



Exceptional service in the national interest

MATERIALS STRATEGIES AIMED AT LOW-COST HIGH-CAPACITY AND LONG-CYCLE LIFE GRID STORAGE BATTERIES FROM EARTH ABUNDANT ELEMENTS

Zinc & Manganese - Academic and National Laboratory Research Frontiers

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Materials Science and Innovation Portfolio – ID#: 1005

DOE OE Energy Storage Peer Review & Annual Meeting, 2026
July 27-30th, Dallas, Texas, USA, Earth, Milky Way

Presentation ID #1005



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SAND2026-23972PE

PROJECT OVERVIEW

Program Objective:

Establish a robust technical foundation - developing new materials, methods, components & technologies to enable low-cost Zn-based batteries for grid and long duration energy storage.

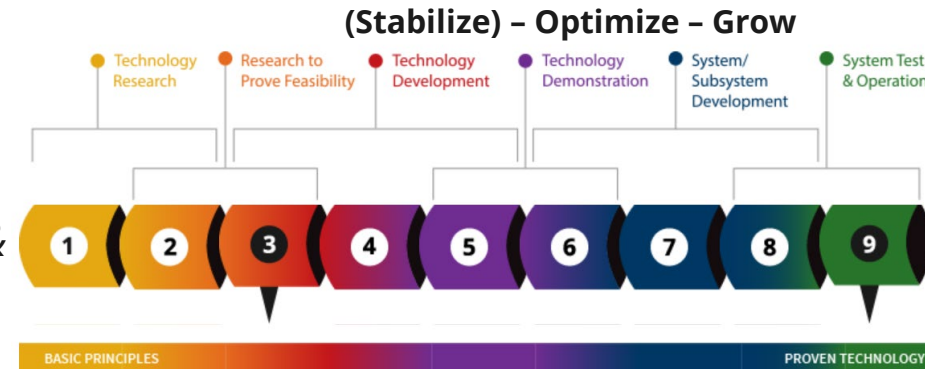
Current Practice:

Grid Storage is currently dominated by Li-ion batteries: high energy density, cycling stability, manufacturability.

- Significant cost, safety and supply chain concerns (Li, Co, Ni...)
- Typically limited to ≤ 4 h of duration.

Zinc Batteries have the potential to provide reliable, safe, domestically sourced energy generation to strengthen the US electrical grid.

- Energy Dense [Zn/MnO₂ primary ~ 400 Wh/L]
- Safe, Non-flammable electrolytes (*i.e.* aqueous)
- Based solely on abundant materials w/ existing *battery grade* supply chain
- Fundamental limitations of Zn battery chemistries still need to be determined
 - Applications from High-Power: Zn-Ni to Long Duration: Zn-MnO₂, Zn-air
 - Increased utilization at high volumetric and areal capacities

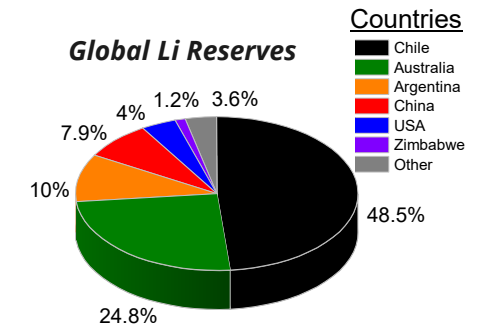


Collectively **Materials and Systems Innovation** works in the TRL 1-4/5 realm

Anodes: Zn, Mn

Cathodes: MnO₂, CuO, Ni, VOx, O₂ Electrocatalyst

Electrolyte: Acidic to Basic, Organic



Source: BP Statistical Review of World Energy, 2021

PROJECT OVERVIEW

Innovation:

- Gain control of the conversion chemistry reactions through fundamental understanding
- & Higher utilization of active materials in Zinc-based batteries
- Successful rechargeable Zinc-based battery development
- Chemical species that provide valuable mechanistic information are often interfacial or amorphous
- Challenging to detect or monitor
- Comprehensive approach: electrochemistry, materials science, advanced characterization, and simulation/modeling are all required to advance the technology

Vertical/Investment Area: Materials Science and Innovations (OE FY25 Update, SI 2030 FY26-28)

Impact: 'Filling in the knowledge gaps' = de-risking Zn-battery Technologies for U.S. Energy Dominance

Alignment:

Inexpensive rechargeable Zn-based batteries that can be sourced and manufactured in the U.S. supports DOE's mission to strengthen our nation's power grid to maintain a reliable, affordable, secure, and resilient electricity delivery infrastructure.



PROJECT OVERVIEW –WHY SANDIA TEAM ?

- Strong combination of material science, engineering, and chemistry knowledge with significant experience in zinc-based batteries including tech maturation and industrial partnerships
- Success in forming strategic partnerships (e.g., SI-2030) and expertise with advanced characterization capabilities including access to DOE national user facilities – CINT (Cryo-FIB), NSLS-II (QAS, ISS, XPD, HEX etc.), APS, SNS

FY25 Sandia Team

The High-capacity Durable Energy storage Zinc battery consortium (HiDEZ), CY26-CY28

(One of three ~ \$5M competitive SI – 2030 awards)



PROJECT PROBLEM

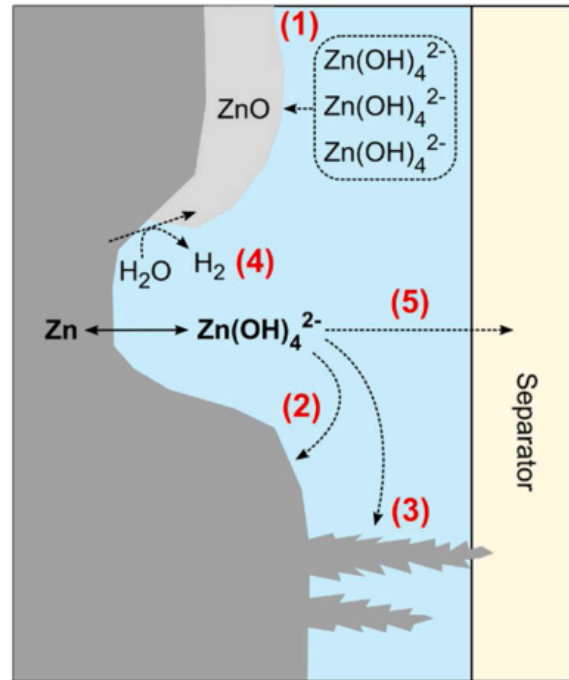
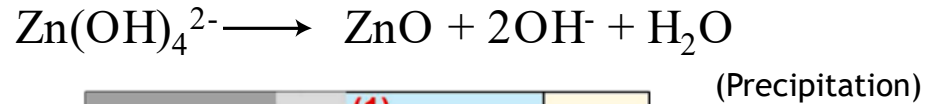


Fig. 4. Schematic diagram illustrating fundamental performance-limiting issues with the zinc anode in alkaline electrolytes: (1) passivation, (2) shape change or redistribution of active material, (3) dendrite formation, (4) hydrogen evolution or corrosion, and (5) crossover of zincate to the cathode.

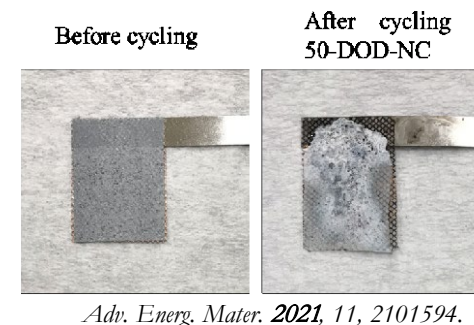
OH^- is charge carrier, proton insertion at MnO_2 or NiOOH

Cycling Zn at high capacity is Challenging

- (1) Zn Passivation as ZnO (capacity loss, internal resistance)
- (2) Shape Change (cycle life, capacity loss)
- (3) Zn Dendrite formation (shorting, dead Zn)
- (4) Hydrogen Evolution Reaction (Bi, In.... additives)
- * (5) Zincate $[\text{Zn(OH)}_4]^{2-}$ crossover (capacity loss, poisons MnO_2 cathode, need a selective separator)

Mitigation Strategies include

- 1) Low-capacity utilization (Lowers energy, increases cost)
- 2) Limiting Current (lowers rate)
- * 3) Electrode Additives (Bi, Ca, CaZn, lowers energy)
- 4) Novel Electrode architectures (3D Zinc, adds complexity, \$)
- 5) Mechanical Scraping/ 'Two site Anode' (adds complexity)
- 6) Flow



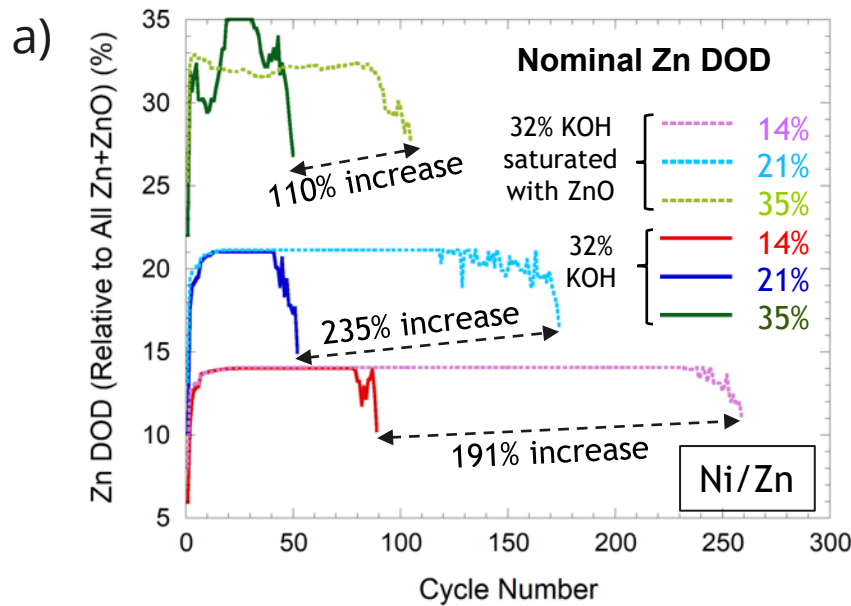
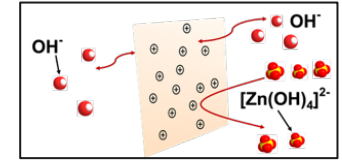
J. Electrochem. Soc., 163 (9), A1836 (2016)

