



Exponent[®]
Engineering & Scientific Consulting

Ryan A. Adams, Ph.D.

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Professional Profile

Dr. Adams employs his chemical engineering training towards the design, testing, and analysis of electrochemical energy storage systems. In particular, he is experienced in diagnosing lithium-ion battery failure modes induced mechanically or thermally. Additionally, Dr. Adams is well versed in electrode material synthesis and characterization, for the elucidation of structure-property relationships that correlate to lithium-ion battery performance and safety.

Dr. Adams has synthesized a variety of inorganic and carbonaceous electrodes with tunable properties, utilizing techniques such as sonochemistry, solution combustion synthesis, autogenic synthesis, and solid-state synthesis. His expertise in material characterization includes X-ray diffraction (XRD), Raman spectroscopy, Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy dispersive X-ray spectroscopy (EDS), thermogravimetric analysis (TGA), and others. Dr. Adams is skilled in electrochemical impedance spectroscopy (EIS), galvanostatic intermittent titration technique (GITT), and voltammetric techniques to analyze kinetic and thermodynamic properties of electrochemical systems.

Prior to joining Exponent, Dr. Adams conducted graduate research at Purdue University, where he designed electrode materials for lithium-ion batteries and next-generation potassium-ion batteries for inexpensive stationary energy storage. There he utilized differential scanning calorimetry to determine the thermal runaway mechanisms for both systems, evaluating the dependence of heat generation on cycling history and cell parameters. He also compared the influence of cycling temperature on cell aging, electrochemical kinetics, and polarization for these two systems.

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, Purdue University, 2019

B.S., Chemical Engineering, University of California, Los Angeles (UCLA), Magna Cum Laude, 2014

Purdue University College of Engineering Outstanding Research Award, 2019

Bilsland Dissertation Fellowship, 2018

Purdue University Chemical Engineering Centennial Fellowship, 2014

Professional Affiliations

American Institute of Chemical Engineers (AIChE)

The Electrochemical Society (ECS)

Publications

Adams RA, Varma A, Pol VG. Carbon Anodes for Nonaqueous Alkali Metal- Ion Batteries and Their Thermal Safety Aspects. *Advanced Energy Materials* 9 (35), 1900550 (2019). doi.org/10.1002/aenm.201900550.

Li B, Parekh MH, Adams RA, Adams TE, Love CT, Pol VG, Tomar V. Lithium-ion Battery Thermal Safety by Early Internal Detection, Prediction and Prevention. *Scientific Reports* 9, 13255 (2019). doi:10.1038/s41598-019-49616-w.

Adams RA, Varma A, Pol VG. Temperature Dependent Electrochemical Performance of Graphite Anodes for K-ion and Li-ion Batteries. *Journal of Power Sources* 410, 124-131 (2019). doi:10.1016/j.jpowsour.2018.11.007

*Adams RA, *Mistry AN, Mukherjee PP, Pol VG Materials by Design: Tailored Morphology and Structures of Carbon Anodes for Enhanced Battery Safety. *ACS Applied Materials & Interfaces* 11 (14), 13334-13342 (2019). doi:10.1021/acsami.9b02921

Lim DG, Zhao Y, Manikandan P, Adams RA, Youngblood JP, Pol VG. Tailored Sonochemical Synthesis of V₂O₅ | Graphene Nanoplatelets Composites and its Enhanced Li-ion Insertion Properties. *Materials Research Bulletin* 114, 37-44 (2019). doi:10.1016/j.materresbull.2019.02.014

Xu C, Manukyan KV, Adams RA, Pol VG, Chen P, Varma A. One-step solution combustion synthesis of CuO/Cu₂O/C anode for long cycle life Li-ion batteries. *Carbon* 142, 51-59 (2019). doi:10.1016/j.carbon.2018.10.016

Adams RA, Varma A, Po, VG. Mechanistic Elucidation of Thermal Runaway in Potassium-ion Batteries. *Journal of Power Sources* 375, 131-137 (2018). doi:10.1016/j.jpowsour.2017.11.065

