



Exponent[®]
Engineering & Scientific Consulting

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Professional Profile

A materials engineer by training, Dr. Faenza specializes in lithium-ion batteries. He has vast experience synthesizing positive electrode materials and in characterizing them; physically, structurally and electrochemically. Dr. Faenza uses his diverse technical capabilities to characterize the performance of batteries, particularly in regards to the safety hazards they present (e.g. thermal testing, abuse testing, hazard assessments), and in identifying root cause failure mechanisms.

He has extensive experience in a host of physical and structural characterization techniques, as well as in abuse testing of batteries, which he uses to evaluate material and product performance, and in identifying the root causes of failed batteries and devices, focusing on consumer products ranging from wearables to electric vehicles (EV).

Dr. Faenza is highly skilled at multiple electrochemical characterization methods, such as electrochemical impedance spectroscopy (EIS), potentiostatic intermittent titration technique (PITT) as well as more traditional cycling procedures. His material fabrication experience based on hydrothermal co-precipitation synthesis, encompasses the use of a variety of thermal and powder processing techniques. He is experienced with numerous analytical techniques including; X-ray diffraction (XRD), microcalorimetry, thermogravimetric analysis (TGA), Karl-Fischer coulometry (KF), Fourier transform infrared spectroscopy (FTIR), and others.

Prior to joining Exponent, Dr. Faenza's graduate research focused on investigating the structural and chemical degradation mechanisms for positive electrode materials at high states of charge. Additionally, he led a thorough analysis of the surface impurity species that develop on state of the art electrode materials and their impact on the material's electrochemical performance. Prior to that, Dr. Faenza developed graphene and silicon-based electrodes and also worked on reducing the flammability of polyurethane foam at the National Institute of Standards and Technology (NIST).

Academic Credentials & Professional Honors

Ph.D., Materials Science and Engineering, Rutgers University, 2018

B.S., Materials Science & Engineering, University of Maryland, College Park, 2013

Journal of the Electrochemical Society Editor's Choice Article, 2017

Department of Materials Science & Engineering Outstanding Materials Student Service Award, 2013

Licenses and Certifications

Professional Engineer, Metallurgical, California, #2011

Certified Fire and Explosion Investigator (CFEI) in accordance with the National Association of Fire Investigators, National Certification Board

Professional Affiliations

The Electrochemical Society

Materials Research Society

Publications

N. Faenza, N. Pereira, D.M. Halat, J. Vinckeviciute, L. Bruce, M. Radin, P. Mukherjee, F. Badway, A. Halajko, F. Cosandey, C. P. Grey, A. Van der Ven, and G. G. Amatucci, The Phase Evolution and Degradation Modes of $R\bar{3}m$ $\text{Li}_x\text{Ni}_{1-y-z}\text{Co}_y\text{Al}_z\text{O}_2$ Electrodes Cycled Near Complete Delithiation, *Chemistry of Materials*, (2018).

(Editors' Choice) N. Faenza, Lejandro Bruce, Zachary W. Lebens-Higgins, Irene Plitz, Nathalie Pereira, Louis F. J. Piper, and Glenn G. Amatucci, Growth of Ambient Induced Surface Impurity Species on Layered Positive Electrode Materials and Impact on Electrochemical Performance, *Journal of the Electrochemical Society*, 164 (2017) A3727-A3741.

(Invited) N. Faenza, Z. Lebens-Higgins, P. Mukerjee, S. Sallis, N. Pereira, F. Badway, A. Halajko, G. Ceder, F. Cosandey, L. Piper, and G. G. Amattuci, Electrolyte-Induced Surface Transformation and Transition-Metal Dissolution of Fully Delithiated $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$, *Langmuir* 33 (2017) 9333-9353.

Z. Lebens-Higgins, H. Chung, M. Zuba, J. Rana, Y. Li, **N. Faenza**

, N. Pereira, B. D. McCloskey, F. Rodolakis, W. Yang, S. Whittingham, G.G. Amatucci, Y. S. Meng, T. Lee, and L.F.J Piper, How Bulk Sensitive is Hard X-ray Photoelectron Spectroscopy: Accounting for the Cathode-Electrolyte Interface When Addressing Oxygen Redox, *J. Phys. Chem. Letters.*, **11**

, (2020), pg. 2106-2112.

Z. Lebens-Higgins, D. Halat, **N. Faenza**

, M. Wahila, M. Mascheck, T. Wiell, S. Eriksson, P. Palmgren, J. Rodriguez, F. Badway, N. Pereira, G. G. Amatucci, T. Lee, C. Grey, L. F. J. Piper, Surface Chemistry Dependence on Aluminum Doping in Ni-rich $\text{LiNi}_{0.8}\text{Co}_{0.2-y}\text{Al}_y\text{O}_2$ Cathodes, *Nature Scientific Reports*, (2019).

Z. Lebens-Higgins, **N. Faenza**

, M. Radin, H. Liu, S. Sallis, J. Rana, J. Vinckeviciute, P. Reeves, M. Zuba, F. Badway, N. Pereira, K. Chapman, T-L. Lee, T. Wu, C.P. Grey, B. Melot, A. Van der Ven, G. G. Amatucci, W. Yang, and L. F. J. Piper, Revisiting the charge compensation mechanisms in $\text{LiNi}_{0.8}\text{Co}_{0.2-y}\text{Al}_y\text{O}_2$ systems, *Materials Horizons*, (2019).

