

Exponent®
Engineering & Scientific Consulting

A.J Deberghes, Ph.D.

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Professional Profile

Adrien (AJ) Deberghes has a background in chemical engineering and practices in Exponent's Thermal Sciences Practice specializing in process design, electrochemistry, and catalysis.

Dr. Deberghes has developed expertise in device and process development for reactions including cyclohexene electro-oxidation, water electrolysis, and carbon dioxide reduction. He also has significant experience in material characterization and gas/liquid sample analysis.

Through his PhD research in the Seitz lab at Northwestern University's Department of Chemical and Biological Engineering, Dr. Deberghes developed novel reactor and process designs for the selective upgrading and valorization of cyclohexene and other organic compounds. His work initially focused on the design of a liquid diffusion electrode reactor to facilitate the oxidation of concentrated organic reactants using water as an oxidant. Later research focused on enhancing the selectivity and rate of reactions through tuning catalyst and system variables.

Beyond organic electrocatalysis, Dr. Deberghes has also researched the synthesis and application of transition metal oxide catalysts for use in proton exchange membrane electrolysis, the development of quantitative methodologies for tracking catalyst and substrate degradation across electrochemical processes, the use of pulsed electrolysis to enhance the CO2 reduction reaction, and the application of differential electrochemical mass spectroscopy to understand electrocatalytic reaction dynamics.

Through his research, Dr. Deberghes has developed expertise in both fundamental electrochemistry and applied electrocatalytic process design. He also has a wealth of experience in material characterization using techniques such as scanning electron microscopy (SEM), X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS) along with sample analysis via gas chromatography (GC), liquid chromatography (LC), ion chromatography (IC), inductively coupled plasma mass spectrometry (ICP-MS), and nuclear magnetic resonance (NMR).

Academic Credentials & Professional Honors

Ph.D., Chemical and Biological Engineering, Northwestern University, 2025

B.S., Chemical Engineering and Philosophy, Northeastern University, 2019

Northwestern Chemical and Biological Engineering Distinguished trainee service award (2025)

Northwestern University Safety Leadership Award (2024)

Omega Chi Epsilon Chemical Engineering Honor Society - member

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Tau Beta Pi Engineering Honor Society - member

Prior Experience

Doctoral Researcher, Northwestern University, 2020-2025

Graduate Teaching Assistant, Northwestern University, 2020-2024

Process Improvement Engineer, Poly6 Technologies, 2019-2020

Undergraduate Researcher, Northeastern University, 2016-2019

Product Engineer (Co-op), Poly6 Technologies, 2018

Process Development Co-op, Alkermes, 2017

Engineering Co-op, TEL NEXX, 2016

Professional Affiliations

American Institute of Chemical Engineers - member

Publications

Lu, X.K., Ni, W., Deberghes, A., Seitz, L.C. "Insight into the effects of pulsed CO2 electrolysis in a zero-gap electrolyzer," Chemical Communications, 2025. DOI: 10.1039/D5CC01463H

Edgington, J., Li, R., Deberghes, A., Seitz, L.C. "Quantification of Electrochemically Accessible Iridium Oxide Surface Area with Mercury Underpotential Deposition," Science Advances, 2024. DOI: 10.1126/sciadv.adp8911

Ruggiero, B.N., Lu, B., Lu, X.K., Deberghes, A., Nordlund, D., Notestein, J.M., Seitz, L.C. "Efficient Electrosynthesis of Hydrogen Peroxide in Neutral Media using Boron and Nitrogen Doped Carbon Catalysts," Journal of Materials Chemistry A, 2024. DOI: 10.1039/D4TA04613G

Deberghes, A., Kazour, M., Notestein, J.M., Seitz, L.C. "Chlorine mediated oxidation of cyclohexene at high current density and selectivity in a liquid diffusion electrode cell," ACS Catalysis, 2024. DOI: 10.1021/acscatal.4c03356

Salaria, S., Ruggiero, B., Deberghes, A., Seitz, L.C., Notestein, J.M. "Biphasic selective oxidation of cyclohexene with dilute aqueous hydrogen peroxide using phase transfer catalysts," Industrial and Engineering Chemistry Research, 2024. DOI: 10.1021/acs.iecr.4c01988

Deberghes, A., Ruggiero, B.N., Notestein, J.M., Seitz, L.C. "Water-Based Electrooxidation of Cyclohexene in a Novel Liquid Diffusion Electrode Reactor Design," ACS Sustainable Chemistry & Engineering, 2023. DOI: 10.1021/acssuschemeng.3c04020

Edgington, J., Deberghes, A., Seitz, L.C. "Glassy carbon substrate oxidation effects on electrode stability for oxygen evolution reaction catalysis stability benchmarking," ACS Applied Energy Materials, 2022. DOI: 10.1021/acsaem.2c01690

Presentations

Deberghes, A., Sullivan, S., Notestein, J.N., Seitz, L.C. Direct Electrooxidation of Cyclohexene at a

Liquid-Liquid-Solid interface in a Liquid Diffusion Electrode Reactor. Oral presentation at ACS Fall meeting, Denver, CO, 2024.

Deberghes, A., Sullivan, S., Seitz, L.C. Oxidation of Cyclohexene in a Liquid Diffusion Electrode Reactor with Electrodeposited Cobalt Manganese Oxide Catalyst. Poster presentation at Northwestern Catalysis Center for Surface Science Ipatieff Lecture series, Evanston, IL, 2024.

Deberghes, A., Seitz, L.C. Indirect Electrooxidation of Cyclohexene by Active Halogen Species in a Liquid Diffusion Electrode Cell. Oral presentation at Northwestern Catalysis Center for Surface Science Student Seminar Series, Evanston, IL, 2024.

Deberghes, A., Seitz, L.C. Electrooxidation of Cyclohexene by Halogen Intermediates in a Liquid Diffusion Electrode Cell. Oral presentation at AIChE annual meeting, Orlando, FL, 2023.

Deberghes, A., Seitz, L.C. Investigating Electrochemical Oxidation of Cyclohexene Towards Value Added Chemicals in a Unique Cell Design. Oral presentation at ACS Fall meeting, Chicago, IL, 2022.

Deberghes, A., Seitz, L.C. Understanding and Characterizing a Novel Cell Design for the Electrooxidation of Cyclohexene Towards Value Added Chemicals. Oral presentation at AIChE annual meeting, Phoenix, AZ, 2022.

Deberghes, A., Xie, Z., Choi, S. CO2 Capture Characteristics of MgO Produced from Calcination of Metal Organic Frameworks. Poster presentation at AIChE annual meeting, Minneapolis, MN, 2017.