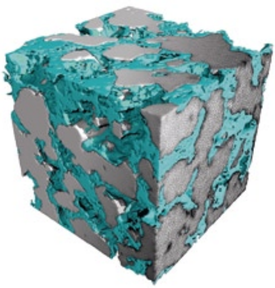
SYMPOSIUM

23 – 25 SEPTEMBER 2019

Magdeburg, Germany

MAX PLANCK INSTITUTE
FOR DYNAMICS OF COMPLEX
TECHNICAL SYSTEMS
MAGDEBURG

TU Clausthal



Symposium on Insights into Gas Diffusion Electrodes

From Fundamentals to Industrial Applications

www.mpi-magdeburg.mpg.de/gde-symposium-2019

Conference Venue

Veranstaltungszentrum Festung Mark
Hohepfortewall 1
39104 Magdeburg

Internet Access

WiFi access is available for free throughout the conference venue. As WiFi can be used by all participants, a loss of efficiency is possible.
Network: Zukunftswerkstatt
Password: ZKW_2017

Book of Abstracts

Book of Abstracts (lectures and posters) is available online for participants of the meeting "Insights into Gas Diffusion Electrodes: From Fundamentals to Industrial Applications":
https://www.mpi-magdeburg.mpg.de/gde-symposium-2019

Social Programme

Tuesday, 24 September 2019, 19:00
Conference Dinner (Festung Mark)

Wednesday, 25 September 2019, 14:00
Guided Tour MPI Magdeburg

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General Information

Scientific Scope

The Symposium on "Insights into Gas Diffusion Electrodes: From Fundamentals to Industrial Applications" is an initiative of the Research Unit 2397 approved by German Research Foundation (DFG) in July 2016. The main research focus of the project „Multiscale Analysis of Complex Three-Phase Systems: Oxygen Reduction at Gas Diffusion Electrodes in Aqueous Electrolyte" are the complex processes within gas diffusion electrodes (GDEs).
GDEs have broad applications in different electrochemical devices such as (bio)-fuel cells, (bio)-electrolyzers, and batteries for energy as well as inorganic and organic synthesis applications. Although very different chemistries and materials are involved, all of these examples share some similarities related to so-called "three phase boundaries" as well as pronounced mass transfer resistances related to slow diffusivity and/or low solubility of gases.

Plenary Lectures

Multiphase transport in gas diffusion electrodes for fuel cells and electrolyzers: Modelling, imaging, and design
Aimy Bazylak, Mechanical & Industrial Engineering, University of Toronto, Canada

Understanding and Optimizing Water Transport in Gas Diffusion Layers
F. Büchi, Paul Scherrer Institut, Switzerland

Durability of carbon-supported nanostructured electrocatalysts in alkaline environments: more noble is not necessarily more stable
Marian Chatenet, Grenoble Institute of Technology, France

How can gas-diffusion electrodes leverage enzymatic fuel cells performance
Elisabeth Lojou, CNRS-Aix Marseille Université, France

Scientific Committee

Ulrike Krewer	TU Braunschweig
Ingo Manke	Helmholtz Zentrum Berlin
Ulrich Nieken	University Stuttgart
Christina Roth	University Bayreuth
Wolfgang Schuhmann	RBU Bochum
Thomas Turek	TU Clausthal
Tanja Vidaković-Koch	MPI Magdeburg

Sponsors

German Research Foundation (Deutsche Forschungsgemeinschaft, DFG) is the self-governing organisation for science and research in Germany. It serves all branches of science and the humanities. In organisational terms, the DFG is an association under private law. Its membership consists of German research universities, non-university research institutions, scientific associations and the Academies of Science and the Humanities. DFG supports this symposium within the framework of the research unit FOR 2397.
www.dfg.de
www.for2397.tu-clausthal.de

The International Society of Electrochemistry (ISE) was founded in 1949 by leading European and American Electrochemists to serve the growing needs of electrochemistry in becoming a modern scientific discipline. Since then the association has evolved and now comprises about 3000 individual members and more than 20 Corporate Members (teaching institutions, non-profit-making research organizations and learned societies) and Corporate Sustaining Members (industrial and commercial organizations). Its membership comes from more than 70 countries and is organized in over 40 regional sections. ISE is a non-profit-making organization with its seat in Lausanne, Switzerland.
www.ise-online.org

Otto von Guericke University Magdeburg has a distinctive profile. It aims to create a lean and sharply-defined structure with its main focus of expertise in the traditional areas of engineering, the natural sciences and medicine. It also views economics and management and the social sciences and humanities as essential disciplines for a modern university in the information age.
www.uni-magdeburg.de/en