PROJECT BACKGROUND

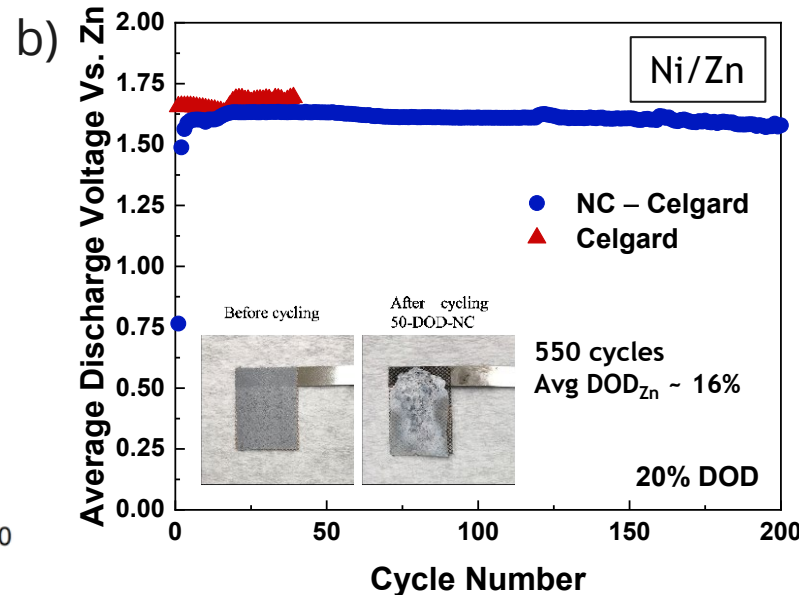
Controlling Zincate to enable increased DOD and cycle life for Zn Anodes and CuO, MnO₂ cathodes



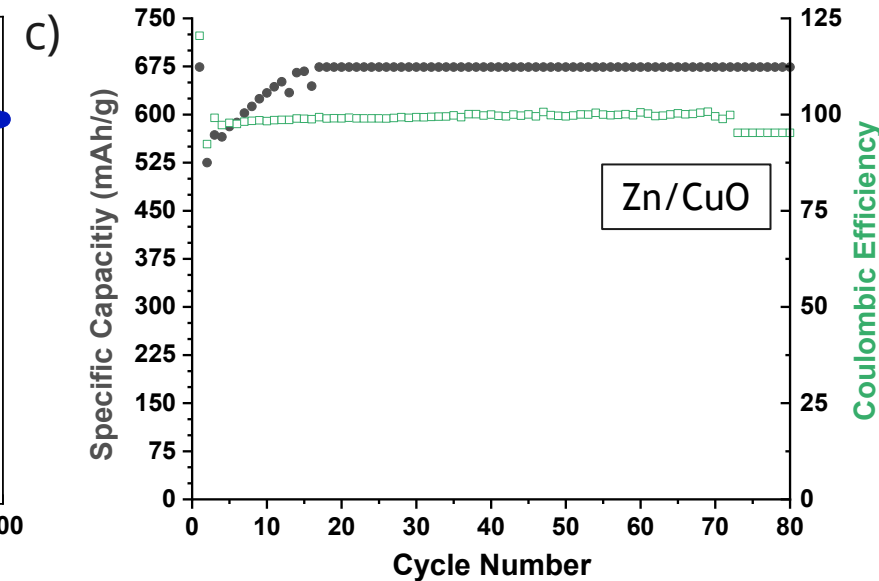
- a) Zincate increases cycle life while minimizing shape change in Ni/Zn
- b) Selective separator (in situ zincate) performs even better (< 1% change in cell volume)
- c) Selective membrane enables extends 2-electron cycle life (CuO, Cu/Bi-MnO₂)



M. B. Lim et al. "Effect of ZnO-Saturated Electrolyte on Rechargeable Alkaline Zinc Batteries at Increased Depth-of-Discharge" *J. Electrochem. Soc.* **2020**, 167, 060508.
DOI: 10.1149/1945-7111/ab7e90.



D. J. Arnot et al. "High Depth-of-Discharge Zinc Rechargeability Enabled by a Self-Assembled Polymeric Coating" *Adv. Energ. Mater.* **2021**, 11, 2101594.
DOI: 10.1002/aenm.202101594.

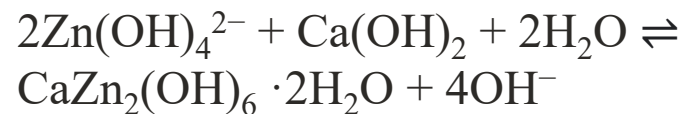


N. Schorr **et al. "Rechargeable Alkaline Zinc/Copper Oxide Batteries" *ACS Applied Energy Mater.* **2021**, 4, 7, 7073-7082.DOI: 10.1021/acsaem.1c01133

Zn fails due to shape change or passivation - how to control shape change?

PROJECT BACKGROUND

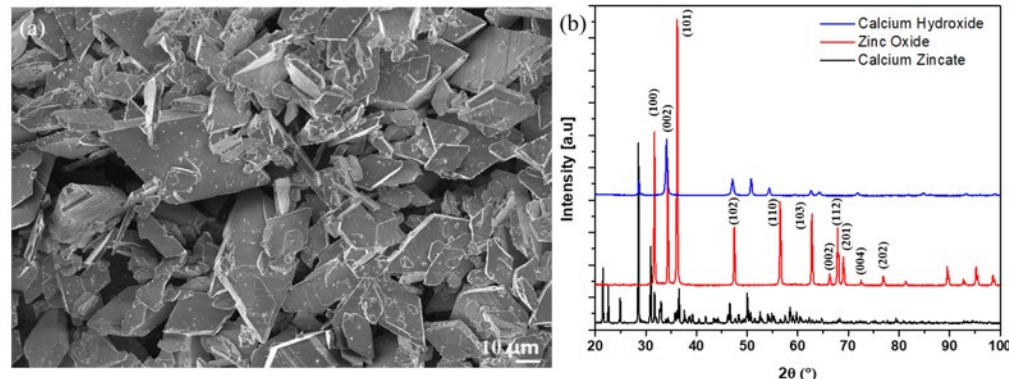
Goal: Evaluate cycling and failure mechanism for CaZn electrodes at 50% DOD



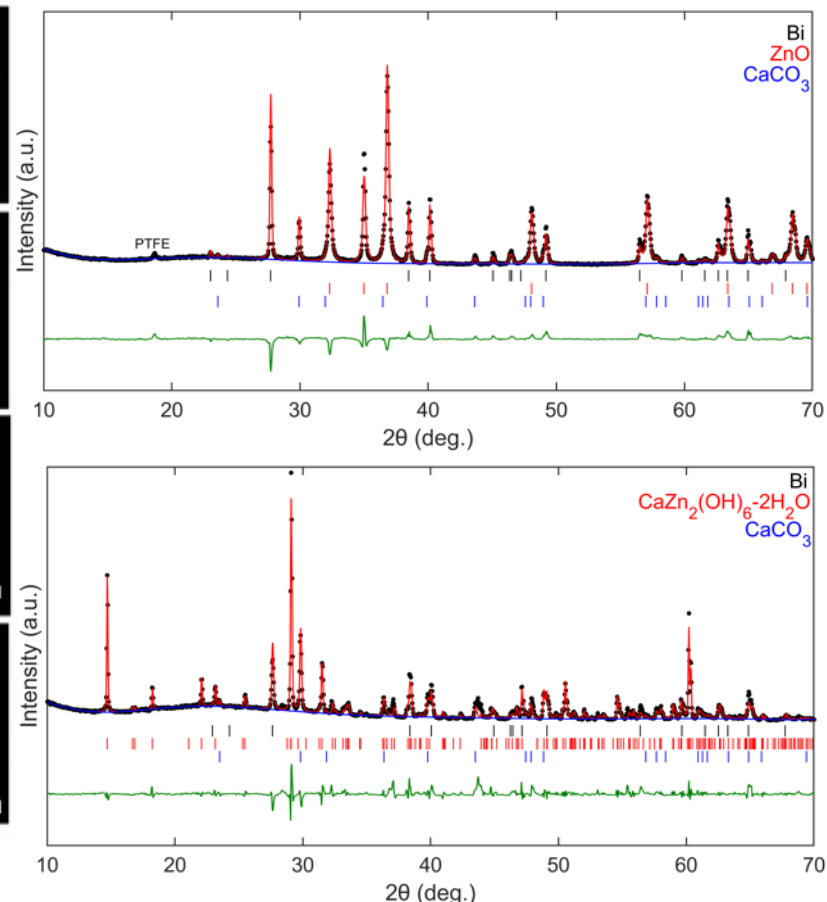
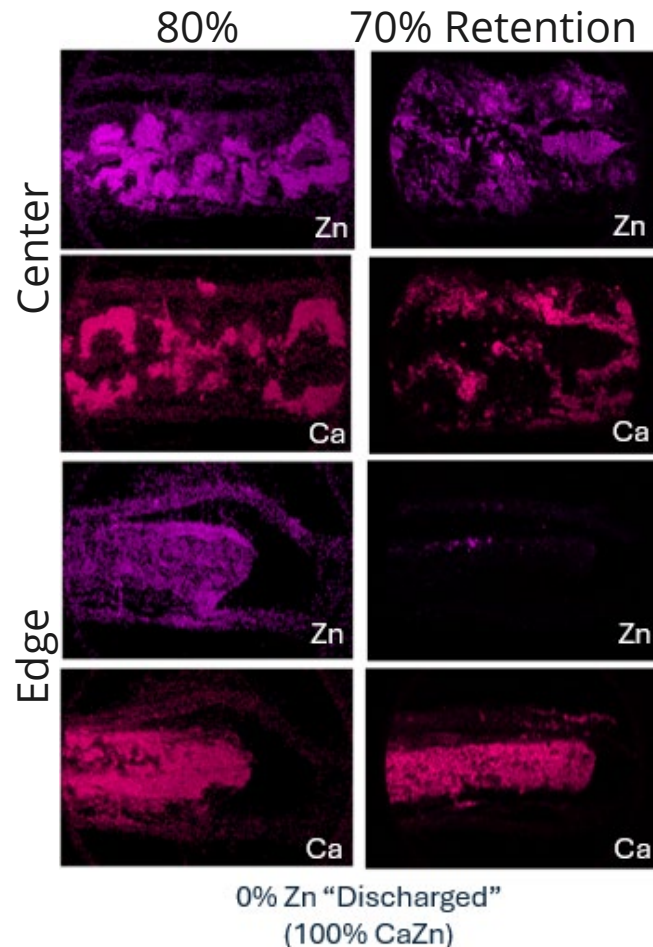
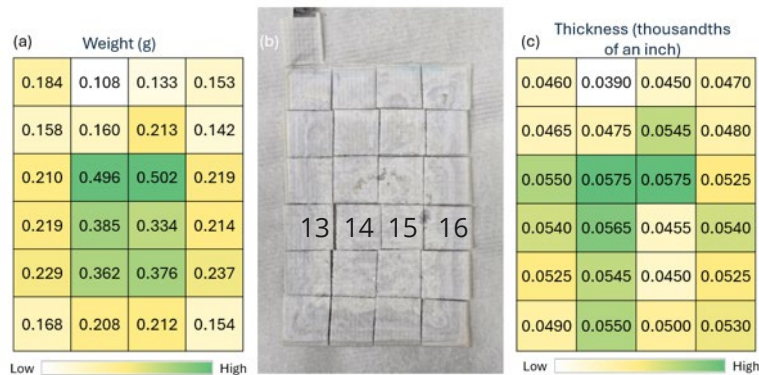
Phase pure (>98%)
CaZn synthesized

