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Engineering & Scientific Consulting

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Professional Profile

A chemical engineer by training, Dr. Cardoza specializes in battery material performance and emerging technologies. He has extensive experience in next-generation chemistries such as Lithium Sulfur (Li-S), and Lithium metal batteries (LMB). Additionally, he has worked on particle degradation of high nickel cathodes, and in-operando X-ray diffraction for lithium sulfur batteries. Dr. Cardoza leverages a variety of material and electrochemical characterization techniques to understand cell performance and degradation. At Exponent, Dr. Cardoza utilizes these skills to support clients with failure analysis, quality and safety testing, and performance analysis in battery applications ranging from consumer electronics to electric vehicles and beyond.

Prior to Exponent, Dr. Cardoza was a graduate research associate at the Nanofibers for Energy Storage and Conversion Laboratory at Drexel University and a visiting researcher at Cornell University. His dissertation focused on the study and application of titania nanomaterials as lithium and sulfur host materials for lithium-sulfur batteries. In addition, he worked on in-operando X-ray diffraction studies into the crystallographic changes of a novel monoclinic gamma sulfur crystal (γ -S) during cycling, and electrospinning of nanofibers for free-standing electrode structures. Dr. Cardoza completed an internship at Bosch USA, where he worked on the parametrization of high nickel cathode active material degradation for lithium-ion battery management systems. Prior to his Ph.D., he was a ThinkSwiss Summer Fellow at the Paul Scherrer Institute in Switzerland, where he studied polysulfide speciation using UV-Vis spectroscopy.

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, Drexel University, 2024

M.S., Chemical Engineering, Purdue University, 2019

Bachelors, Chemical Engineering, Purdue University, 2018

2023 R. Gautam '76 Ph.D. Fellowship

2017 ThinkSwiss Fellowship, Switzerland

Prior Experience

Battery Experimentalist Intern, Bosch USA, September 2022 – March 2023

ThinkSwiss Summer Fellow, Paul Scherrer Institute, Switzerland, May 2017 – August 2017

Publications

Krishna Sarode, Taber Yim, Rhyz Pereira, Neal A. Cardoza, Vibha Kalra. Solid-liquid-solid mediated artificial SEI coated stable lithium and high-sulfur percentage SPAN for high performance Li-S batteries. *Energy Advances* 2024; 3, 584-591.

Taber Yim, Rhyz Pereira, Neal A. Cardoza, Vibha Kalra. A Facile Polymer Interlayer for Lithium Stability in Lithium-Sulfur Batteries, *ACS Applied Energy Materials* 2023; 6(24), 12326-12333.

Neal A. Cardoza, Hussein O. Badr, Rhyz Pereira, Michel W. Barsoum, Vibha Kalra. One-Dimensional, Titania Lepidocrocite-Based Nanofilaments and Their Polysulfide Anchoring Capabilities in Lithium-Sulfur Batteries. *ACS Applied Materials & Interfaces* 2023; 15(44), 50973-50980.

Rahul Pai, Neal A. Cardoza, Varun Natu, Michel W. Barsoum, Vibha Kalra. Non-Confined Gamma Monoclinic Sulfur Cathode in Carbonate Electrolyte Based Room Temperature K-S Batteries. *Journal of Material Chemistry A* 2023; 11, 15924-15930.

Arthur Dence Dysart, Neal A Cardoza, Garrett Mitchell, Volkan Ortalan, Vilas Ganpat Pol. Effect of Synthesis Method Using Varying Types of Micropore Level Sulfur Infiltration on Electrochemical Performance in Lithium-Sulfur Batteries. *Energy Technology* 2019; 7: 1900194.

Presentations

Neal A. Cardoza, Mary Q. Hassig, Taber Yim, Michael Barsoum, Vibha Kalra. Dopamine Functionalized TiO₂ 1D Lepidocrocite Mesoporous Particles As a Sulfur Host. Oral presentation, 245th ECS Meeting, San Francisco, CA, 2024

Neal A. Cardoza, Mary Q. Hassig, Taber Yim, Michael Barsoum, Vibha Kalra. Vertically Orientated TiO₂ 1D Lepidocrocite Nnaoflakes as Scaffold for Enhanced Li-Metal Anodes. 2024 MRS Spring Meeting, Seattle, WA, 2024

Neal A. Cardoza, Rhyz Pereira, Hussein Badr, Rahul Pai, Varun Natu, Michael Carey, Michel W Barsoum, Vibha Kalra. A New Class of 2D Materials - Quaternary Derived Nanostructures - and Their Polysulfide Anchoring Capabilities in Lithium Sulfur Batteries. Poster presentation, 2023 International Battery Association, Austin, TX, 2023

Neal A Cardoza, Rhyz Pereira, Hussein Badr, Rahul Pai, Varun Natu, Michael Carey, Michel W Barsoum, Vibha Kalra. A New Class of 2D Materials-Quaternary Derived Nanostructures-and Their Polysulfide Anchoring Capabilities in Lithium Sulfur Batteries. Oral presentation, 242nd ECS Meeting, Atlanta, GA, 2022

Neal A. Cardoza, Rahul Pai, Varun Natu, Maxim Sokol, Michael Carey, Tom Greszler, Michel W.Barsoum, Vibha Kalra Tuning Ti₃C₂Tz-Mxenes Via Surface Functionalization for Lithium-Sulfur Batteries Enabling High Sulfur Utilization and Carbonate Electrolytes. Poster presentation, MXene Conference, Philadelphia, PA, 2022

Neal A. Cardoza, Arthur, Dence Dysart, Vilas Ganpat Pol. Fast Charging, High Energy Rechargeable batteries: Carbon Sulfur Composites Autogenic. Oral Presentation, Gulf Coast Undergraduate Symposium, Houston, TX, 2018

Neal A. Cardoza, Arthur, Dence Dysart, Vilas Ganpat Pol. Autogenic Synthesis of High Rate, High Energy Carbon-Sulfur Cathodes for Rechargeable Lithium Sulfur Batteries. Poster Presentation. 2017 AIChE Annual Meeting. Minneapolis, MN, 2017