DIYI CHENG, PH.D.

Postdoctoral Fellow | Lawrence Berkeley National Laboratory
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RESEARCH INTERESTS

In situ and cryogenic electron microscopy; solid-state and lithium-metal batteries; electrochemical interfaces; materials synthesis and transformation; beam-sensitive and liquid-phase material systems

ACADEMIC APPOINTMENTS

Lawrence Berkeley National Laboratory — Berkeley, CA
Postdoctoral Fellow, Materials Sciences Division — *Jul 2023 – Present*
Advisor: Haimei Zheng

EDUCATION

University of California San Diego — San Diego, CA
Ph.D., Materials Science and Engineering — *Sep 2017 – Apr 2023*
Advisor: Ying Shirley Meng

Jilin University — Changchun, China
B.S., Material Physics — *Sep 2013 – Jul 2017*

PUBLICATIONS

32 peer-reviewed publications, including 6 first-author and 2 co-first-author papers;
3,192 citations; h-index: 26 (Google Scholar, November 2026). *Equal contribution.

1. **D. Cheng**, T. Kodalle, A. T. Promi, C. M. Sutter-Fella, and H. Zheng, "Visualizing Crystallization Dynamics and Transformation Pathways of Disordered Rocksalt Oxides During Thermally Activated Sol–Gel Synthesis," *Advanced Functional Materials*, 2026, e76376.
2. **D. Cheng**, J. Hong, D. Lee, S.-Y. Lee, and H. Zheng, "In Situ TEM Characterization of Battery Materials," *Chemical Reviews*, 2025, 125, 1840–1896.
3. **D. Cheng**, T. Wynn, B. Lu, M. Marple, B. Han, R. Shimizu, B. Sreenarayanan, J. Bickel, P. Hosemann, Y. Yang, H. Nguyen, W. Li, G. Zhu, M. Zhang, and Y. S. Meng, "A Free-standing Lithium Phosphorus Oxynitride Thin Film Electrolyte Promotes Uniformly Dense Lithium Metal Deposition with No External Pressure," *Nature Nanotechnology*, 2023, 18, 1448–1455.
4. **D. Cheng**, K. Tran, S. Rao, Z. Wang, R. van der Linde, A. Kamath, and Y. S. Meng, "Manufacturing Scale-up of Anodeless Solid State Lithium Thin Film Battery for High Volumetric Energy Density Application," *ACS Energy Letters*, 2023, 8, 4768–4774.
5. **D. Cheng**, B. Lu, G. Raghavendran, M. Zhang, and Y. S. Meng, "Leveraging Cryogenic Electron Microscopy for Advancing Battery Design," *Matter*, 2022, 5, 26–42.
6. R. Shimizu*, **D. Cheng***, J. L. Weaver, B. Lu, T. Wynn, M. Kim, G. Zhu, M. Zhang, and Y. S. Meng, "Unraveling the Stable Cathode Electrolyte Interface in All Solid-state Thin-film Battery Operating at 5V," *Advanced Energy Materials*, 2022, 2201119.
7. M. Kim*, N. Ahn*, **D. Cheng***, M. Xu, S. Ham, X. Pan, S. J. Kim, Y. Luo, D. P. Fenning, D. H. S. Tan, M. Zhang, G. Zhu, K. Jeong, M. Choi, and Y. S. Meng, "Imaging Real-Time Amorphization of Hybrid Perovskite Solar Cells under Electrical Biasing," *ACS Energy Letters*, 2021, 6, 3530–3537.
8. **D. Cheng**, T. A. Wynn, X. Wang, S. Wang, M. Zhang, R. Shimizu, S. Bai, H. Nguyen, C. Fang, M. Kim, W. Li, B. Lu, S. J. Kim, and Y. S. Meng, "Unveiling the Stable Nature of the Solid Electrolyte Interphase between Lithium Metal and LiPON via Cryogenic Electron Microscopy," *Joule*, 2020, 4, 2484–2500.
9. S. Bai, Z. Liu, **D. Cheng**, B. Lu, N. J. Zaluzec, G. Raghavendran, S. Wang, T. S. Marchese, B. van Leer, L. Li, L. Jiang, A. Stokes, J. P. Cline, R. Osmundsen, M. Chen, P. Barends, A. Bright, M. Zhang, and Y. S. Meng, "Guidelines for Correlative Imaging and Analysis of Reactive Lithium Metal Battery Materials," *Joule*, 2026, 10, 102311.
10. A. Cronk, X. Wang, J. A. S. Oh, S.-Y. Ham, S. Bai, P. Ridley, M. Chouchane, C.-J. Huang, **D. Cheng**, G. Deysher, H. Yang, B. Sayahpour, M. Vicencio, C. Lee, D. Lee, M.-S. Son, J. Jang, J. B. Lee, and Y. S. Meng, "A Highly Utilized and Practical Lithium-Sulfur Positive Electrode Enabled in All-solid-state Batteries," *Nature Communications*, 2026, 17, 3298.