Failure through heterogeneity:

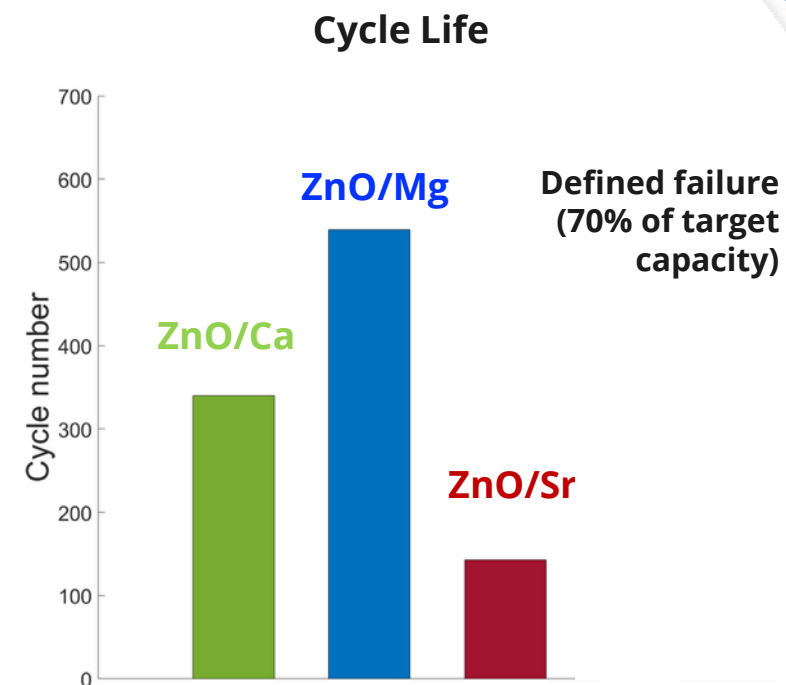
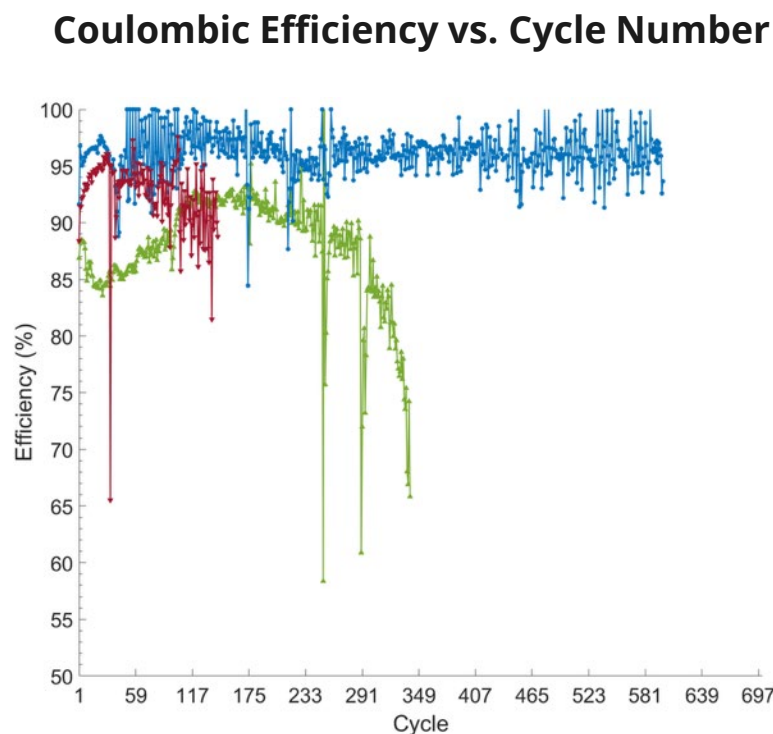
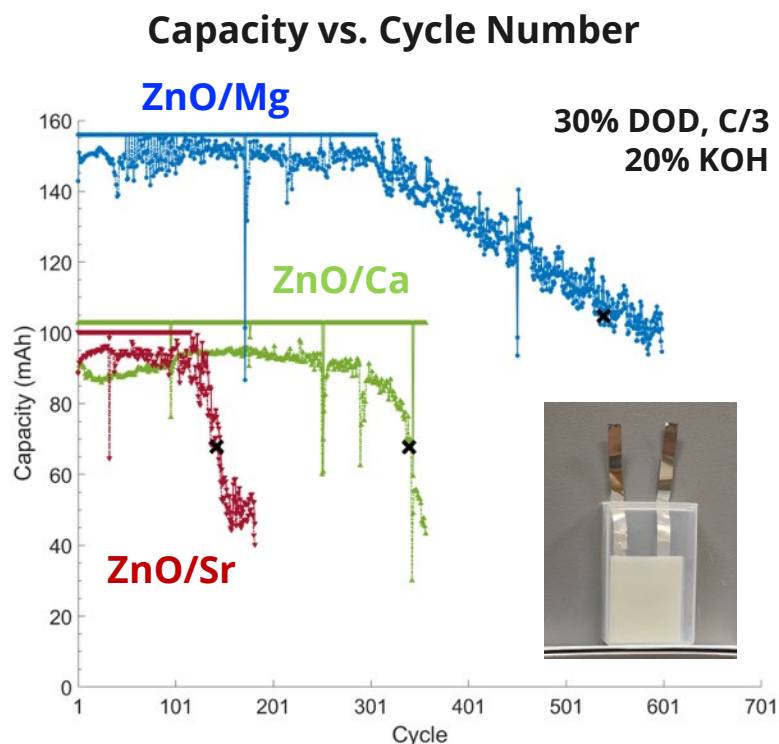
- Migration of Zn and Ca species
- Breakdown of CaZn structure
- Carbonates



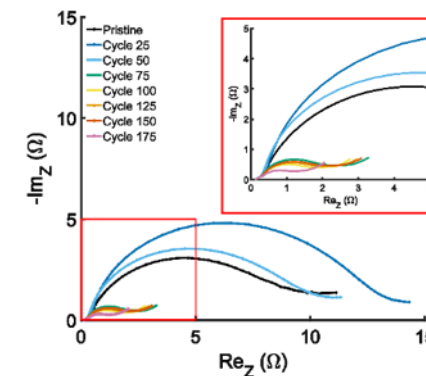
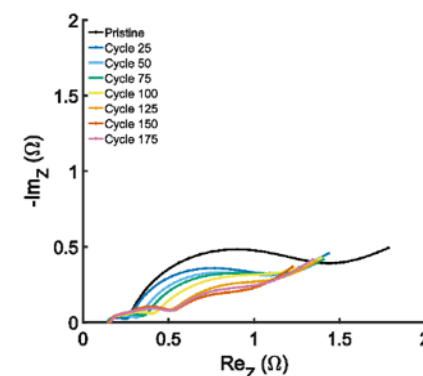
At 70% capacity, significant shape change (migration)



Cycling comparison between Ca, Mg, Sr additives in ZnO electrodes



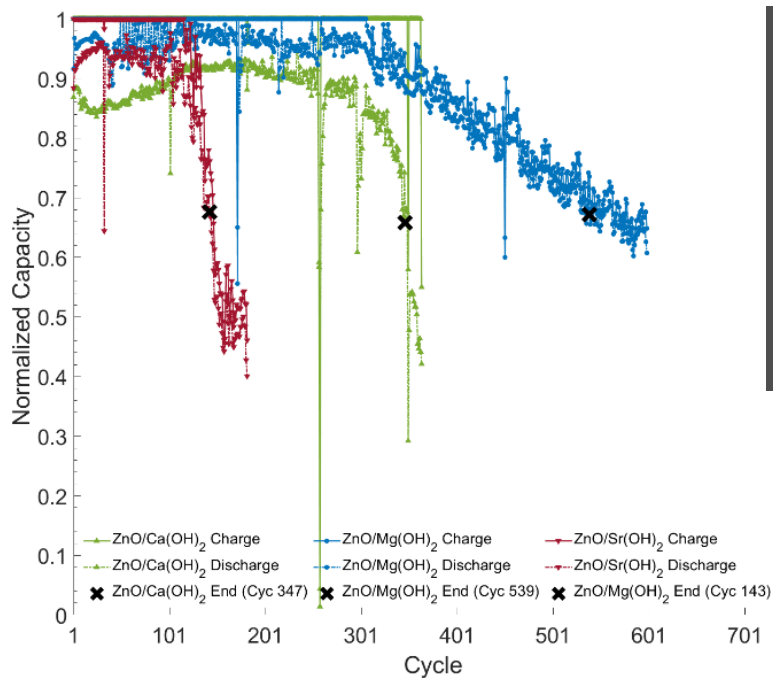
1. ZnO/Mg has ~ 50-60% higher capacity for a given electrode
2. Cycle life is improved (~ 1.6 x longer)
3. CE improved with ZnO/Mg > ZnO/Ca > ZnO/Sr
4. Lowest impedance is for ZnO/Mg < ZnO/Ca < ZnO/Sr



