

JOSEPH SPANJAARD ELIAS, PH.D.

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SCHOLARLY PROFILE

I am a physical inorganic chemist specializing in nanomaterials and electrocatalysis. My specific interests include developing novel techniques for the synthesis and functionalization of nanoparticles and using these to investigate the mechanisms for electrocatalytic CO₂ reduction and denitrification. I particularly enjoy incorporating my research into the lab components of the courses I teach.

EDUCATION

Massachusetts Institute of Technology

2016 **Ph.D.** in Inorganic Chemistry
Thesis: “Carbon monoxide oxidation catalysis with substituted ceria nanoparticles”
Advisor: Yang Shao-Horn, J.R. East Professor of Engineering

Reed College

2009 **B.A.** in Chemistry, Phi Beta Kappa
Thesis: “The coordination of acetic acid to oxovanadium(V) triisopropoxide”
Advisor: Margret J. Geselbracht, Professor of Chemistry

TEACHING EXPERIENCE

Simmons University

2022 – Assistant Professor of Chemistry, tenure-track; developing curricula and leading lecture, lab, and recitation sections for undergraduate-level courses in general and inorganic chemistry, and quantum mechanics; leading an undergraduate research laboratory focusing on materials design and electrocatalysis for sustainability

Lasell University

2019 – 2022 Visiting Instructor; developed curricula and led lecture, lab, and recitation sections for undergraduate-level courses in general and organic chemistry

Boston College – Woods College of Advancing Studies

2020, 2021 Instructor; developed the online curriculum for the summer organic chemistry sequence for (Summer) undergraduates, including recording lectures for the entire sequence

RESEARCH AND PROFESSIONAL EXPERIENCE

Massachusetts Institute of Technology

2022 – 2023 Research Affiliate
Projects: Electrochemical carbon dioxide reduction; methanol oxidation reaction catalysts
Host: Yang Shao-Horn, J.R. East Professor of Engineering

Harvard University

2016 – 2019 Post-doctoral Fellow
Projects: Electrochemical carbon dioxide and phosphorus(V) reduction
Mentor: Daniel G. Nocera, Patterson Rockwood Professor of Energy

PUBLICATIONS

1. **Elias, J.S.** “An Improved Potentiostat/Galvanostat for Undergraduate-Designed Electrochemical Laboratories,” *J. Chem. Educ.*, **2024**, 101 (4), 1703-1710.
2. Zhang, B. A.; Ozel, T.; **Elias, J. S.**; Costentin, C. & Nocera, D. G. “Interplay of Homogeneous Reactions, Mass Transport, and Kinetics in Determining Selectivity of the Reduction of CO₂ on Gold Electrodes,” *ACS Cent. Sci.*, **2019**, 5 (6) 1097-1105.
3. **Elias, J. S.**; Costentin, C. & Nocera, D. G. “Direct electrochemical P(V) to P(III) reduction of phosphine oxide facilitated by triaryl borates,” *J. Am. Chem. Soc.*, **2018**, 140 (42), 13711-13718.

- Elias, J. S.;** Stoerzinger, K. A.; Hong, W. T.; Risch, M.; Giordano, L.; Mansour, A. N. & Shao-Horn, Y. "In Situ Spectroscopy and Mechanistic Insights into CO Oxidation on Transition-Metal-Substituted Ceria Nanoparticles," *ACS Catalysis*, **2017**, 7 (10), 6843-6857.
- Sheberla, D.; Bachman, J. C.; **Elias, J. S.;** Sun, C.-J.; Shao-Horn, Y. & Dincă, M. "Conductive MOF electrodes for stable supercapacitors with high areal capacitance," *Nature Materials*, **2017**, 16 (2), 220.
- Elias, J. S.;** Artrith, N.; Bugnet, M.; Giordano, L.; Botton, G. A.; Kolpak, A. M. & Shao-Horn, Y. "Elucidating the Nature of the Active Phase in Copper/Ceria Catalysts for CO Oxidation," *ACS Catalysis*, **2016** 1675-1679.
- Stephens, I. E. L.; **Elias, J. S.** & Shao-Horn, Y. "The importance of being together: Controlling the coordination of platinum boosts catalytic reaction rates," *Science*, **2015**, 350, 164-165.
- Elias, J. S.;** Risch, M.; Giordano, L.; Mansour, A. N. & Shao-Horn, Y. "Structure, Bonding, and Catalytic Activity of Monodisperse, Transition-Metal-Substituted CeO₂ Nanoparticles," *J. Am. Chem. Soc.*, **2014**, 136, 17193-17200.

PRESENTATIONS

Invited Lectures:

- 2023 Northeast Regional Meeting of the American Chemical Society, Boston, MA
 2015 American Chemical Society National Meeting, Boston, MA
 2015 ICMAT & IUMRS-ICA Conference, Singapore
 2015 Chinese University of Hong Kong, Hong Kong

Contributing Lectures:

- 2024 American Chemical Society National Meeting, New Orleans, LA
 2023 American Chemical Society National Meeting, Indianapolis, IN
 2018 American Chemical Society National Meeting, Boston, MA
 2015 NanoKorea Expo, Seoul, Korea
 2015 Chemical Reactions at Surfaces Gordon Research Conference, Ventura, CA

STUDENT SCHOLARSHIP

- Eddings, T.* "Creating a Biosensor Using Phage Display to Detect PFAS," Simmons Senior Thesis, **2024**.
- Lee, L.* "Determining the effectiveness of different mixed-metal sulfide nanoparticles as catalysts for CO₂ reduction reactions," *American Chemical Society National Meeting*, **Spring 2024**. [Talk]
- Hannah, A*.; Wilson, J*.; Elias, J.S. "Investigating iron and manganese thiospinels as catalysts for CO₂ reduction reactions," *American Chemical Society National Meeting*, **Spring 2024**. [Poster]

AWARDS & GRANTS

Research Grants

- 2025 – 2027 **ACS Petroleum Research Fund**
 Undergraduate New Investigator Grant
 2011 **NSF Graduate Research Fellowship Program**
 Inorganic Chemistry

PROFESSIONAL SERVICE

Simmons Committees

- 2023 – Undergraduate Curriculum Committee

Educational Outreach

- 2011 – 15 MIT Department of Chemistry Outreach Program

Professional Memberships

- 2008 – American Chemical Society