11. T. Kodalle, Y. Fei, M. Grass, **D. Cheng**, V. S. Avvaru, A. Halder, K. Cruse, H. Hau, R. F. Moral, F. Babbe, M. Kunz, H. Kim, H. Zheng, G. Ceder, and C. M. Sutter-Fella, "Solvent Determines the Formation Pathway in Sol–Gel Synthesis of Disordered Rock Salt Material for Lithium Ion Battery Application," *Nano Letters*, 2025, 25, 11647–11654.
12. G. Deysher, J. A. S. Oh, Y. Chen, B. Sayahpour, S. Ham, **D. Cheng**, P. Ridley, A. Cronk, S. W. Lin, K. Qian, L. H. B. Nguyen, J. Jang, and Y. S. Meng, "Design Principles for Enabling an Anode-Free Sodium All-Solid-State Battery," *Nature Energy*, 2024, 9, 1161–1172.
13. R. Shimizu, **D. Cheng**, G. Zhu, B. Han, T. S. Marchese, R. Burger, M. Xu, X. Pan, M. Zhang, and Y. S. Meng, "Elucidating Dynamic Conductive State Changes in Amorphous Lithium Lanthanum Titanate for Resistive Switching Devices," *Next Materials*, 2024, 2, 100102.
14. S. Wang, B. Lu, **D. Cheng**, Z. Wu, S. Feng, M. Zhang, W. Li, Q. Miao, M. Patel, J. Feng, E. Hopkins, J. Zhou, S. Parab, B. Bhamwala, B. Liaw, Y. Meng, and P. Liu, "Structural Transformation in Sulfurized Polymer Cathode to Enable Long Life Rechargeable Lithium Sulfur Batteries," *Journal of the American Chemical Society*, 2023, 145, 9624–9633.
15. B. Lu, **D. Cheng**, B. Sreenarayanan, W. Li, B. Bhamwala, W. Bao, and Y. S. Meng, "Key Parameters in Determining the Reactivity of Lithium Metal Battery," *ACS Energy Letters*, 2023, 8, 3230–3238.
16. J. A. S. Oh, G. Deysher, P. Ridley, Y. Chen, **D. Cheng**, A. Cronk, D. H. S. Tan, J. Jang, L. H. B. Nguyen, and Y. S. Meng, "High-performing All-solid-state Sodium-ion Batteries Enabled by the Presodiation of Hard Carbon," *Advanced Energy Materials*, 2023, 13, 2300776.
17. B. Lu, W. Li, **D. Cheng**, B. Bhamwala, M. Ceja, W. Bao, C. Fang, and Y. S. Meng, "Suppressing Chemical Corrosions of Lithium Metal Anodes," *Advanced Energy Materials*, 2022, 2202012.
18. H. Chung, Y. Li, M. Zhang, A. Grenier, C. Mejia, **D. Cheng**, B. Sayahpour, C. Song, M. H. Shen, R. Huang, E. A. Wu, K. W. Chapman, S. J. Kim, and Y. S. Meng, "Mitigating Anisotropic Changes in Classical Layered Oxide Materials by Controlled Twin Boundary Defects for Long Cycle Life Li-Ion Batteries," *Chemistry of Materials*, 2022, 34, 7302–7312.
19. J. Jang, Y. Chen, G. Deysher, **D. Cheng**, S. Ham, A. Cronk, P. Ridley, H. Yang, B. Sayahpour, B. Han, W. Li, W. Yao, E. A. Wu, J. Doux, L. H. B. Nguyen, J. A. S. Oh, D. H. S. Tan, and Y. S. Meng, "Enabling a Co-Free, High-Voltage LiNi0.5Mn1.5O4 Cathode in All-Solid-State Batteries with a Halide Electrolyte," *ACS Energy Letters*, 2022, 7, 2531–2539.
20. Y. Yin, Y. Yang, **D. Cheng**, M. Mayer, J. Holoubek, W. Li, G. Raghavendran, A. Liu, B. Lu, D. M. Davies, Z. Chen, O. Borodin, and Y. S. Meng, "Fire-extinguishing, Recyclable Liquefied Gas Electrolytes for Temperature-resilient Lithium Metal Batteries," *Nature Energy*, 2022, 7, 548–559.