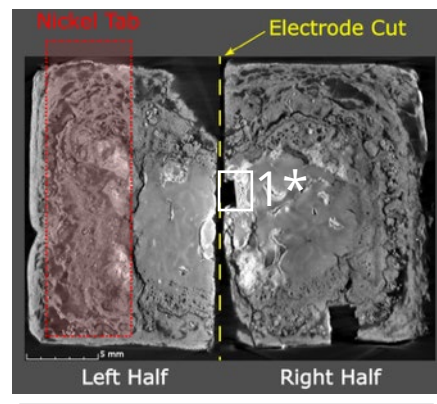
PROJECT HIGHLIGHTS



Normalized Capacity vs. Cycle Number



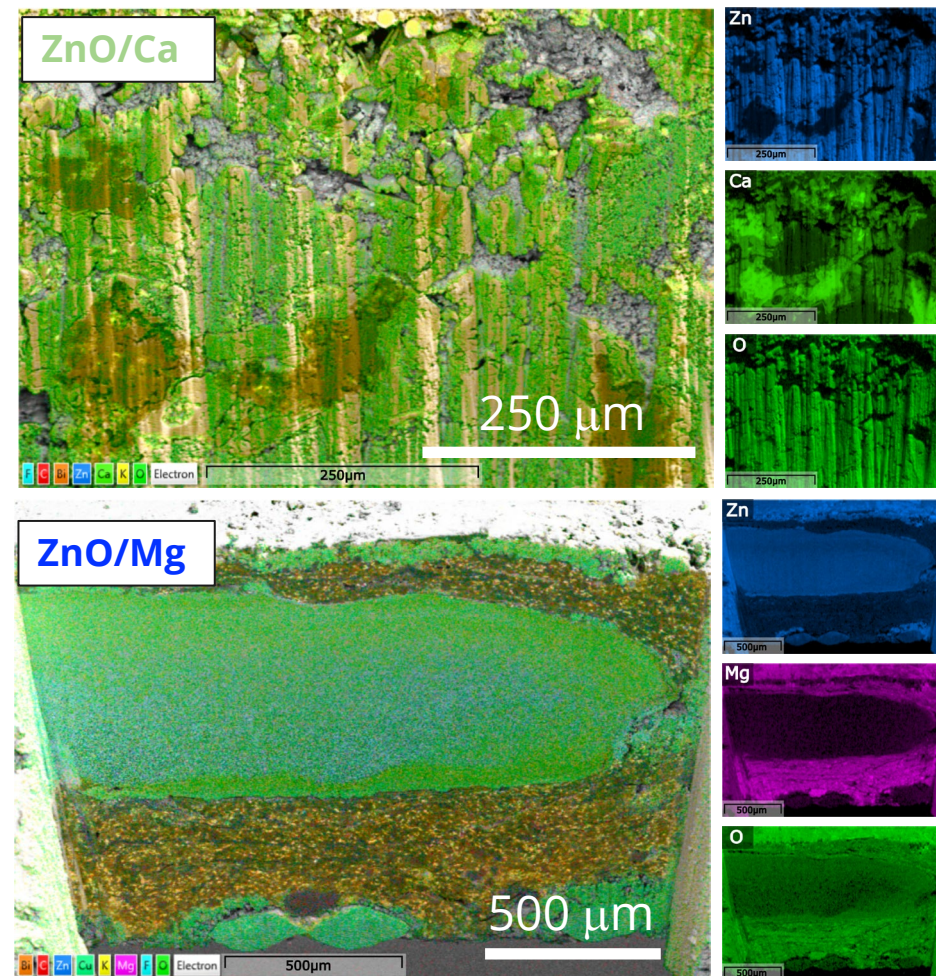
CT



1.90 cm

2.54 cm

Difference in Microstructure at EOL



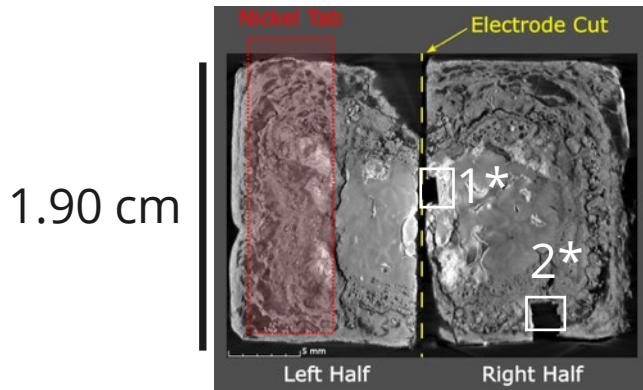
(EOL = End of Life)