Sponsors

The Gesellschaft Deutscher Chemiker (GDCh) is the largest chemical society in continental Europe with members from academe, education, industry and other areas. The GDCh supports chemistry in teaching, research and application and promotes the understanding of chemistry in the public. The Electrochemistry division of GDCh was founded in 1960. The increasing number of members (today, about 450) reflects the resonance in all areas of science and engineering. The division's established aim is to comprehensively promote electrochemistry from the fundamentals up to applications.
http://en.gdch.de

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www.covestro.com/en

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With the central office near Munich and offices around Germany we provide application consulting, sales, installation and training as well as after sales support for our customers.
Our portfolio related to battery research, development and testing covers potentiostats and EIS measurement systems from Gamry Instruments (USA) and electrochemical accessories from ALS (Japan). For battery cells and packs, as well as material and safety testing, we offer isothermal and adiabatic calorimeters from tht (UK) and for mixing electrode pastes we can provide Thinky planetary mixers (Japan).
www.c3-analysentechnik.de

Monday, 23 September 2019

12:00	Registration
13:00	Welcome
Chair	Ulrich Nieken
13:10	PLENARY LECTURE Understanding and Optimizing Water Transport in Gas Diffusion Layers **F. Büchi, Paul Scherrer Institut**
14:00 O-01	FIB Tomography of silver-based gas diffusion electrodes with different silver-PTFE ratios, **M. Paulisch, Helmholtz Zentrum Berlin**
14:20 O-02	Prediction of Electrolyte Distribution in Technical Gas Diffusion Electrodes: From Imaging to SPH Simulations, **T. Mager, University of Stuttgart**
14:35 O-03	3D pore-scale lattice Boltzmann modelling of porous electrodes in fuel cells and batteries, **Cai Qiong, University of Surrey**
14:55 O-04	Estimation of effective parameters from pore network simulations **N. Vorhauer, Otto von Guericke University Magdeburg**
15:15	Coffee Break
Chair	Tanja Vidaković-Koch
15:45	INVITED LECTURE Optimizing Local Reaction Conditions in Porous Electrodes: Insights from Theory and Computation, **M. Eikerling, Forschungszentrum Juelich**
16:10 O-05	Models and experiments for the analysis of ORR product accumulation within porous oxygen gas diffusion electrodes, **S. Eggermont, KU Leuven**
16:25 O-06	Dynamics and States of Oxygen Depolarized Cathodes: A Model-Based Analysis, **M. Röhe, TU Braunschweig**
16:40 O-07	Spatially resolved model of oxygen reduction reaction in porous gas-diffusion Electrodes, **D. Franzen, TU Clausthal**
16:55 O-08	Dynamic Changes of Cathode Morphology During Operation of Li-O_2 Batteries: A Model-Based Analysis, **S. Kynast, TU Braunschweig**
17:10	Short Introduction of Poster Programm
17:15 – 19:15	Poster Party (with snacks)

Tuesday, 24 September 2019

Chair	Wolfgang Schuhmann
09:00	PLENARY LECTURE How can gas-diffusion electrodes leverage enzymatic fuel cells performance, **E. Lojou, CNRS-Aix Marseille Université**
9:50 O-09	Polymer Modified Gas Diffusion Electrodes Containing Hydrogenases or Their Artificial Mimics as Active H_2 Oxidation Catalysts **J. Szczesny, Ruhr-Universität Bochum**
10:05 O-10	Development and upscaling of gas diffusion electrodes for environmental applications in wastewater treatment and electrosynthesis of chemicals, **D. Pant, Flemish Institute for Technological Research (VITO)**
10:25	Coffee Break
Chair	Jürgen Kintrup
10:55	INVITED LECTURE CO_2 electroreduction. From catalyst design to gas diffusion electrodes **C. Andronescu, Universität Duisburg-Essen**
11:20 O-11	Electrochemical conversion of CO_2 to methanol – A feasible reaction for large scale?, **S. Geiger, German Aerospace Center**
11:40 O-12	The electrolyte matters: stable systems for high rate electrochemical CO_2 reduction, **S. Kriescher, RWTH Aachen University**
12:00 O-13	Examination of gas-diffusion electrodes applied in CO_2 electrolysis employing electrochemical impedance spectroscopy (EIS), **F. Bienen, German Aerospace Center**
12:15	INVITED LECTURE Benchmarking and tuning the oxygen reduction activity on Pt-based catalysts: from model studies to gas diffusion electrode measurements **M. Escudero-Escribano, University of Copenhagen**
12:40 O-14	Beyond Equivalent Circuit Approach: Computer-Enhanced Nonlinear Frequency Response Method **L. Živković, Faculty of Technology and Metallurgy, University of Belgrade**
12:55	Lunch Break