21. W. Li, **D. Cheng**, R. Shimizu, Y. Li, W. Yao, G. Raghavendran, M. Zhang, and Y. S. Meng, "Artificial Cathode Electrolyte Interphase for Improving High Voltage Cycling Stability of Thick Electrode with Co-Free 5 V Spinel Oxides," *Energy Storage Materials*, 2022, 49, 77–84.
22. Y. Li, W. Li, R. Shimizu, **D. Cheng**, H. Nguyen, J. Paulsen, S. Kumakura, M. Zhang, and Y. S. Meng, "Elucidating the Effect of Borate Additive in High-Voltage Electrolyte for Li-Rich Layered Oxide Materials," *Advanced Energy Materials*, 2022, 2103033.
23. B. Sayahpour, H. Hirsh, S. Bai, N. B. Schorr, T. N. Lambert, M. Mayor, W. Bao, **D. Cheng**, M. Zhang, K. Leung, K. L. Harrison, W. Li, and Y. S. Meng, "Revisiting Discharge Mechanism of CFx as a High Energy Density Cathode Material for Lithium Primary Battery," *Advanced Energy Materials*, 2021, 2103196.
24. C. Fang, B. Lu, G. Pawar, M. Zhang, **D. Cheng**, S. Chen, M. Ceja, J. Doux, H. Musrock, M. Cai, B. Liaw, and Y. S. Meng, "Pressure-tailored Lithium Deposition and Dissolution in Lithium Metal Batteries," *Nature Energy*, 2021, 6, 987–994.
25. W. Bao, C. Fang, **D. Cheng**, Y. Zhang, B. Lu, D. H. S. Tan, R. Shimizu, B. Sreenarayanan, S. Bai, W. Li, M. Zhang, and Y. S. Meng, "Quantifying Lithium Loss in Amorphous Silicon Thin-Film Anodes via Titration-Gas Chromatography," *Cell Reports Physical Science*, 2021, 2, 100597.
26. B. Lu, E. Olivera, J. Scharf, M. Chouchane, C. Fang, M. Ceja, L. E. Pangilinan, S. Zheng, A. Dawson, **D. Cheng**, W. Bao, O. Arcelus, A. A. Franco, X. Li, S. H. Tolbert, and Y. S. Meng, "Quantitatively Designing Porous Copper Current Collectors for Lithium Metal Anodes," *ACS Applied Energy Materials*, 2021, 4, 6454–6465.
27. S. Zhao, D. Xia, M. Li, **D. Cheng**, K. Wang, Y. S. Meng, Z. Chen, and J. Bae, "Self-Healing and Anti-CO2 Hydrogels for Flexible Solid-state Zinc-air Batteries," *ACS Applied Materials & Interfaces*, 2021, 13, 12033–12041.
28. W. Yim, **D. Cheng**, S. H. Patel, R. Kou, Y. S. Meng, and J. V. Jokerst, "KN95 and N95 Respirators Retain Filtration Efficiency despite a Loss of Dipole Charge during Decontamination," *ACS Applied Materials & Interfaces*, 2020, 12, 54473–54480.
29. M. A. T. Marple, T. A. Wynn, **D. Cheng**, R. Shimizu, H. E. Mason, and Y. S. Meng, "Local Structure of Glassy Lithium Phosphorus Oxynitride Thin Films: A Combined Experimental and ab initio Approach," *Angewandte Chemie International Edition*, 2020, 59, 22185–22193.
30. M. Kim, S. Ham, **D. Cheng**, T. A. Wynn, H. S. Jung, and Y. S. Meng, "Advanced Characterization Techniques for Overcoming Challenges of Perovskite Solar Cell Materials," *Advanced Energy Materials*, 2021, 11, 2001753.