PROJECT HIGHLIGHTS



Postmortem - Microstructural analysis of ZnO/Mg

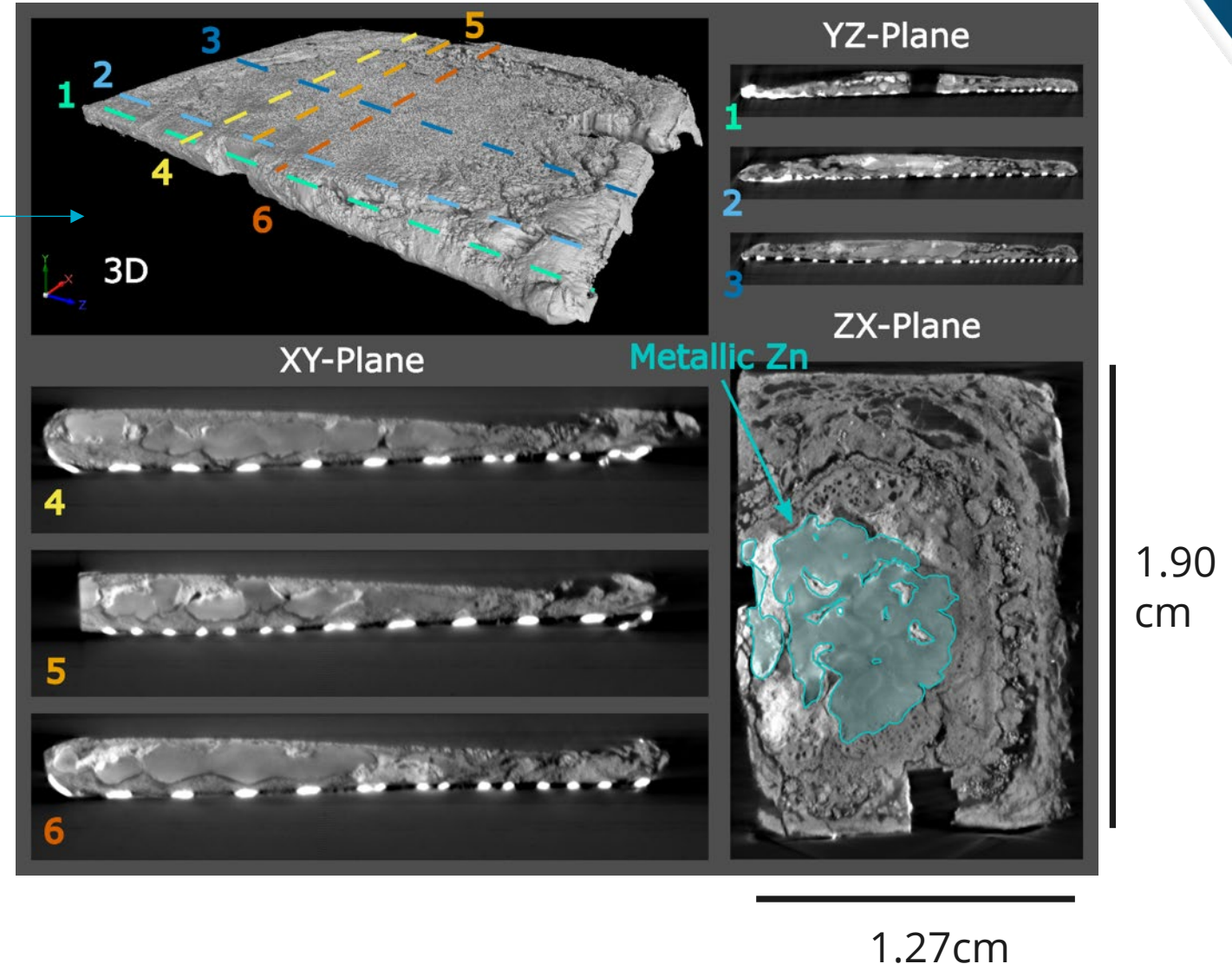
FIB/SEM cuts on dissected electrode



Right half

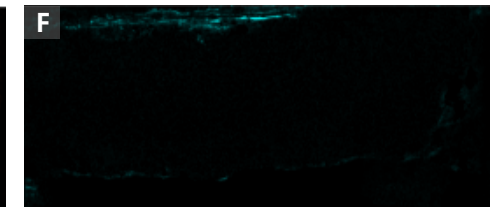
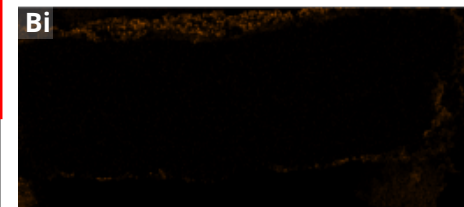
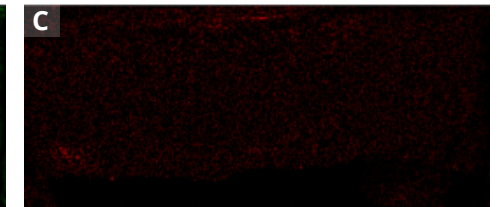
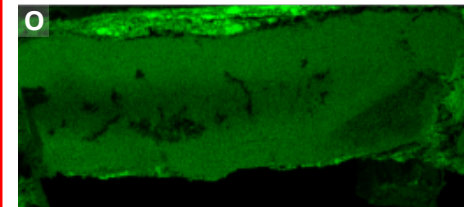
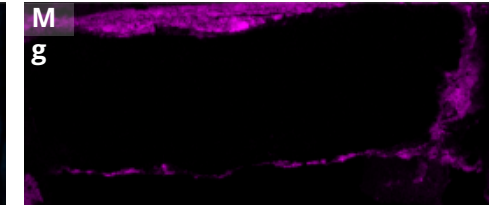
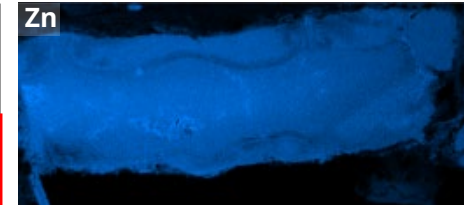
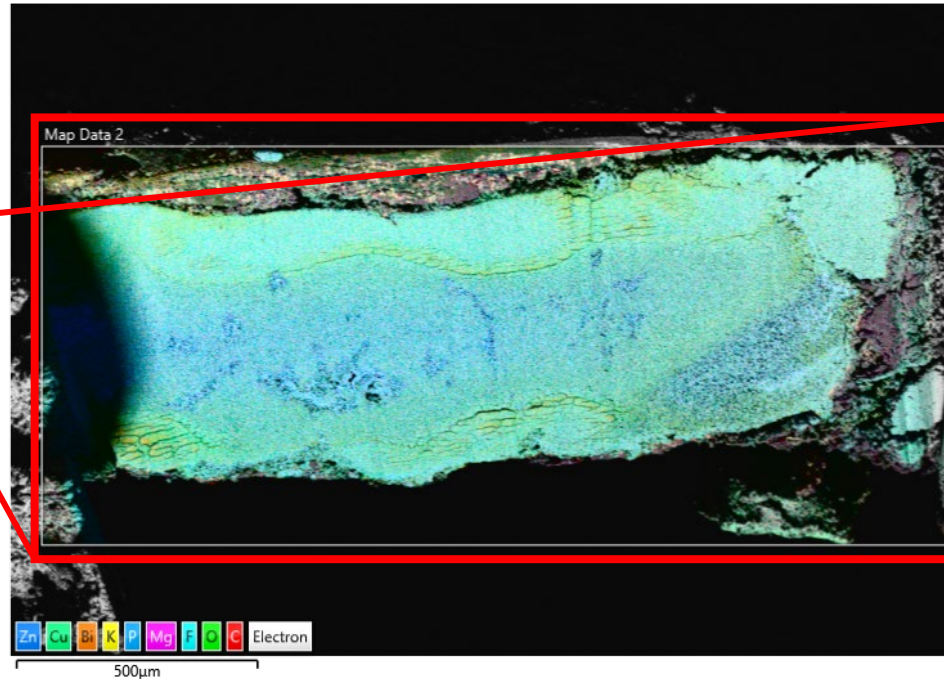
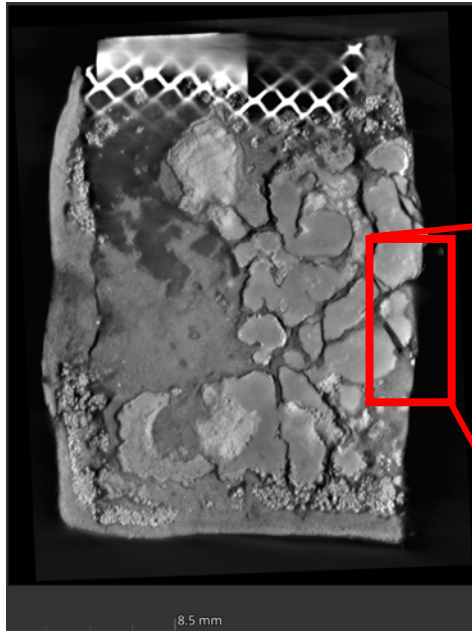
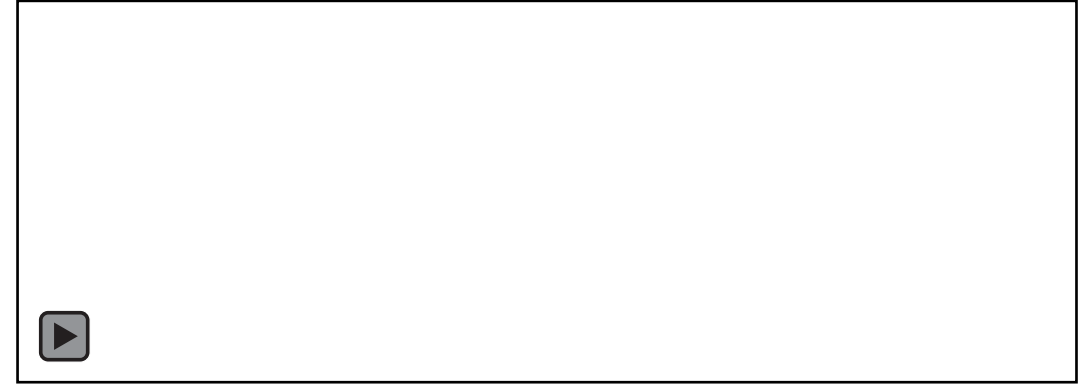
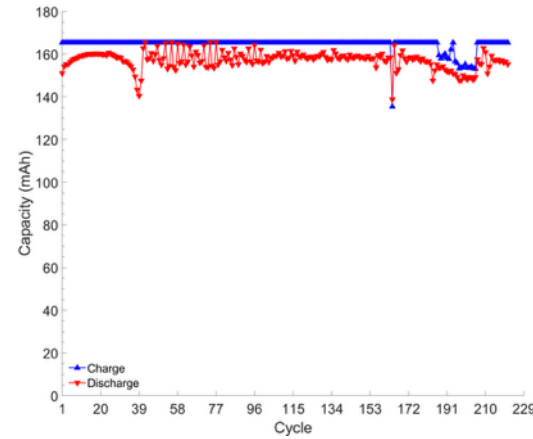
2.54 cm

- CT corroborates FIB/SEM at even longer scale lengths
- Consistent with a dense Zn 'core'
- Mass migration towards center is observed in the shape
- Suggests Zn monolith is the reason for cell failure
- Lack of porosity and surface area limits re-oxidation back to ZnO (passivation in 20% KOH)



PROJECT HIGHLIGHTS

Healthy Cell ~ cycle 220
Stopped in discharged state



FIB/SEM on dissected electrode taken at center (left side)
Electrode in discharged state

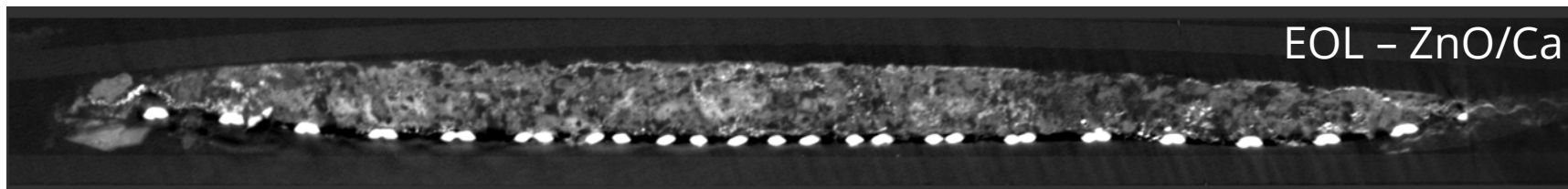
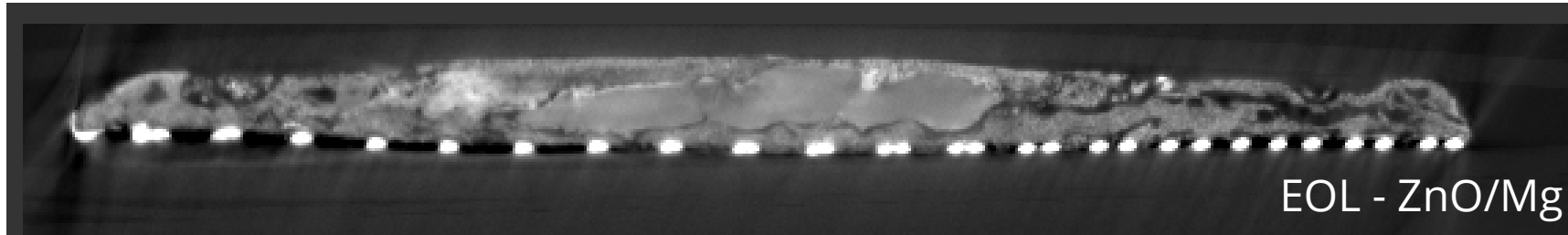
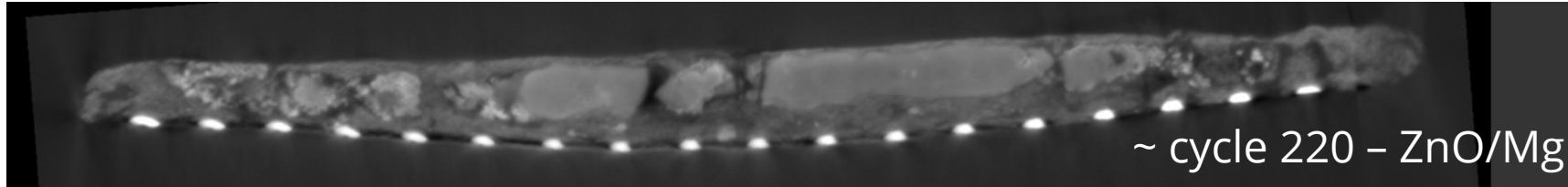
Densification of ZnO to Zn core over time

I. Bezsonov *et al.* 2026 manuscript under review.

PROJECT HIGHLIGHTS

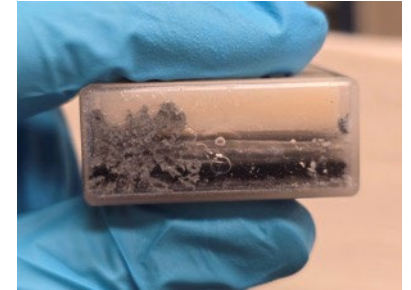


Microstructural comparisons between additives



Mg does not form carbonates – unlike Ca and Sr

EOL – ZnO/Mg Cell
Thicker, more dense dendrites



EOL – ZnO/Ca Cell
Thinner, less dense dendrites

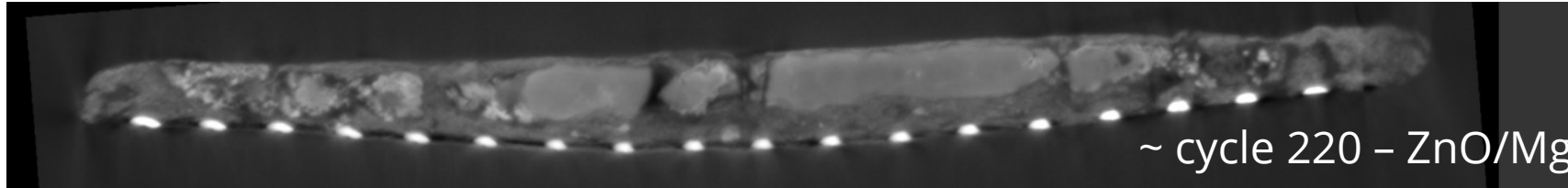


(EOL = End of Life)

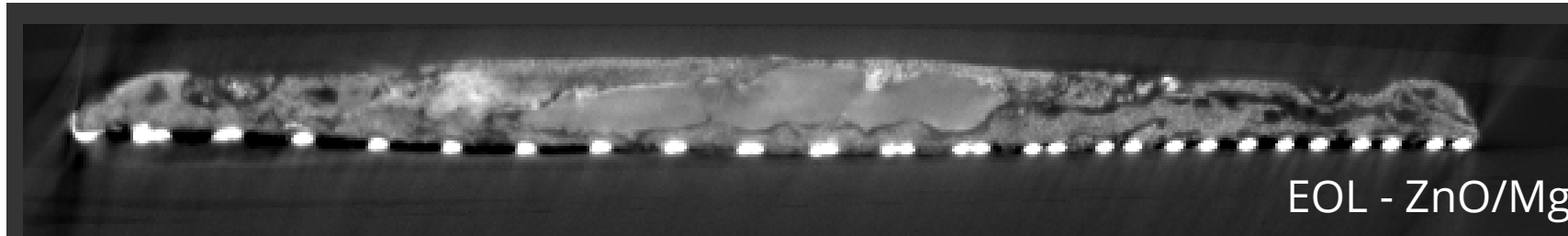
PROJECT HIGHLIGHTS



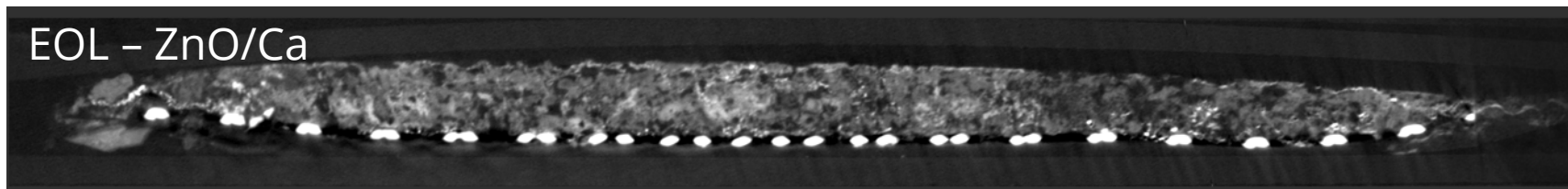
Microstructural comparisons between additives



