

Wesley Chang

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EDUCATION

- PhD, Princeton University** 2017 - 2022
Department of Mechanical Engineering
Advisor: Daniel Steingart
Spatial dynamics and chemo-mechanics of lithium-ion and lithium-metal batteries
- MS, Stanford University** 2014 - 2016
Department of Chemical Engineering
Advisor: Zhenan Bao
Investigation of self-healing-polymer/silicon-microparticle anodes
- BS, Stanford University** 2010 - 2014
Department of Chemical Engineering
Advisor: Hongjie Dai
Synthesis and functionalization of metal oxide nanoparticles as ORR/OER catalysts

RESEARCH EXPERIENCE

- Columbia Electrochemical Energy Center – Staff Associate** 2019 - Present
I am currently investigating acoustic phenomena of lithium-ion and lithium metal batteries. I am also coupling this technique with other spectroscopic characterization tools (i.e., x-ray photoelectron, x-ray transmission and diffraction, nuclear magnetic resonance) for dynamic multimodal analysis of lithium metal anodes. Part of my responsibility involves managing and maintaining various equipment (i.e., inert atmosphere gloveboxes, pouch cell fabrication line) in a shared lab facility and training new students.
- Andlinger Center for Energy and the Environment – Graduate Researcher** 2017 - 2019
I conducted x-ray spectroscopy spatial mapping along with microscopy and electrochemical analyses to mechanistically understand the nucleation and growth of electrodeposited columnar lithium morphologies as a function of substrate pre-treatment methods and electrolyte additive composition.
- Primus Power – Flow Battery Scientist** 2016 - 2017
I conducted electrochemical testing (e.g., GITT, impedance, cyclic voltammetry, chronoamperometry) of various zinc-bromine flow battery geometries (beaker cells, micro-cells, larger cell stacks) to understand properties of zinc deposition and bromine evolution in proprietary electrolytes and electrode coatings. I also performed lifetime testing and performance validation for scaled up zinc-bromine flow cells.
- Prof. Zhenan Bao's Lab – Master's Student** 2015 - 2016
I studied SiMP-SHP/graphite (silicon microparticle – self-healing polymer) graphite composite electrodes, with the idea of using the elastic properties of a self-healing polymer to contain large volumetric changes of silicon microparticles.
- Prof. Hongjie Dai's Lab – Undergraduate Researcher** 2011 - 2013
I synthesized various reduced graphene oxides and multiwalled carbon nanotubes and functionalized them with metal nanoparticles (cobalt oxide and nickel metal hydroxide) using hydrothermal and gas phase annealing treatments to optimize their catalytic performance for the oxygen evolution and oxygen reduction reaction.

PEER-REVIEWED PUBLICATIONS

- Chang, W.***, May, R.*, Wang, M., Sakamoto, J., Marbella, L., Steingart, D. Evolving Contact Mechanics and Microstructure Formation Dynamics of the Lithium Metal – $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$ (LLZO) Interface, *Under Review*
- Chang, W.**, Steingart, D. Operando 2D Acoustic Characterization of Li-ion Battery Spatial Dynamics, *Under Review*
- Chang, W.***, Bommier, C.*, Mohr, R., Steingart, D. Impact of Non-Arrhenius Temperature Behavior on Fast-Charging Capabilities of LiCoO_2 -Graphite Lithium-ion Batteries, *Journal of Physical Chemistry C*, 125, 3, 1731-1741, DOI: 10.1021/acs.jpcc.0c09972 (2021)

4. Sarkar, A., May, R., Ramesh, S., **Chang, W.**, Marbella, L. Recovery and Reuse of Composite Cathode Binder in Lithium-Ion Batteries, *ChemistryOpen*, 10, 1-9, DOI: 10.1002/open.202100060 (2021)
5. **Chang, W.**, Mohr, R., Kim, A., Raj, A., Davies, G., Denner, K., Park, J.H., Steingart, D. Measuring Effective Stiffness of Li-ion Batteries from Acoustic Signal Processing, *Journal of Materials Chemistry A*, DOI: 10.1039/D0TA05552B (2020)
6. **Chang, W.**, Park, J.H., Dutta, N., Arnold, C.B., Steingart, D. Morphological and Chemical Mapping of Columnar Lithium Metal, *Chemistry of Materials*, 32, 7, 2803-2814, DOI: 10.1021/acs.chemmater.9b04385 (2020)
7. **Chang, W.***, Bommier, C.*, Fair, T., Yeung, J., Patil, S., Steingart, D. Understanding Adverse Effects of Temperature Shifts on Li-ion Batteries: An Operando Acoustic Study, *Journal of the Electrochemical Society Focus Issue*, 167, 9, DOI:10.1149/1945-7111/ab6c56 (2020)
8. Bommier, C.*, **Chang, W.***, Lu, Y., Yeung, J., Davies, G., Mohr, R., Williams, M., Steingart, D. In Operando Acoustic Detection of Lithium Metal Plating in Commercial LiCoO₂/Graphite Pouch Cells, *Cell Reports Physical Science*, 1, 100035, DOI: 10.1016/j.xcrp.2020.100035 (2020)
9. Bommier, C.*, **Chang, W.***, Li, J.L., Biswas, S., Nanda, J., Steingart, D. Operando Acoustic Monitoring of SEI Formation and Long-Term Cycling in NMC/SiGr Composite Pouch Cells, *Journal of the Electrochemical Society*, 167, 2, DOI: 10.1149/1945-7111/ab68d6 (2020)
10. **Chang, W.**, Park, J.H., Steingart, D. Poor Man's Atomic Layer Deposition of LiF for Additive-Free Growth of Lithium Columns, *Nano Letters*, 18, 11, 7066-7074, DOI: 10.1021/acs.nanolett.8b03070 (2018)
11. Liang, Y., Wang, H., Diao, P., **Chang, W.**, Hong, G., Li, Y., Gong, M., Xie, L., Zhou, J., Wang, J., Regier, T., Wei, F., Dai, H. Oxygen reduction electrocatalyst based on strongly coupled cobalt oxide nanocrystals and carbon nanotubes, *Journal of the American Chemical Society*, 134, 38, 15849-14857, DOI: 10.1021/ja305623m (2012)
12. Wang, H., Liang, Y., Gong, M., Li, Y., **Chang, W.**, Mefford, T., Zhou, J., Wang, J., Regier, T., Wei, F., Dai, H. An ultrafast nickel-iron battery from strongly coupled inorganic nanoparticle/nanocarbon hybrid materials, *Nature Communications*, 3, 917, DOI: 10.1038/ncomms1921 (2012)
13. **Chang, W.**, Nelson S., Rack shadows and their invariants, *Journal of Knot Theory and its Ramifications*, 20, 1259-1269, DOI: 10.1142/S0218216511009315 (2011)