31. H. Wang, H. Yang, D. Wang, **D. Cheng**, T. Deng, H. Liu, H. Zhang, W. Zhang, and W. Zheng, "Designing Chemical Bonds Between Active Materials and Current Collectors for Packaging a High-performance Supercapacitor," *Nanotechnology*, 2019, 31, 105402.
32. H. Wang, D. Wang, T. Deng, X. Zhang, C. Zhang, T. Qin, **D. Cheng**, Q. Zhao, Y. Xie, L. Shao, H. Zhang, W. Zhang, and W. Zheng, "Insight into Graphene/Hydroxide Compositing Mechanism for Remarkably Enhanced Capacity," *Journal of Power Sources*, 2018, 399, 238–245.

PATENT

Y. S. Meng, **D. Cheng**, and T. A. Wynn. "Free-Standing Lithium Phosphorus Oxynitride Thin Films and Methods of Their Manufacture." United States Patent Application US 2023/0313362 A1, October 5, 2023.

RESEARCH FUNDING AND AWARDED PROPOSALS

External Funding and Competitive Research Awards

1. **In Situ Transmission Electron Microscopy Program (KC22ZH)** *2018 – present*
   U.S. Department of Energy, Office of Science, Basic Energy Sciences
   Berkeley Lab contract DE-AC02-05CH11231; PI: Haimei Zheng.
   Role during postdoctoral appointment: Proposal contributor and co-researcher*. Co-developed research aims, drafted the research summary and plan, and performed proposed experiments.*
2. **Science Undergraduate Laboratory Internship (SULI)** *2025*
   U.S. Department of Energy, Office of Science
   Selected research internship project; PI: Haimei Zheng; Student: Kanokwan Tungkitkancharoen.
   Role: Lead proposal writer and research mentor*. Co-developed the research objectives, experimental design and project timeline. Mentored the recipient for experiments and final presentation.*
3. **PPE for All: Simple Strategies to Protect Vulnerable Populations** *2020*
   UC Tobacco-Related Disease Research Program, Emergency COVID-19 Research Seed Funding
   $25,000 total award; Award R00RG2515; PI: Jesse V. Jokerst; Co-PI: Ying Shirley Meng.
   Role: Lead proposal writer and research lead*. Co-conceived the research objectives. Led the proposal writing. Conceived the experiment design and project timeline of the proposal. The primary funding recipient.*
4. **In Situ Analytical Electron Microscopy for Probing Dynamic Nano-Scale Electrochemistry** *2009 – 2019*
   U.S. Department of Energy, Office of Science, Basic Energy Sciences
   $1,475,815; PI: Ying Shirley Meng.
   Role during doctoral appointment: Proposal contributor and co-researcher. *Contributed to proposal writing and annual progress reports. Performed proposed experimental work.*