~ cycle 220 – ZnO/Mg



EOL - ZnO/Mg



EOL – ZnO/Ca

(EOL = End of Life)

ZnO/Mg

Competition Bite-through Ribs



ZnO/Ca

Fall Off the Bone Ribs

PROJECT HIGHLIGHTS

Summary:

- ZnO/Mg cells outperform those based on ZnO/Ca >> ZnO/Sr – EIS, CE, Cycle life, Ah, Wh
- Zn migration to center is 'more complete' with ZnO/Mg and happens during 'healthy cell' phase
- No Mg or Sr zincate phases are observed by XRD – only CaZn forms
- No MgCO_3 phase is observed in XRD – kinetically disfavored – Sr and Ca form carbonates

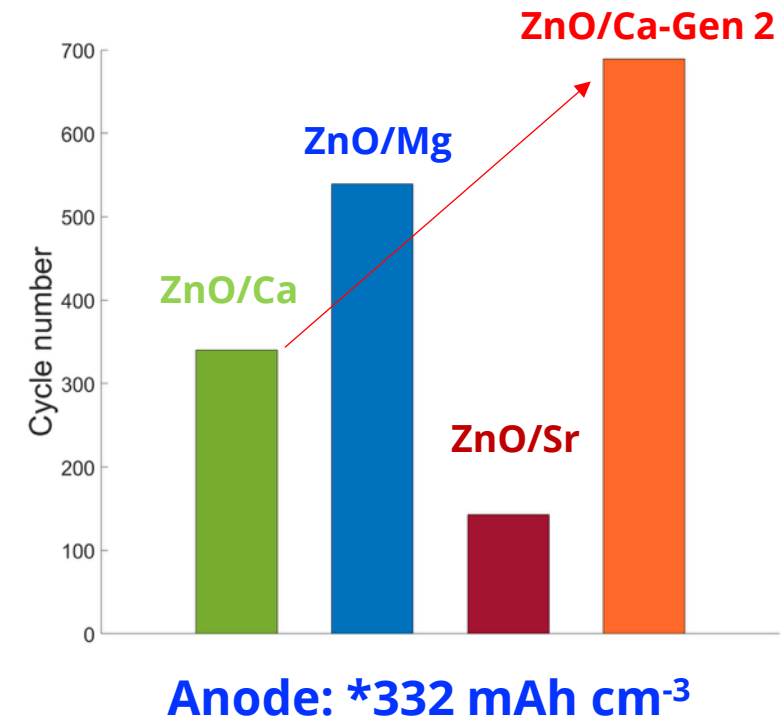
Cycle Performance Comparison to 70%

Additive	30% DOD Capacity (mAh)	Cumulative Capacity (Ah)	Cumulative Energy (Wh)	Cycle Life
ZnO/Mg	159	75	120	539
ZnO/Ca	104	31	51	340
ZnO/Sr	139	13	21	143

Next Steps:

- NSLS-II allocation 8/3/26 – 8/6/26 (9 shifts – *No sleep till Brooklyn at Brookhaven*)
- Establish improved 'control' over electrode chemistry & microstructure
- Increased Zn utilization/energy (High DOD/ Zn^0), pair with MnO_2 *
- Module development
- Pressure Effects on Zn/Ni are underway.....SI 2030

Cycle Life – 30% utilization C/3



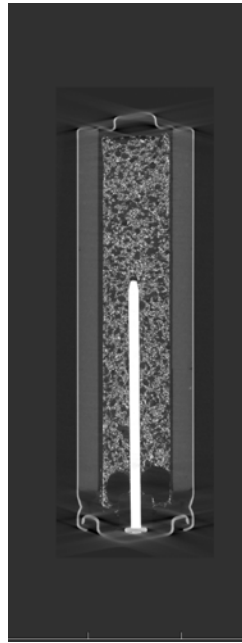
Enabling high-capacity zinc utilization through electrode and electrolyte fundamentals



- What are the effects of pressure on electrochemical cycling and stability?
- Which form factor is best for Zn battery assembly?
- Optimum pressure for any given form factor ?



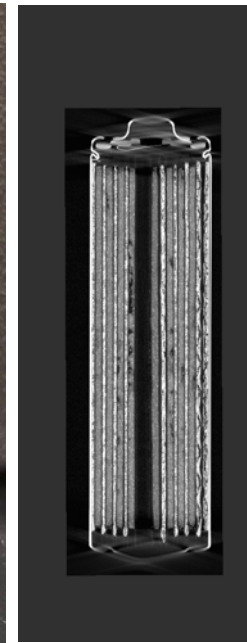
MnO₂ - Zn Cell
Primary



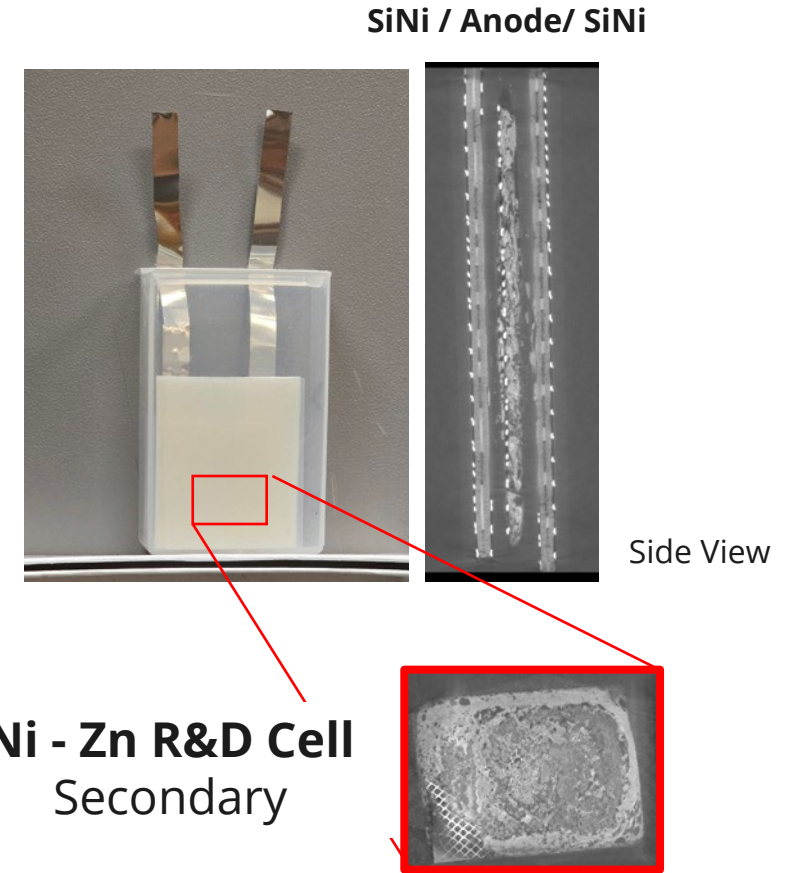
(Bobbin)



Ni - Zn Cell
Secondary



(wound)



Ni - Zn R&D Cell
Secondary

(prismatic)

PROJECT BACKGROUND

Effect of pressure on electrochemical performance of aqueous electrodes



Rechargeability of manganese dioxide in alkaline electrolyte

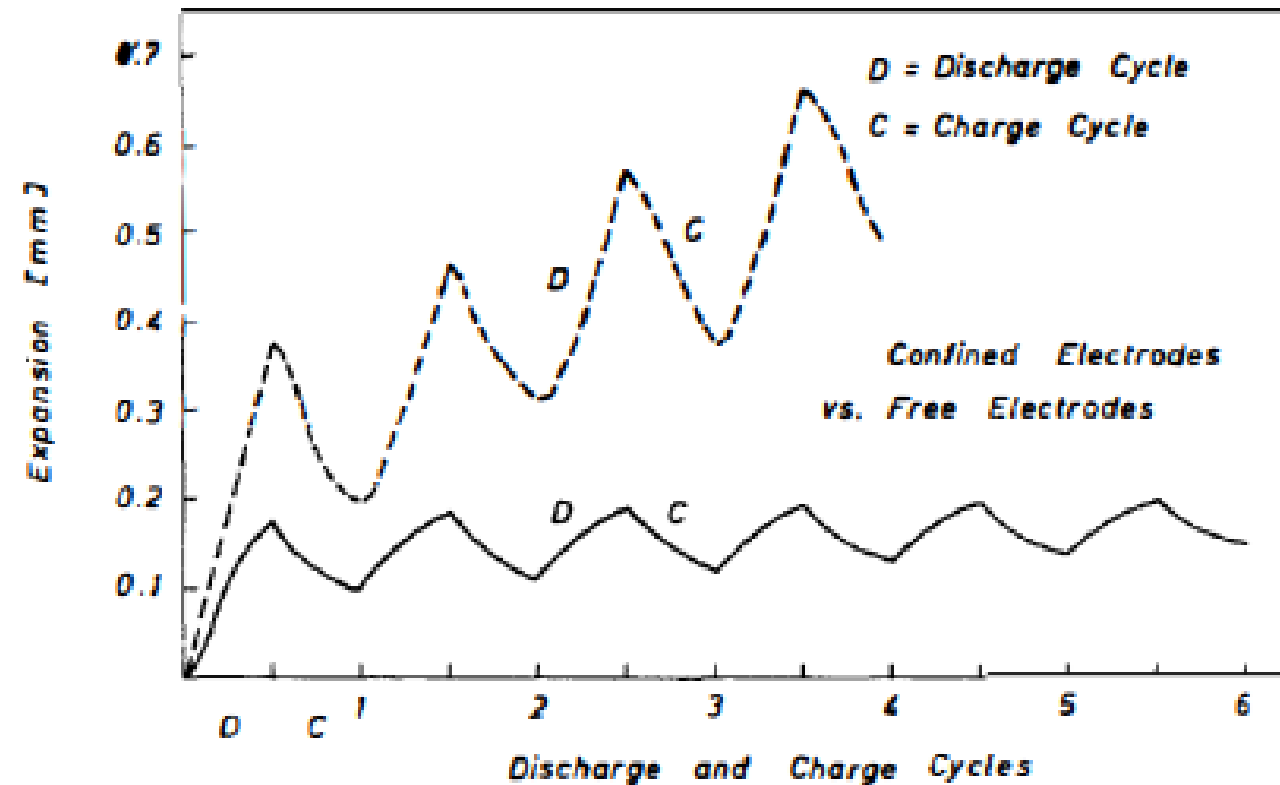


Fig. 1: The perpendicular expansion and contraction of 3 mm thick manganese dioxide-graphite disc during cycling¹