Tuesday, 24 September 2019

Chair	Thomas Turek
14:00	**PLENARY LECTURE** Durability of carbon-supported nanostructured electrocatalysts in alkaline environments: more noble is not necessarily more stable! **Marian Chatenet, Grenoble-INP**
14:50 O-15	Nanoscale Studies Solve Macroscopic Problems: De- and Reactivation of Oxygen Depolarized Cathodes Under Process Conditions **D. Öhl, Ruhr-Universität Bochum**
15:05 O-16	Probing the degradation pathways of PEM water electrolysers under dynamic operating conditions with advanced microscopy methods **G. Papakontantinou, MPI Magdeburg**
15:25	Coffee Break and Poster Discussions
Chair	Christina Roth
16:25 O-17	Analysing the performance instability of H_2-O_2 Alkaline Membrane Fuel Cell due to water imbalance, **P. Khadke, Freie Universität Berlin**
16:45 O-18	Novel nanoparticles synthesis method by gas-diffusion electrocrystallization, **G. Pozo, Flemish Institute for Technological Research (VITO)**
17:05 O-19	Three-phase activity of unsupported high-surface area catalysts towards oxygen reduction in the gas diffusion electrode **G. Sievers, Leibniz Institute for Plasma Science and Technology**
17:20 O-20	Using GDE half-cell experiments to close the gap between fundamental and applied fuel cell electrocatalysis **K. Ehelebe, Helmholtz-Institute Erlangen-Nürnberg**
17:40 – 18:05	**INVITED LECTURE** Towards realistic testing conditions for electrocatalysts: Gas diffusion electrodes incorporated into half-cell setups, **M. Arenz, University of Bern**
19:00 – 22:00	Conference Dinner (Festung Mark)

Conference Program

Wednesday, 25 September 2019

Chair	Ingo Manke
09:00	**PLENARY LECTURE** Multiphase transport in gas diffusion electrodes for fuel cells and electrolyzers: Modelling, imaging, and design, **Aimy Bazylak, University of Toronto**
9:50 O-21	Acid Migration in the Gas Diffusion Electrode of High-Temperature Polymer Electrolyte Membrane Fuel Cells, **R. Zeis, Karlsruhe Institute of Technology**
10:10 O-22	Understanding the influence of different porous microstructures derived from diverse drying methods of the cathode catalyst layer in PEMFC **K. Talukdar, German Aerospace Center, Stuttgart**
10:25	Coffee Break
Chair	Ulrike Krewer
10:55	**INVITED LECTURE** Operando X-ray Computed Tomography Study of Water Management in Gas Diffusion Electrodes of PGM-free Polymer Electrolyte Fuel Cells **I. Zenyuk, The Henry Samueli School of Engineering, University of California**
11:20 O-23	A Ternary-based composite as cost-effective, efficient and durable catalyst layer for bifunctional gas diffusion electrodes, **E. Marini, Zentrum für Sonnenenergie- und Wasserstoffforschung Baden-Württemberg (ZSW)**
11:35 O-24	Development of new carbon free electrode for application in secondary zinc-air cells, **G. Raikova, Bulgarian Academy of Sciences**
11:55 O-25	Effect of wetting behaviour on the electrochemical performance of bifunctional gas diffusion electrodes for electrically rechargeable zinc-air batteries **M. Fink, University of Bayreuth**
12:10 O-26	Stable carbon materials for metal/air batteries and PEM fuel cells GDEs **J.-F. Drillet, DECHEMA-Forschungsinstitut**

Conference Program

Wednesday, 25 September 2019

12:30	**INVITED LECTURE** Gas Diffusion Electrodes in Industry - from Chlorine to CO_2 Reduction **J. Kintrup, Covestro Deutschland AG**
12:55	**Closing**
14:00	**Guided Tour MPI Magdeburg**

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Poster Program

	Batteries
P-01	The Developments of Carbon-based Gas Diffusion Electrodes (GDEs) at IEES **B. Abrashev, Bulgarian Academy of Sciences**
P-02	Controllable Preparation of Graphene-based air electrode for Efficient Rechargeable Mg-Air Batteries **D. Fu, Research Institute of Tsinghua University in Shenzhen**
P-03	Highly Mesoporous Carbon Derived from Cigarette Butt as Efficient Electro-catalysts for Zinc-Air Batteries, **S. Hosseini, Chulalongkorn University**
P-04	Wetting behavior of electrolyte in a GDE and how it affects performance in Zn-Air batteries, **A. Kube, German Aerospace Center**
P-05	Caffeine modified active carbon as catalyst layer in gas-diffusion electrodes for aprotic metal-air systems, **I. Popov, Bulgarian Academy of Sciences**
P-06	Performance Improvement of Lead Acid Batteries by Crystallized Graphite Powders in Negative Electrodes, **H. Yang, National Chung Hsing University**