*Adams RA, *Li B, Kazmi J, Adams TE, Tomar V, Pol VG. Dynamic Impact of LiCoO₂ Electrodes for Li-ion Battery Aging Evaluation. *Electrochimica Acta* 292, 586-593 (2018). doi:10.1016/j.electacta.2018.08.101

*Li B, *Adams RA, Kazmi J, Dhiman A, Adams TE, Pol VG, Tomar V. Investigation of Response of LiCoO₂ Cathode to Dynamic Impact Using Raman Imaging-Based Analyses. *The Journal of The Minerals, Metals & Materials Society* 70 (8), 1423-1429 (2018). doi:10.1007/s11837-018-2941-x

Kim K.; Adams RA, Kim PJ, Arora A, Martinez E, Youngblood JP, Pol VG. Li-Ion Storage in an Amorphous, Solid, Spheroidal Carbon Anode Produced by Dry-Autoclaving of Coffee Oil. *Carbon* 133, 62-68 (2018). doi:10.1016/j.carbon.2018.03.013

Lee TL, Adams RA, Luhrs C, Arora A, Pol VG, Wu CH, Phillips J. High-Stability Tin/Carbon Battery Electrodes Produced Using Reduction Expansion Synthesis. *Carbon* 132, 411-419 (2018). doi:10.1016/j.carbon.2018.02.079

Adams RA, Pol VG, Varma A. Tailored Solution Combustion Synthesis of High Performance ZnCo₂O₄ Anode Materials for Lithium-ion Batteries. *Industrial & Engineering Chemistry Research* 56 (25), 7173-7183 (2017). doi:10.1021/acs.iecr.7b00295

Adams RA, Syu JM, Zhao Y, Lo CT, Varma A, Pol VG. Binder-free N- and O-Rich Carbon Nanofiber Anodes for Long Cycle Life K-ion Batteries. *ACS Applied Materials & Interfaces* 9 (21), 17872-17881 (2017). doi:10.1021/acsami.7b02476

*Naguib M, *Adams RA, Zhao Y, Zemlyanov D, Varma A, Nanda J, Pol VG. Electrochemical Performance of MXenes as K-ion Battery Anodes. *Chemical Communications* 53, 6883-6886 (2017). doi:10.1039/C7CC02026K

Li Y, Adams RA, Arora A, Pol VG, Levine AM, Lee RJ, Akato K, Naskar AK, Paranthaman MP. Sustainable Potassium-Ion Battery Anodes Derived from Waste-Tire Rubber. *Journal of The Electrochemical Society* 164 (6), A1234-A1238 (2017). doi:10.1149/2.1391706jes

Adams RA, Dysart AD, Esparza R, Acuña S, Joshi SR, Cox A, Mulqueen D, Pol VG. Superior Lithium-Ion Storage at Room and Elevated Temperature in an Industrial Woodchip Derived Porous Carbon. *Industrial & Engineering Chemistry Research* 55 (32), 8706-8712 (2016). doi:10.1021/acs.iecr.6b01786

* Equal Contribution

Presentations

Adams RA, Varma A, Pol, VG. Evaluation of Temperature Effect on Graphite Anodes for K-ion and Li-ion Batteries. American Institute of Chemical Engineers (AIChE) Annual Meeting, October 2018, Pittsburgh, PA.

Adams RA, Varma A, Pol, VG. Mechanistic Evaluation of Thermal Runaway in Potassium-ion Batteries. American Institute of Chemical Engineers (AIChE) Annual Meeting, November 2017, Minneapolis, MN.

Adams RA, Varma A, Pol, VG. Anode Performance and Safety Evaluation of Potassium-Ion Batteries. American Institute of Chemical Engineers (AIChE) Annual Meeting, November 2016, San Francisco, CA.

Adams RA, Pol VG, Varma A. Solution Combustion Synthesis for High Performance ZnCo₂O₄ Anode in Lithium-Ion Batteries. American Institute of Chemical Engineers (AIChE) Annual Meeting, November 2016, San Francisco, CA.