

JOSHUA J. ZAK

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SUMMARY

- Electrochemist and materials characterization expert with 5+ years of experience in Li-ion battery work
- Skilled in science communication to various audiences ranging from academics and students to funding agencies and industry leaders through 20+ oral and poster presentations and peer review/editing
- Demonstrated ability to spearhead collaborative efforts in and out of an academic setting through team and project management and volunteer activities

EDUCATION

California Institute of Technology – Pasadena, CA Sep 2017 – Expected Fall 2022
Doctor of Philosophy, Chemistry; Cumulative GPA: 3.85/4.00; NSF Graduate Research Fellow
Advisor: Kimberly A. See
Thesis: *Complex Charge Compensation Mechanisms in Lithium-Rich Chalcogenide Cathodes*

Carnegie Mellon University – Pittsburgh, PA Aug 2013 – May 2017
Bachelor of Science, Chemistry; Cumulative GPA: 3.80/4.00; Science and Humanities Scholar
Concentration: Materials Chemistry
Minor: Japanese Studies (Language and Culture)

RESEARCH EXPERIENCE

California Institute of Technology – Pasadena, CA
Division of Chemistry and Chemical Engineering Dec 2017 – Present
Graduate Research Assistant, lab of Prof. Kimberly A. See

- Determined charge compensation mechanisms in high-capacity Li-rich sulfide materials, successfully leading efforts to find definitive spectroscopic evidence of reversible anionic contributions to redox
- Controlled effects of metal-anion covalency and determined local structure response to anion oxidation in a series of Li-rich chalcogenide cathodes to uncover relationships to reversibility and performance
- Initiated development of in-house *operando* Raman spectroscopy capabilities and investigated local structural consequences of a dynamically changing redox mechanism in a mixed metal Li-rich oxide
- Contributed spectroscopic and electrochemical expertise to cross-cutting efforts within the SCALAR DOE Energy Frontiers Research Center in collaboration with groups from 5 other institutions

Carnegie Mellon University – Pittsburgh, PA
Department of Chemistry, Mellon College of Science May 2014 – May 2017
Undergraduate Research Assistant, lab of Prof. Stefan Bernhard

- Led a project to synthesize photostable iridium metal complexes with long-lived excited states for use as catalysts for hydrogen evolution and other industrially relevant small molecule transformations
- Awarded ACS Undergraduate Award in Inorganic Chemistry for excellence in inorganic coursework and research

TECHNIQUES AND SKILLS

Electrochemistry: cyclic voltammetry, galvanostatic cycling, galvanostatic intermittent titration technique, electrochemical impedance spectroscopy

Materials Science: solid-state synthesis, X-ray diffraction, synchrotron X-ray experiments (X-ray absorption spectroscopy, total scattering pair distribution function, hard X-ray photoelectron spectroscopy, resonant inelastic X-ray scattering), Raman spectroscopy, scanning electron microscopy

Computer: Demeter suite (XANES and EXAFS analysis), GSAS-II (XRD and PDF analysis), Biologic (EC-Lab) and MACCOR electrochemical testing software, LaTeX, Mathematica, Microsoft Office

Languages: English (native speaker), Japanese (conversational)

PUBLICATIONS ([Google Scholar](#)) *indicates co-first authorship

3. Martinolich, A. J.*; **Zak, J. J.***; Kim, S. S.; Bashian, N. H.; Irshad, A.; Agyeman-Budu, D.; Narayan, S.; Melot, B. C.; Nelson Weker, J.; See, K. A. Controlling Covalency and Anion Redox Potentials through Anion Substitution in Li-rich Chalcogenides. *Chem. Mater.* **2021**, 33, 378–391.
2. Bashian, N. H.; Peefer, M. B.; Milam-Guerrero, J.; **Zak, J. J.**; Sendi, C.; Ahsan, S.; Vincent, R.; Haiges, R.; See, K. A.; Seshadri, R.; Melot, B. C. Understanding the Role of Crystallographic Shear on the Electrochemical Behavior of Niobium Oxyfluorides. *J. Mater. Chem. A* **2020**, 8, 12623.
1. Hansen, C. J.*; **Zak, J. J.***; Martinolich, A. J.; Ko, J. S.; Bashian, N. H.; Kaboudvand, F.; Van der Ven, A.; Melot, B. C.; Nelson Weker, J.; See, K. A. Multielectron, Cation and Anion Redox in Lithium-Rich Iron Sulfide Cathodes. *J. Am. Chem. Soc.* **2020**, 142, 6737–6749.

