ECDeHalo**: Catalyzed electrochemical degradation of halogenated pollutants (IGF)
- 2019 - 2026 **EXC2186 Fuel Science Center**: Electrodes, reactors and integrated processes for electrochemical conversions (DFG)
- 2019 - 2024 **SFB985**: Functional microgels and microgel Systems (DFG)
- 2019 - 2022 **ELECTRA**: Infrastructure project for industrial electrochemistry (EU EFRE)

Most important scientific contributions

- F. Wiesner, **M. Wessling** et al., 2023, Adv Eng Mater, DOI: 10.1002/adem.202200986. (3D intertwined electrode pairs for improved mass transport and high electrode surface areas)
- T. Harhues, **M. Wessling** et al., 2023, ACS Sustainable Chem. Eng., DOI: 10.1021/acssuschemeng.3c01403. (Integrated dehydration of fructose to HMF and oxidation to FDCA)
- J. Vehrenberg, **M. Wessling** et al., 2023, Electrochemistry Communications, DOI:

- 10.1016/j.elecom.2023.107497. (Paired electrochemical GOR as replacement for OER in electrochemical CO₂R)
- M. Mohseni, **M. Wessling** et al., 2022, Chemical Engineering Journal, DOI: 10.1016/j.cej.2022.137006. (One-pot synthesis of binder-free HPCs as electrodes for heterogeneous electro-Fenton)
- N. Weber, **M. Wessling** et al., 2023, Adv. Mater. Technol. DOI: 10.1002/admt.202300720. (Additive manufacture of gas diffusion electrodes for electrochemical CO₂ reduction)
- R. G. Keller, **M. Wessling** et al., 2021, Catal. Today, DOI: 10.1016/j.cattod.2020.05.059. (Depolymerization of cellobiose to glucose via an electro-Fenton process coupled with nanofiltration for enhanced conversion)
- H. J. M. Wolff, **M. Wessling** et al., 2018, ACS applied materials & interfaces, DOI: 10.1021/acsami.8b06920. (Continuous precipitation polymerization of thermoresponsive microgels)
- J. Lölsberg, **M. Wessling** et al., 2017, ChemElectroChem, DOI: 10.1002/celec.201700662. (3D-printed flow through electrode mixers with improved mass transport properties)
- S. Stiefel, **M. Wessling** et al., 2016, Green Chem., 18, DOI: 10.1039/C6GC00878J. (Controlled depolymerization of lignin at ambient pressure and room temperature)
- S. Stiefel, **M. Wessling** et al., 2015, Electrochemistry Communications, DOI: 10.1016/j.elecom.2015.09.028. (Electrochemical oxidative depolymerization of lignin without toxic solvent and expensive catalysts)

Patents

- Y. Gendel, **M. Wessling**, O. David: Microtubes made of carbon nanotubes, Patent 20160301084, Disclosure 13.10.2016. (CNT microtubes as electrodes or tubular membranes)
- M. Wessling**, Y. Gendel, O. David: Oxygen-vanadium redox flow battery with vanadium electrolyte having carbon particles dispersed therein, Patent 20160293963, Disclosure 06.10.2016. (Oxygen-vanadium redox flow battery with vanadium electrolyte and dispersed carbon particles)
- S. S. Hosseiny, M. Saakes, **M. Wessling**: Electro-catalyst, Patent 20130216923, Disclosure 22.08.2013. (Iridium-based electrocatalyst for a bifunctional air electrode)
- M. Wessling**, D. Stamatialis, K. K. Kopec, S. M. Dutczak: Hollow fibre membrane, Patent 20130192459, Disclosure 01.08.2013. (Production of a hollow fiber membrane with support and separation layer)
- G.-H. Koops, M. E. Avramescu, Z. Borneman, R. Kiyono, **M. Wessling**: Functional porous fibres, Patent 7935418, Disclosure 03.05.2011. (Extruded porous polymer fibers with active particles)
- J. de Boer, C. A. Van Blitterswijk, H. V. Unadkat, D. Stamatialis, B. J. Papenburg, **M. Wessling**: High throughput screening method and apparatus for analysing interactions between surfaces with different topography and the environment, Patent 20110009282, Disclosure 13.01.2011. (Method and apparatus for screening surface-environment interactions)
- J. H. Balster, D. Stamatialis, **M. Wessling**: Ion-permeable membrane and the production thereof, Patent 20100065490, Disclosure 18.03.2010. (Ion permeable membrane with profiled surface)
- P. Bongartz, M. Meyer, **M. Wessling**: Integrale begasungs- und röhreinheit für gas-flüssig-reaktoren, Patent WO2021152128A1, Pending 29.01.2021. (Bubble-free entry of process gas into liquid)