Awarded Facility Partner and User Proposals

1. **In Situ Liquid Cell Electron Microscopy: Atomic Level Heterogeneity and Fluctuations at Solid-Liquid Interfaces** *2025 - 2027*
   Molecular Foundry User Program, Lawrence Berkeley National Laboratory
   Awarded partner proposal; Proposal No. 10441
   Role: Lead proposal writer and microscopy lead.
2. **Membrane-based three-electrode liquid cell fabrication for in situ electrochemical TEM development on electrocatalysis** *2025*
   Molecular Foundry User Program, Lawrence Berkeley National Laboratory
   Awarded user proposal; Proposal No. 10481
   Role: Lead proposal writer and experiment lead.
3. **New-generation three-electrode liquid cell fabrication for in situ electrochemical TEM development on electrocatalysis study** *2023 - 2024*
   Molecular Foundry User Program, Lawrence Berkeley National Laboratory
   Awarded user proposals; Proposal No. 8927 & 9491
   Role: Lead proposal writer and experiment lead.
4. **Dynamic Characterization of Li Metal Plating and Solid-State Interface Evolution Via In Situ Cryogenic Electron Microscopy** *2019*
   Molecular Foundry User Program, Lawrence Berkeley National Laboratory
   Awarded user proposal; Proposal No. 6616
   Role: Co-developer and experiment contributor.

INVITED TALKS AND SEMINARS

1. "Unveiling Crystallization Dynamics of Disordered Rocksalt Cathode During Thermally Activated Sol–Gel Synthesis," *Gordon Research Conference on Liquid Phase Electron Microscopy*, Ventura, CA, January 25–30, 2026.
2. "A Deeper Understanding of Interfacial Characteristics in LiPON-based Thin Film Batteries via Advanced Electron Microscopy," *Battery Division Seminar*, Apple Inc., Santa Clara, CA, July 23, 2024.
3. "Deepening the Understanding of LiPON and Associated Interfaces via Advanced Electron Microscopy in All-Solid-State Thin Film Batteries," *Electrochemical Energy Lab Seminar*, Massachusetts Institute of Technology, September 15, 2023.
4. "Nanoscale Phenomena in Advanced Batteries: From Thin Film Battery Platform to Practical Batteries," *TMS 2023* Annual Meeting, San Diego, CA, March 21, 2023.
5. "Advanced Electron Microscopy-assisted Interface Study in Thin Film Battery and Beyond," *Cha Group Seminar*, Cornell University, Ithaca, NY, January 19, 2023.
6. "Unveiling the Nature of Electrode/Electrolyte Interfaces in Thin Film Batteries," *ICTN-KLC 2021*, virtual, August 25, 2021.
7. "Local Structure of Glassy Lithium Phosphorus Oxynitride Thin Films and Their Interphases with Lithium Metal Anode," *PRiME 2020*, The Electrochemical Society, October 5, 2020.
8. "Characterizing Sensitive Materials and Interfaces in Lithium Metal Battery via Cryogenic Focused Ion Beam and 3D Reconstruction Analysis," *Thermo Fisher Scientific Day*, April 29, 2020.

CONTRIBUTED CONFERENCE PRESENTATIONS

1. Oral presentation, "Free-standing LiPON: From the Fundamentals to Uniformly Dense Li Metal Deposition without External Pressure," *2023 MRS Fall Meeting*, Boston, MA, December 1, 2023.
2. Poster, "Free-standing LiPON: From the Fundamentals to Uniformly Dense Lithium Metal Deposition with No External Pressure," *Clean Energy Forum*, Thermo Fisher Scientific, San Diego, CA, September 25, 2023.
3. Oral presentation, "Unravelling the Stable Electrode–Electrolyte Interphase in All-Solid-State Thin Film Battery Operating at 5V," *2022 MRS Fall Meeting*, Boston, MA, November 29, 2022.
4. Oral presentation, "Unveiling the Stable Nature of LiPON-Associated Electrode/Electrolyte Interphases via Cryogenic Electron Microscopy," *240th ECS Meeting*, October 11, 2021.
5. Oral presentation, "Unveiling the Stable Nature of the Solid Electrolyte Interphase Between Lithium Metal and LiPON via Cryogenic Electron Microscopy," *2020 MRS Fall Meeting*, November 30, 2020.