*indicates equal contribution

FELLOWSHIPS AND AWARDS

F.M. Becket Fellowship of The Electrochemical Society	2021
Peter B. Lewis Fund for Student Innovation in Energy and Environment	2019
NDSEG Alternate Awardee	2019
Princeton School of Engineering Travel Grant	2018
Princeton Graduate Fellowship	2017 - 2018
Stanford School of Engineering Master's Scholarship	2015 - 2016
Stanford Undergraduate Summer Research Fellowship	2011
QuestBridge Match Scholarship	2010 - 2014
Siemens National Science Competition Semi-Finalist	2009

CONFERENCE PRESENTATIONS

Battery Modeling Webinar Series (Invited Talk)	May 2021
NY-BEST (Virtual Poster)	Nov 2020
ECS Prime (Virtual Talk)	Oct 2020
Columbia Electrochemical Energy Center, New York, NY (Virtual Seminar Talk)	Apr 2020
Gordon Research Conference in Batteries, Ventura, CA (Poster)	Feb 2020
NY Battery and Energy Storage Workshop, New York, NY (Poster)	Oct 2019
236 th ECS, Atlanta, GA (Invited Talk)	Oct 2019
Electrochemical Conference on Energy and the Environment, Glasgow, UK (Talk)	Jul 2019
NGenE – Next Generation Electrochemistry, University of Illinois, Chicago (Poster)	Jun 2019
256 th ACS National Meeting and Exposition, Boston, MA (Invited Talk)	Aug 2018
Princeton E-affiliates Conference, Princeton Club in New York (Poster)	Jun 2018

Gordon Research Conference in Batteries, Ventura, CA (Poster)	Feb 2018
Stanford Mason Lecture Series, Stanford University (Poster)	May 2013
Stanford Undergraduate Research Symposium, Stanford University (Poster)	Aug 2011

SERVICE, OUTREACH AND PROFESSIONAL DEVELOPMENT

Super User for Columbia Electrochemical Energy Center	2021
trained new students in the use of: glovebox, battery fabrication line (press, thin film slurry coater, coin cell and pouch cell fab)	
	2020
Princeton Inclusive Leadership Learning Cohort	2019
NGenE (Next Generation Electrochemistry) Workshop	2018
Judge for Princeton Energy Case Competition	
judged pitch sessions on energy issues by high school student teams	
Technical Lead for Young Global Leaders Conference (YGL)	2018
setup and led solar panel and battery demonstration/competition for World Economic Forum YGL participants	
Graduate Fellow for Princeton Scholars Institute Fellows Program (SIFP)	2017- 2018
led weekly meetings connecting first-generation/low-income undergraduate students with graduate students	
Volunteer for Spark Clean Energy	2016
helped create weekly email newsletters on cleantech and entrepreneurship news for the non-profit group	
QuestBridge	2014
college admissions application reader for first-generation/low-income students	

TEACHING AND MENTORSHIP

Princeton Teaching Transcript and Pedagogy Certification	2021
Princeton MAE 206: Engineering Dynamics	Spring 2019
Princeton MAE 324: Intro to Materials	Fall 2018
Master's Student (Columbia): Gunnar Thorsteinsson	Summer 2021 -
• Acoustics signal processing and modeling	
Undergraduate (Columbia): Khushi Kabra	Summer 2021 -
• Cathode/electrolyte interfaces and cathode synthesis	
Undergraduate (Columbia): Agnes Thornberg	2020 - 2021
• Spatial acoustic imaging resolution and signal processing	
Master's Student (Columbia): Shripad Patil	Fall 2019
• Temperature effects of Li-ion batteries (work led to 1 publication)	
Undergraduate (Columbia): Silas Swanson	2019 – 2020
• Electrochemical analysis of Li-Zn alloy anodes	
Undergraduate (Princeton): Kate Denner	Fall 2018
• Design and build of pressure chuck for lithium-ion and lithium metal acoustic studies (work led to 1 publication)	

REFERENCES

Prof. Daniel Steingart: dan.steingart@columbia.edu
Prof. Lauren Marbella: lem2221@columbia.edu
Prof. Craig Arnold: cbarnold@princeton.edu