Z. Lebens-Higgins, J. Vinckeviciute, J. Wu, **N. Faenza**

, Y. Li, S. Sallis, N. Pereira, Y. Shirley Meng, G.G. Amatucci, A. Van der Ven, W. Yang, L. F. J. Piper, Distinction Between Intrinsic and X-ray Induced Oxidized Oxygen States in Li-Rich 3d Layered Oxides and LiAlO_2 , *The Journal of Physical Chemistry C*, (2019).

J. Vinckeviciute, M. Radin, **N. Faenza**

, G.G. Amatucci, and A. Van der Ven, Fundamental insights about interlayer cation migration in Li-ion electrodes at high states of charge, *Journal of Materials Chemistry A*, (2019).

P. Mukherjee, **N. Faenza**

, N. Pereira, J. Ciston, L. Piper, G. G. Amatucci, and F. Cosandey, Surface Structural and Chemical Evolution of Layered $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ (NCA) Under High Voltage and Elevated Temperature Conditions, *Chemistry of Materials*, **30**

, pg. 8431-8445, (2018).

P. Mukherjee, **N. Faenza**

, N. Pereira, G. G. Amatucci, and F. Cosandey, Equivalence of Three Seemingly Different Phases of Ni-rich Li-ion Battery Cathodes - New Insights Using Combined STEM and EELS Study, *Microscopy and Microanalysis*, **24**,

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Z. Lebens-Higgins, S. Sallis, N. Faenza, F. Badway, N. Pereira, D. Halat, M. Wahila, C. Schlueter, T.-L. Lee, W. Yang, C. Grey, G. Amatucci, and L. Piper, Evolution of the Electrode-Electrolyte Interface of $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ Electrodes Due to Electrochemical and Thermal Stress, *Chemistry of Materials*, 30 pg. 958-969 (2018).

Z. W. Lebens-Higgins, N. V. Faenza, P. Mukherjee, S. Sallis, F. Badway, N. Pereira, C. Schlueter, T.-L. Lee, F. Cosandey, G. G. Amatucci, and L. F. J. Piper, Electrochemical and Thermal Stress of $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ Electrodes: Evolution of Aluminum Surface Environments, *ECS Transactions*, 80 (10) pg. 197-206 (2017).

S. Sallis, N. Pereira, P. Mukherjee, N.F. Quackenbush, N. Faenza, C. Schlueter, T. Lee, W. L Yang, F. Cosandey, G. G. Amatucci, L. Piper, Surface degradation of $\text{Li}_{1-x}\text{Ni}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$ cathodes: Correlating charge transfer impedance with surface phase transformations, *Applied Physics Letters*, 108 (2016).

J. Wan, A. Kaplan, J. Zheng, X. Han, Y. Chen, N. Weadock, N. Faenza, S. Lacey, T. Li, J. Guo, and L. Hu, Two dimensional silicon nanowalls for lithium ion batteries, *Journal of Materials Chemistry A*, 17 (2014).

Presentations

(Oral Presentations)

N. Faenza, L. Bruce, Z. W. Lebens-Higgins, I. Plitz, N. Pereira, L. F. J. Piper and G. G. Amatucci, Surface Impurities on Layered Positive Electrode Materials: Mechanism for Formation and Impact on Performance, Laboratory for Surface Modification/Institute for Advanced Materials, Devices and Nanotechnology Symposium, New Brunswick, NJ, USA, February 27th 2018.

N. Faenza, P. Mukherjee, S. Sallis, N. Pereira, H. Das, G. Ceder, L. Piper, F. Cosandey, and G. G. Amatucci, Dynamic Transformations of Layered Compounds at Full Delithiation Due to Surface Triggered Reactions, Electrochemical Society PRIME Conference, Honolulu, HI, USA, October 6th 2016.

N. Faenza, Y. Li, and R. Davis, Multi-Substrate Flammability Reduction Using a Layer-by-Layer Assembly with Natural Materials, National Institute of Standards and Technology SURF Symposium, Gaithersburg, MD, USA, August 2013.

N. Faenza, Y. Li, Y. Kim, and R. Davis, Reduced Flammability of Polyurethane Foam Using a Layer-by-Layer Assembly with Natural Materials, National Institute of Standards and Technology SURF Symposium, Gaithersburg, MD, USA, August 2012.

(Poster Presentations **N. Faenza, L. Bruce, Z. W. Lebens-Higgins, I. Plitz, N. Pereira, L. F. J. Piper, and G. G. Amatucci, Surface Impurities on Layered Positive Electrode Materials-Mechanisms for Formation and Impact on Performance, Materials Research Society Fall Conference, Boston, MA, US, November 2017.**

N. Faenza, Z. Lebens-Higgins, P. Mukherjee, S. Sallis, F. Badway, A. Halajko, N. Pereira, G. Ceder, F. Cosandey, L. Piper, and G. G. Amatucci, NECEES: Electrochemically Initiated Surface Chemistries Inhibiting the Realization of the Theoretical Capacity of $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$, Department of Energy, Energy Frontier Research Center, Midterm Review, July 2017.

N. Faenza, S. Sallis, P. Mukherjee, H. Das, A. Urban, N. Pereira, L. Piper, F. Cosandey, G. Ceder and G. G. Amatucci, Understanding Cathode-Electrolyte Reactions via Microcalorimetry, NorthEast Center for Chemical Energy Storage Summer Meeting, June 29th 2016.

N. Faenza and G. G. Amatucci, Understanding Cathode-Electrolyte Reactions via Microcalorimetry, NorthEast Center for Chemical Energy Storage Fall Meeting, October 2015.

Peer Reviewer

Journal of Materials Science

Journal of Solid State Electrochemistry