Table 3. Dependence of the number of cycles on the pressure exerted on the surface of the cathode. MnO₂-content: 79 %, Graphite mix

No. of cycles	P (N/cm ²)	P (kgf/cm ²)	Notes
20	1	0.1	MnO ₂ -Type: I.C. 2
40	27	2.7	Conc. KOH: 9 M
70	150	15	Current density: 10 mA/cm ²
90	500	50	
75	1000	100	Depth of D.: 35 %

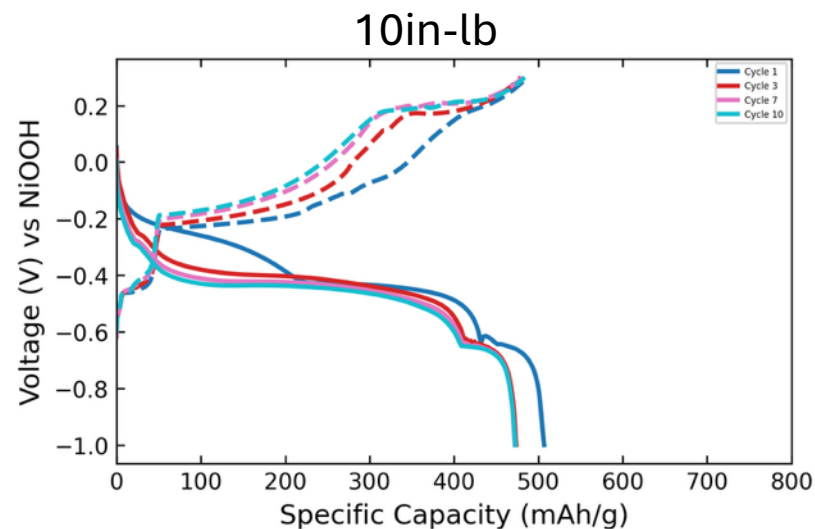
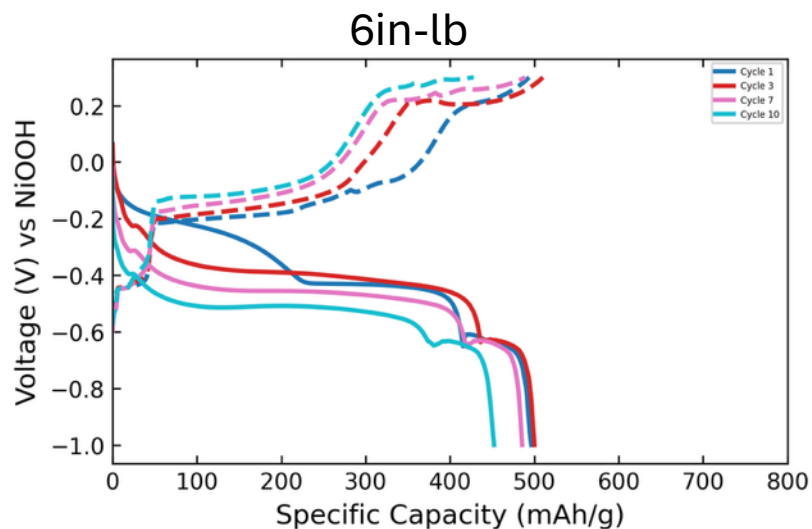
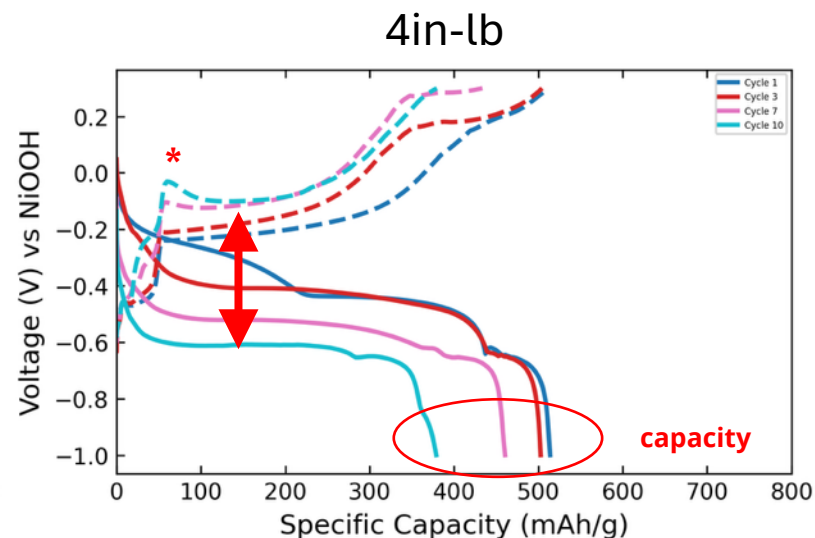
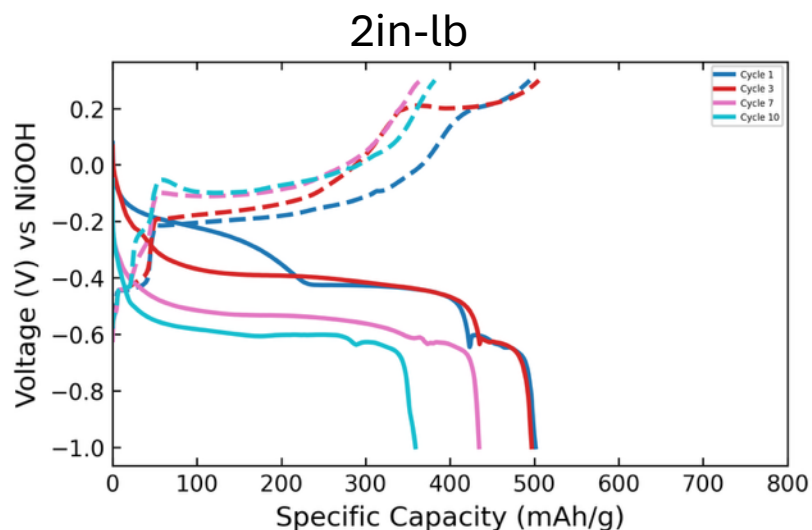
- The applied pressure reduces the expansion of cell during cycling.
- An increase in applied pressure results in longer cycle life.
- There is an optimum pressure

K. Kordesch *et al.*, *Electrochim. Acta* 1981, **26** (10), 1495-1504.

D. Kharel *et al.* "Effect of Externally Applied Pressure on Rechargeable Alkaline Zinc Batteries at Limited Depth of Discharge" *J. Mater. Chem. A* 2026, **14**, 15782-15792. <https://doi.org/10.1039/D5TA08160B>.

PROJECT HIGHLIGHTS

Effects of pressure on MnO_2 (100% DOD MnO_2)



55% Mn loading
(55% EMD, 11% Bi_2O_3 , 34% CNT)
Alkaline electrolyte, Ni cathode

- Lower compression (2–4 in-lb) shows a "spike" in later charge
- "Spike" diminishes with increasing compression
- Capacity retention improves with higher compression (less fade between cycles 1 to 10)
- Charge-discharge voltage gap narrows at higher compression levels

* Resistive spike on charge

Overpotential

PROJECT RESULTS - ZINC BATTERIES (PUBLICATIONS)



3 Published, 8 Submitted, 2 DOE Review

1. D. Kharel, C. D. Quilty, I. I. Bezsonov, C. N. Wright, T. N. Lambert, and Y-T Cheng "Effect of Externally Applied Pressure on Rechargeable Alkaline Zinc Batteries at Limited Depth of Discharge" J. Mater. Chem. A 2026, 14, 15782-15792. <https://doi.org/10.1039/D5TA08160B>.
2. K. Eeso, A. Sarswat, Z. Chen, C-T Hsieh, T. N. Lambert and N. Liu "The Effects of Synthesis Conditions on the Structure and Conductivity of Hydrogen Substituted Graphdiyne" ACS Materials Au 2026 6, 3, 513-518. <https://doi.org/10.1021/acsmaterialsau.5c00228>.
3. Z. Chen, J. Watt, C. Zhang, L. Lu, K. Eeso, C-T. Hsieh, Y. Ma, T. N. Lambert, B. Wang, M. Wang, N. Liu "Restoring Escaped Zincate in Rechargeable Alkaline Zinc Batteries with a Seed-in-Nanoshell Design" ACS Energy Lett. 2026, 11, 5, 3907-3915. <https://doi.org/10.1021/acsenerylett.6c00301>.
4. J. Kang, Z. Chen, F. Mo, C-T Hsieh, T. N. Lambert, N. Liu "Hydrogen Evolution Reaction-Resistant Manganese-Telluride Anodes for Aqueous Manganese-Ion Batteries" Materials Horizons 2026 **manuscript submitted**.
5. C. D. Quilty, I. I. Bezsonov, J. J. Huang, J. I. Deitz, P. G. Kotula, D. P. Cummings, C. N. Wright, L. W. To, T. N. Lambert "Soft Shorts and Other Pernicious Problems in Zn-Ion Battery Research" Cell Reports Physical Science 2026 **manuscript submitted**.
6. Y. Agilan, B. R. Wygant, T. N. Lambert, J. W. Gallaway "From Mechanisms to Commercialization: CuO Cathodes for Rechargeable Alkaline Zinc Batteries" ACS Omega **manuscript submitted**.
7. Y. Agilan, J. R. Mulligan, C. D. Quilty, L. W. To, B. R. Wygant, N. T. Vo, M. Drakopoulos, Z. Zhong, T. N. Lambert, J. W. Gallaway "Mechanical Compression Limits Cu₂O Agglomerate Size and Enables Two-Electron Cycling in Rechargeable Alkaline CuO Cathodes for Zn-CuO Batteries: NPJ Energy Materials 2026 **manuscript submitted**.
8. X. Xue, M. Motin, M. Hertzog, C. D. Quilty, I. Bezsonov, N. Delaney, S. Eisenberg, C. Tran, S. Chandrasekaran, M. A. Worsley, C. Zhu, T. N. Lambert, Y. Li "Copper Surface Engineering Enables Dendrite-Free Zn Batteries at Unity N/P Ratio" **manuscript submitted**.
9. Z. Chen, C. Zhang, K. Eeso, C-T. Hsieh, T. N. Lambert and N. Liu "Control of the Perpendicular Distribution of Zinc in Thick Porous Current Collectors" ACS Appl Energy Mater. 2026 **manuscript submitted**.
10. P. Sharma, N. Chandrasiri, J. B. Espano, A. Thapa, T. N. Lambert, S. J. Percival, B. R. Wygant, D. Y. Kim "In situ Raman Spectroscopic Studies of Composition-tuned Nickel Sulfoselenides for the Oxygen Evolution Reaction" 2026 ACS Catalysis **manuscript submitted**.
11. J. B. Espano, J. D. Pillars, T. N. Lambert, B. R. Wygant "Tunable Nickel Sulfoselenides for Rechargeable Zn-Air Flow Batteries" J. Mater Chem A. 2026 **manuscript submitted**.
12. I. I. Bezsonov, T. N. Lambert, C. D. Quilty, C. M. Davis, A. Ilgen, L. W. To "The Comparative Effects of Alkaline Earth Hydroxides on Rechargeable Alkaline Zinc Batteries" Adv. Energ. Mater. 2026 **manuscript under review by DOE-OE**.
13. A. Nicoll, P. J. Barry, C. D. Quilty, A. Pace, S. Yan, M. Drakopoulos, N. T. Vo, Z. Zhong, T. N. Lambert, E. S. Takeuchi, A. C. Marschilok, K. J. Takeuchi "Understanding and Optimizing Dissolution Suppressing Electrolytes for Sodium Vanadate (NaV₃O₈) Electrodes: Progress Towards Improved Capacity Retention Over Long Duration Electrochemical Testing" **manuscript under review by DOE-OE**.

