Michael J. Zachman
R&D Associate
Center for Nanophase Materials Sciences
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Education:

2018	Cornell University, Ph.D., Applied Physics
2015	Cornell University, M.S., Applied Physics
2012	Purdue University, B.S. *(Highest Distinction)*, Physics

Professional Experience:

2019–present	R&D Associate, Center for Nanophase Materials Sciences, ORNL
2018–2019	Postdoctoral Research Associate, Center for Nanophase Materials Sciences, ORNL
2013–2018	Graduate Research Assistant, Cornell University
2012–2013	Teaching Assistant, Cornell University
2011–2012	Undergraduate Research Assistant, Purdue University
2011	Summer Undergraduate Research Fellow, Purdue University
2010	Intern, Thermophysical Properties Research Laboratory, Inc.

Honors and Awards:

William Nichols Findley Award for Outstanding Research Paper, Cornell University School of Applied & Engineering Physics, 2019
Early Career Representative and Scholarship for EMAS 2019, Microanalysis Society, 2019
Best Microscopy and Microanalysis Journal Paper of 2016 Award, Microscopy Society of America, 2017
Materials Handling Prize, Silent Hoist and Crane, 2017
Meeting Scholarship, Enhanced Data Generated by Electrons, 2017
Eric Samuel Scholarship Award, Microscopy Society of America, 2015
Watt W. Webb Graduate Fellowship in Nanoscience, Kavli Institute at Cornell, 2014

Experimental Expertise:

Transmission Electron Microscopy (room/cryogenic tmperature):
- Atomic resolution and low-dose imaging
- Nanoscale dark-field imaging
- Selected area diffraction

Aberration-Corrected Scanning Transmission Electron Microscopy (room/cryogenic temperature):
- Atomic resolution imaging by dark-field, bright-field, annular bright-field
- Atomic resolution and long-range differential phase contrast imaging utilizing pixelated detectors
- Valence and core-loss spectroscopic mapping and fine-structure analysis by electron energy loss spectroscopy (EELS)
- Phonon mapping and analysis by monochromated EELS

Focused Ion Beam/Scanning Electron Microscopy (room/cryogenic temperature):
- Milling and nanoscale imaging/energy dispersive X-ray (EDX) spectroscopic mapping
- Preparation of electron transparent lamellas from samples such as snap-frozen hard-soft composite materials or solid-liquid interfaces for cryo-STEM by cryo-FIB lift-out

Publications:

1. **Zachman, M. J.**; De Jonge, N.; Fischer, R.; Jungjohann, K. L.; Perea, D. E., "Cryogenic specimens for nanoscale characterization of solid-liquid interfaces," *MRS Bulletin* **44** (12), 949 (2019).
2. Yu, S.-H.*; **Zachman, M. J.***; Kang, K.; Gao, H.; Huang, X.; DiSalvo, F. J.; Park, J.; Kourkoutis, L. F.; Abruña, H. D., "Atomic-Scale Visualization of Electrochemical Lithiation Processes in Monolayer MoS_2 by Cryogenic Electron Microscopy," *Advanced Energy Materials* **9**, 1902773 (2019). ***Contributed equally.**
3. **Zachman, M. J.**; Hachtel, J. A.; Idrobo, J. C.; Chi, M., "Emerging Electron Microscopy Techniques for Probing Functional Interfaces in Energy Materials," *Angewandte Chemie* **131**, 2 (2019).