MANUSCRIPTS IN SUBMISSION/REVIEW

4. **Zak, J. J.**; Zuba, M.; Lebens-Higgins, Z. W.; Huang, H.; Crafton, M. J.; McCloskey, B. D.; Piper, L. F. J., See, K. A. Irreversible Anion Redox and Dynamically Changing Charge Compensation in Low-Ru Li-rich Cathode $\text{Li}_2\text{Ru}_{0.3}\text{Mn}_{0.7}\text{O}_3$. *In preparation*.
3. **Zak, J. J.**; Kim, S. S.; Laskowski, F. A. L.; See, K. A. From Intercalation to Conversion and the Hybrid Mechanisms Between: An Exploration of Sulfur Redox in Li Cathodes. *In preparation*.
2. Kim, S. S.; Agyeman-Budu, D. N.; **Zak, J. J.**; Dawson, A.; Yan, Q.; Cában-Acevedo, M.; Yao, Y.; Irshad, A.; Narayan, S. H.; Luo, J.; Nelson Weker, J.; Tolbert, S. H.; See, K. A. Promoting Reversibility of Multielectron Redox in Alkali-Rich Sulfide Cathodes through Cryomilling. *In review, Jan 2022*.
1. Wyckoff, K. E.; Kaufman, J. L.; Baek, S. W.; Dolle, C.; **Zak, J. J.**; Bienz, J.; Kautzch, L.; Vincent, R. C.; Zohar, A.; See, K. A.; Eggeler, Y. M.; Pilon, L.; Van der Ven, A.; Seshadri, R. Metal-Metal Bonding as an Electrode Design Principle in the Low-Strain Cluster Compound $\text{LiScMo}_3\text{O}_8$. *In review, Nov 2021*.

SELECTED PRESENTATIONS

Oral, Materials Research Society, “Controlling Covalency and Anion Redox Potentials through Anion Substitution in Li-rich Chalcogenides.” 2021

Oral (invited), Stanford Synchrotron Radiation Lightsource Monthly Seminar, “Tunable Multielectron Redox in Lithium-Rich Iron Chalcogenide Cathodes.” 2020

Oral, Energy Frontiers Research Center Principal Investigator Meeting, “Investigating the Redox Activity and Lithiation of Boron Icosahedra in the Solid State.” 2019

HONORS & AWARDS

Fellow, National Science Foundation Graduate Research Fellowship Program, 2019-present

Poster Award, Caltech Division of Chemistry and Chemical Engineering Seminar Day, 2019

Team Science Award, Office of Basic Energy Sciences, U.S. Department of Energy, 2018

Student Service Award, Carnegie Mellon Alumni Association, 2017 (highest university award for service)

Scholar, Andrew Carnegie Society, 2017 (given to 40 graduating seniors in a class of 1600)

SELECTED COMMUNITY INVOLVEMENT

Student Representative, Chemistry Graduate Studies Committee, Caltech, 2019-present

- Planned division-wide activities and townhalls, and advocated for policy changes with regards to diversity, equity, inclusion, and accessibility in graduate student recruitment and retention

Student Leader, PRISM/oSTEM, Caltech, 2018-present

- LGBTQ+ and allies group focused on organizing social and educational programs for the Caltech community and outreach opportunities in the greater Los Angeles area

Student Representative, LGBTQ+ Working Group, Caltech, 2018-present

- Worked with LGBTQ+ faculty and staff to advocate for a safe and vibrant environment for queer students