TEACHING EXPERIENCE

Guest Lecturer, MSE 241 Electron Microscopy Laboratory 2025 | UC Berkeley

- Delivered a 90-minute guest lecture on "Cryogenic Electron Microscopy Characterization for Battery Materials".
- Developed lecture materials. Facilitated class discussion and collaborative problem solving.

Teaching Assistant, NANO 164 Advanced Micro and Nano Materials for Energy Storage 2019 | UC San Diego

- Developed quiz and examination questions and graded course assignments.
- Designed and led weekly discussion sessions and delivered the final review lectures.
- Held office hours and provided individual feedback to students.

MENTORING EXPERIENCE

Research Mentor, Science Undergraduate Laboratory Internship Program 2025 | Lawrence Berkeley Lab

- Developed the SULI research proposal with undergraduate researcher Kanokwan Tungkitkancharoen from MIT.
- Designed the intern's scientific study plan on clay-water interaction via in situ liquid cell TEM.
- Provided training on electron microscopes and guided weekly discussion on data interpretation.
- Advised the intern on the final project presentation and led the preparation of a manuscript based on the results.

Research Mentoring, Zheng Group 2023 - present | Lawrence Berkeley Lab

- Mentored two graduate researchers working on in situ liquid-cell TEM and electrochemical studies of battery and catalytic materials.
- Provided training on electron microscopes and in situ data acquisition.
- Helped the students troubleshoot experiments and establish data-quality criteria.

Research Mentoring, Laboratory For Energy Storage and Conversion 2020 - 2023 | UC San Diego

- Mentored two undergraduate and two graduate researchers in thin-film battery fabrication and characterization of solid–solid interfaces.
- Provided hands-on training in thin film vacuum deposition techniques and cryogenic focused-ion-beam operation.
- Helped the students troubleshoot experiments and establish data-quality criteria.
- Advised the students on presenting results to the advisor and research group.

TECHNICAL TRAINING EXPERIENCE

X-Ray Diffraction Instrument Manager 2020 - 2022 | UC San Diego

- Managed the operation, scheduling, maintenance, and user access for a shared Rigaku SmartLab XRD instrument at the Center for Memory and Recording Research
- Trained more than 40 researchers in instrument operation, sample preparation, measurement design, laboratory safety, and data-quality assessment.
- Developed or maintained standard operating procedures and supported users in troubleshooting measurements and interpreting diffraction data.
- Coordinated routine maintenance and communication with Rigaku technician, helping sustain safe and reliable instrument operation.

ACADEMIC SERVICE

- Journal reviewer for *Nature Communications*, *Matter*, *Advanced Functional Materials*, *ACS Nano*, *Materials Today Energy*, *Nanoscale Horizons*, *RSC Advances*, *Carbon*, *Vacuum*, *Journal of Energy Storage*, *Energy Advances*, and *Journal of Alloys and Compounds.*
- Grant reviewer for the U.S. Department of Energy Office of Science Graduate Student Research Program, 2026 Solicitation 1.
- Guest editor for the special issue "Cutting-Edge Characterizations for Expanding Energy Material Chemistries" in *Molecules*.

AWARDS AND HONORS

Carl Storm Fellowship, Gordon Research Conference 2026
Best Pitch Presenter, Sustainable Power and Energy Center 2022
Materials Science and Engineering Program Graduate Fellowship, UC San Diego 2018

PROFESSIONAL MEMBERSHIPS

Royal Society of Chemistry; Materials Research Society; The Electrochemical Society

ADDITIONAL PROFESSIONAL EXPERIENCE

Intern, Ensurge Micropower ASA 2022 | San Jose, CA

- Performed failure analysis on solid-state thin-film batteries using FIB/SEM, TEM, EIS, XRD, and Raman spectroscopy.
- Provided findings used to guide battery performance optimization.