4. Wang, Z.; Goodge, B. H.; Baek, D. J.; **Zachman, M. J.**; Huang, X.; Bai, X.; Brooks, C. M.; Paik, H.; Mei, A. B.; Brock, J. D.; Maria, J. P.; Kourkoutis, L. F.; Schlom, D. G., "Epitaxial $SrTiO_3$ film on silicon with narrow rocking curve despite huge defect density," *Physical Review Materials* **3** (7), 073403 (2019).
5. Choudhury, S.; Tu, Z.; Nijamudheen, A.; **Zachman, M. J.**; Stalin, S.; Deng, Y.; Zhao, Q.; Vu, D.; Kourkoutis, L. F.; Mendoza-Cortes, J. L.; Archer, L. A., "Stabilizing Polymer Electrolytes in High-Voltage Lithium Batteries," *Nature Communications* **10**, 3091 (2019).
6. Zhao, Q.; **Zachman, M. J.**; Al Sadat, W. I.; Zheng, J.; Kourkoutis, L. F.; Archer, L. A., "Solid Electrolyte Interphases for High-Energy Aqueous Aluminum Electrochemical Cells," *Science Advances* **4**, eaau8131 (2018).
7. **Zachman, M. J.**; Tu, Z.; Choudhury, S.; Archer, L. A.; Kourkoutis, L. F., "Cryo-STEM Mapping of Solid-Liquid Interfaces and Dendrites in Li-Metal Batteries," *Nature* **560**, 345 (2018).
8. Tu, Z.*; **Zachman, M. J.***; Choudhury, S.; Khan, K. A.; Zhao, Q.; Kourkoutis, L. F.; Archer, L. A., "Stabilizing Protic and Aprotic Liquid Electrolytes at High-Bandgap Oxide Interphases," *Chemistry of Materials* **30**, 5655 (2018). ***Contributed equally.**
9. Prasad, B.; Pfanzelt, G.; Fillis-Tsirakis, E.; **Zachman, M. J.**; Kourkoutis, L. F.; Mannhart, J., "Integrated Circuits Comprising Patterned Functional Liquids," *Advanced Materials* **30**, 1802598 (2018).
10. Tu, Z.; Choudhury, S.; **Zachman, M. J.**; Wei, S.; Zhang, K., Kourkoutis, L. F.; Archer, L. A., "Fast Ion Transport at Solid-Solid Interphases in Hybrid Battery Anodes," *Nature Energy* **3**, 310 (2017).
11. Tu, Z.; Choudhury, S.; **Zachman, M. J.**; Wei, S.; Zhang, K., Kourkoutis, L. F.; Archer, L. A., "Designing Artificial Solid-Electrolyte Interphases for Single-Ion and High-Efficiency Transport in Batteries," *Joule* **1**, 394 (2017).
12. Choudhury, S.; Wei, S.; Ozhabes, Y.; Gunceler, D.; **Zachman, M. J.**; Tu, Z.; Shin, J.-H.; Nath, P.; Agrawal, A.; Kourkoutis, L. F.; Archer, L. A., "Designing Solid-Liquid Interphases for Sodium Batteries," *Nature Communications* **8**, 898 (2017).
13. Choudhury, S.; Wan, C. T.-C.; Al Sadat, W. I.; Tu, Z.; Lau, S.; **Zachman, M. J.**; Kourkoutis, L. F.; Archer, L. A., "Designer Interphases for the Lithium-Oxygen Electrochemical Cell," *Sceince Advances* **3** (4), e1602809 (2017).
14. Levin, B. D. A.; **Zachman, M. J.**; Werner, J.; Sahore, R.; Nguyen, K. X.; Han, Y.; Xie, B.; Ma, L.; Archer, L. A.; Giannelis, E. P.; Wiesner, U.; Kourkoutis, L. F.; Muller, D. A., "Characterization of Sulfur and Nanostructured Sulfur Battery Cathodes in Electron Microscopy without Sublimation Artifacts," *Microscopy and Microanalysis* **23**, 155 (2017).
15. Tu, Z.; **Zachman, M. J.**; Choudhury, S.; Wei, S.; Ma, L.; Yang, Y.; Kourkoutis, L. F.; Archer, L. A., "Nanoporous Hybrid Electrolytes for High-Energy Batteries Based on Reactive Metal Anodes," *Advanced Energy Materials* **7**, 1602367 (2017).
16. **Zachman, M. J.**; Asenath-Smith, E.; Estroff, L. A.; Kourkoutis, L. F., "Site-Specific Preparation of Intact Solid-Liquid Interfaces by Label-Free *In-Situ* Localization and Cryo-Focused Ion Beam Lift-Out," *Microscopy and Microanalysis* **22**, 1338 (2016).

Invited Presentations:

1. Mapping Local Structural and Electron Properties of 2D Materials by Multi-Dimensional STEM, *Microscopy and Microanalysis*, Portland, OR, 9/6/19.
2. Probing the Native Structure and Chemistry of Li-Metal Batteries by Cryo-Electron Microscopy, *EMAS 2019 – 16th Workshop on Modern Developments and Applications in Microbeam Analysis*, Trondheim, NO, 5/21/19.
3. Recent Progress and Future Opportunities for Cryo-STEM in Materials Science, *Center for Nanophase Materials Sciences Seminar*, Oak Ridge National Laboratory, Oak Ridge, TN, 5/16/19.
4. Ion Conductivity and Stability of Interfaces Involving Solid Electrolytes, *14th Annual Lithium Battery Materials and Chemistries Conference*, Arlington, VA, 11/2/2018.

Professional Memberships:

Microscopy Society of America
Microanalysis Society
European Microbeam Analysis Society

Professional Activities:
Session Chair at *'17th Frontiers of Electron Microscopy in Materials Science,'* Asheville, NC, 9/6/19.
Session Chair at *'Microscopy and Microanalysis,'* Portland, OR, 8/7/19.
Session Chair at *'14th Annual Lithium Battery Materials and Chemistries Conference,'* Arlington, VA, 11/2/2018.

Outreach and Mentoring Activities:
Volunteer and tabletop scanning electron microscope operator for ORNL CNMS Science Trailer events, 2019–present
Volunteer and microscopy activity designer/presenter, Cornell CCMR Outreach Program, 2013–2018
Undergraduate mentor, REU Program, Cornell University, 2014
Volunteer and designer/presenter of an interactive microscopy program, Sciencenter, Ithaca, NY, 2013–2014