PROJECT RESULTS - ZINC BATTERIES (PRESENTATIONS)



12 Invited Presentations and Panels

1. **Invited Panel Member.** T. N. Lambert, Panel Member on "Consortium Applied R&D Programs (SAGE/Zn/OE 960/OE 961)" 2026 Battery Council International Convention and Power Mart Expo, Nashville, Tennessee, May 5th, 2026. <https://www.bestmag.co.uk/bci-panel-consortium-r-and-d/>
2. **Invited Talk.** T. N. Lambert "Advancing Zinc-Based Energy Storage: Academic and National Laboratory Research Frontiers - Sandia National Laboratories" 2026 Battery Council International Convention and Power Mart Expo, Nashville, Tennessee, May 6th, 2026.
3. **Invited Talk.** T. N. Lambert "Advancing Zinc-Based Energy Storage: Academic and National Laboratory Research Frontiers - Sandia National Laboratories" R-Zinc 4.0 Zinc Battery Meeting, Nashville, Tennessee, May 7th, 2026.
4. **Invited Talk.** J. W. Gallaway ""The Electrochemistry of Two-Electron Conversion Reactions for Rechargeable Aqueous Batteries" Energy Storage From Molecules To Megawatts: in honor of Dr. Imre Gyuk. TechConnect World 2026, Raleigh, NC, March 2026.
5. **Invited Talk.** B. R. Wygant, T. N. Lambert, J. Espano "Development and Characterization of Tunable, Non-Precious Bifunctional Oxygen Electrocatalysts for Zn-Air Batteries" 2025 Fall MRS Meeting and Exhibit, EN02.07, Boston, Massachusetts, November 30th-December 5th, 2025.
6. **Invited Talk.** T. N. Lambert "Advancing Zinc-based energy Storage: Academic and National Laboratory Research Frontiers – Sandia National Laboratories " NAATBatt International Sodium-Zinc Battery Workshop, Los Angeles California, November 18-19, 2025.
7. **Invited Talk.** T. N. Lambert "Recent Developments in Zinc-based Batteries" Department of Chemical and Materials Engineering, University of Kentucky, Lexington, Kentucky, November 12th, 2025.
8. **Invited Talk.** T. N. Lambert, C. D. Quilty, I. I. Bezsonov, J. Watt, J. Huang, C. Wright, L. To "Investigations into the Electrochemical Cycling of Zinc-Based Batteries" 248th ECS Meeting Fall 2025, October 12-16th, Chicago, IL, 2025.
9. **Invited Talk.** N. Liu "Nano- and Microscale Material and Reactor Engineering for Electrochemical Energy Storage" Department of Chemical and Biological Engineering, University of Alabama, Tuscaloosa, AL, October 9, 2025
10. **Invited Talk.** N. Liu "Nanoscale Material Engineering for Deeply Rechargeable Aqueous Batteries" AIChE Annual Meeting, Symposium on Materials for Energy Storage I: Advances in Batteries, Boston, MA, November 6, 2025
11. **Invited Talk.** N. Liu "Material and Reactor Engineering for Electrochemical Energy Storage" School of Chemistry, University of Edinburgh, Edinburgh, Scotland, March 26, 2026
12. **Invited Talk.** Z. Chen, J. Watt, T. N. Lambert, B. Wang, M. Wang, N. Liu "Restoring Escaped Zincate in Rechargeable Alkaline Zinc Batteries with a Seed-in-Nanoshell Design" 34th International Materials Research Congress, Cancún, Mexico, August 16-20, 2026

PROJECT RESULTS - ZINC BATTERIES (PRESENTATIONS)



10 Contributed Presentations

1. T. N. Lambert, I. Bezsonov, C. D. Quilty, L. To "Materials Strategies Aimed at Low-Cost High-Capacity and Long-Cycle Life Zn-Based Anodes for Grid Storage Batteries" 2026 Spring MRS Meeting and Exhibit, EN03.15.03, Honolulu, Hawaii, April 26th-May 1st, 2026.
2. C. Nguyen, E. Zimmerer, J. R. Mulligan, T. N. Lambert and J. W. Gallaway "A Study of Mechanical Compression Effects on the Reversibility of Rechargeable Alkaline Zn-MnO₂ Batteries" Symposium A02: Whittingham Young Investigator and Student Slam 2, The Electrochemical Society (ECS) 249th Meeting, Seattle WA, May 2026.
3. C. D. Quilty, I. Bezsonov, J. J. Huang, J. Dietz, P. Kotula, D. P. Cummings, C. N. Wright, L. To, J. Watt, T. N. Lambert "Investigations into the Electrochemical Cycling of Zinc in Mildly Acidic Electrolytes" EN03.13.03: Honolulu, Hawaii, April 26th-May 1st, 2026.
4. I. Bezsonov, C. D. Quilty, C. N. Wright, T. N. Lambert "In Operando Hydrogen Evolution Studies for Aqueous Zinc Batteries" CH05.09.03: Honolulu, Hawaii, April 26th-May 1st, 2026.
5. C. D. Quilty, J. I. Diertz, P. G. Kotula, D. P. Cummings, J. D. Watt, C. N. Wright, L. W. To, T. N. Lambert "Investigations into the Electrochemical Cycling of Zinc in Mildly Acidic Electrolytes" 2025 Fall MRS Meeting and Exhibit, EN02.05, Boston, Massachusetts, November 30th-December 5th, 2025.
6. I. I. Bezsonov, C. Quilty, J. D. Watt, C. N. Wright, L. W. To, T. N. Lambert "Influence of Alkaline Earth Metal Additives on Rechargeable Zinc Oxide Alkaline Cell Cycling and Failure" 2025 Fall MRS Meeting and Exhibit, EN02.07, Boston, Massachusetts, November 30th-December 5th, 2025.
7. J. J. Huang, C. Fujimoto, C. Quilty, L. W. To, T. N. Lambert "An Investigation into the Role of the Separator in the Performance of Zinc-Ion Batteries" 2025 Fall MRS Meeting and Exhibit, EN02.07, Boston, Massachusetts, November 30th-December 5th, 2025.
8. Y. Agilan, E. Zimmerer, T. N. Lambert, B. R. Wygant, J. W. Gallaway "The Effect of Electrode Compression on Copper Oxide Electrodes for Alkaline Grid-Scale Batteries" Symposium A06: Next Generation Aqueous Batteries: Electrodes, Electrolytes, and Interphases, The Electrochemical Society (ECS) 248th Meeting, Chicago IL, October 2025.
9. T. N. Lambert, C. D. Quilty, I. I. Bezsonov, J. Huang, C. Wright, L. To "Investigations into the Electrochemical Cycling of Zinc-based Batteries" " 4th International Zinc and Other Aqueous Batteries Conference, Kyoto, Japan, September 17-19, 2025.
10. K. Eeso et al. "Alkyne Stability and Electrochemical Functionality of Graphdiyne: From Synthesis Control to Battery Performance and Molecular Sensing" 249th ECS Meeting, Seattle, WA, May 24-28, 2026

PROJECT RESULTS - ZINC BATTERIES (PRESENTATIONS)



Symposium Organization and Session Chairs

1. N. Liu co-organized I06 – Heterogeneous Functional Materials for Energy Conversion and Storage 4 in 249th ECS meeting, Seattle, WA, May 24-28, 2026.
2. Joshua Gallaway, session chair, Symposium A06: Next Generation Aqueous Batteries: Electrodes, Electrolytes, and Interphases, The Electrochemical Society (ECS) 248th Meeting, Chicago IL, October 2025.

AWARDS or OTHER

1. CINT USER Proposal: T. N. Lambert “Determining the Role of Interfacial Layered Zinc Hydroxy Anion Species (ZHX) on Zinc-ion Batteries.” – through June 2027
2. CINT User Proposal: Y. Zhou “Unraveling SEI Growth in Ionic Liquid-Based Electrolytes for Lithium Metal Batteries” – through June 2027
3. CINT User Proposal: A. Frischknecht “Ion Transport in Gelled Polymer Electrolytes for Rechargeable Alkaline Batteries” – through December 31, 2026.
4. CINT User Proposal: N. Liu “Carbonyl-graphdiyne mechanistic interactions and the effects on mechanical and electronic properties” – through June 30, 2026.
5. CINT User Proposal: J. Gallaway “Identification of Bismuth Supramolecular Clusters in Aqueous Conversion Cathodes” – through June 30, 2026.
6. CINT User Proposal: N. Liu “Enabling High Areal Capacity 3-Dimensional Porous Zinc” – through December 31, 2025.
7. Zhitao Chen awarded PhD at Georgia Tech in December 2025

Patents

1. Patent Filing: D. Dutta, D. Turney, T. N. Lambert, S. Banerjee “ACETATE-BASED ELECTROLYTE FOR USE IN HIGH-VOLTAGE AQUEOUS BATTERIES”
2. Awarded: T. N. Lambert “Electrocatalytic Devices Using MO_x/ICP Composite Thin Films and Methods of Making the Same” US 12,531,16, Jan 20, 2026. (from prior SNL-LDRD but relevant to OE work ongoing)

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