	PEM FC + Electrolyser
P-07	Towards realistic benchmarking of fuel cell catalysts – Bridging the gap between RDE and MEA, **A. Jensen, University of Copenhagen**
P-08	In situ estimation of the effective (Nafion® & Anion) membrane Water diffusion coefficient in a PEMFC, **K. Chadha, Pprime, University of Poitiers**
P-09	Permeability for gaseous reactants – a key characteristic of PEM FC gas diffusion layer, **M. Drakselová, University of Chemistry and Technology, Prague**
P-10	Tuning the structure of Pt-Co catalyst materials for the oxygen reduction reaction in PEM fuel cell applications **M. Singer, Carl von Ossietzky University of Oldenburg**
P-11	Micro-CT imaging of electrolyser gas diffusion layers to extract pore space information for pore network modeling, **H. Altaf, Fakultät für Verfahrens- und Systemtechnik, Otto von Guericke University Magdeburg**
P-12	Simple and straight-forward thermal preparation of metal oxide nanocatalysts from commercially available metal precursors for electrochemical water oxidation, **A. Aziz, Center of Research Excellence in Nanotechnology (CENT), King Fahd University of Petroleum and Minerals**
P-13	Catalytic active Manganese Oxide on Hydrophobic Nickel-Mesh for Application as Gas Diffusion Electrodes, **A. Bekisch, Fraunhofer Institute for Ceramic Technologies and Systems IKTS**

	CO_2 Reduction
P-14	Electrochemical Reduction of CO_2 on Copper Phosphide Catalysts in a Near Zero-gap Electrolytic Cell **M. Choi, Gwangju Institute of Science Technology**
P-15	Gas-Diffusion Electrodes for Practical CO_2 Reduction: Challenges & Strategies **G. El-Nagar, Helmholtz Zentrum Berlin für Materialien und Energie GmbH**
P-16	High-entropy alloys as novel electrocatalysts for the CO_2 reduction reaction **J. Junqueira, Ruhr-Universität Bochum**

P-17	Solvent effect on the ink preparation of Copper-based gas diffusion electrodes: A product distribution evaluation on the electrochemical reduction of CO_2, **L. De Sousa, University Of Twente**
P-18	Silver and Copper Nanoparticle Modified Gas Diffusion Electrodes for the CO_2 Reduction Reaction. Impact of CO_2 Back Pressure **J. Weidner, Ruhr-Universität Bochum**

	Processes In Alkaline Enviroment
P-19	Frequency Response Analysis of Oxygen Reduction Reaction in Concentrated Alkaline Solutions, **S. Kandaswamy, Max Planck Institute Magdeburg**
P-20	Workfunction of the Metal as Descriptor for Active and Durable Carbon Nanofiber Support Alkaline Oxygen Reduction Electrocatalyst **S. Kang, Gwangju Institute of Science and Technology**
P-21	Design of an In-Operando Cell for X-Ray and Neutron Imaging of Oxygen-Depolarized Cathodes in Chlor-Alkali Electrolysis **M. Gebhard, Universität Bayreuth**
P-22	Characterization of Bi-functional Oxygen Electrocatalysts **K. Petrov, Bulgarian Academy of Sciences**
P-23	NiCoPx Catalyst Based Electrode for Reversible Alkaline Fuel Cell **J. Hnat, University of Chemistry and Technology Prague**
P-24	Production of Bifunctional GDE for alkaline solutions **H.-J. Kohnke, Gaskatel GmbH**
P-25	Novel alkaline water electrolysis process with nickel-iron gas diffusion electrodes for oxygen evolution, **T. Turek, TU Clausthal**

	Other Processes
P-26	One-Step Preparation of Ruthenium-CNT-Microtubes as Gas Diffusion Electrode for Electrochemical Ammonia Synthesis **X. Wei, RWTH Aachen University**
P-27	Minimizing the influence of the electrolyte hydrostatic pressure on the potential distribution of hydrogen peroxide generating gas diffusion electrodes through electrode design and process parameter **T. Muddemann, TU Clausthal**
P-28	The expanded Micro Flow Cell for the side by side production and electrochemical detection of Hydrogen Peroxide, **J. Hübner, TU Berlin**
P-29	Systematic building of an electroactive material library via gas-diffusion driven electrosynthesis, **R. Prato, VITO NV / KU Leuven**
P-30	Application of gas diffusion electrodes in an electrochemical advanced oxidation process treating different synthetic wastewaters **R. Simon, DECHEMA-Forschungsinstitut**
P-31	Corrosion Current Density Related to Gas Diffusion Electrodes Durability Study, **H. Yang, National Chung Hsing University**

	Microbial Electrobiotechnology
P-32	Microbial reversible fuel cell integrated in membrane electrode assemblies **G. Borisov, Bulgarian Academy of Sciences**
P-33	Fabrication of bioanode for use in microbial electrolysis cell **Y. Hubenova, Bulgarian Academy of Sciences**
P-34	Performance of gas-diffusion electrode as cathode for hydrogen generation in microbial electrolysis cell **M. Mitov, South-West University, Blagoevgrad**