Wesley Chang

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EDUCATION

PhD, Princeton University 2017 - 2021
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

1. **Chang, W.***, May, R.*, Wang, M., Sakamoto, J., Marbella, L, Steingart, D. Evolving Contact Mechanics and Microstructure Formation Dynamics of the Lithium Metal – $Li_7La_3Zr_2O_{12}$ (LLZO) Interface, *Under Review*

2. **Chang, W.**, Steingart, D. Operando 2D Acoustic Characterization of Li-ion Battery Spatial Dynamics, *Under Review*

3. **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 $LiCoO_2$/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
236th 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
256th ACS National Meeting and Exposition, Boston, MA (Invited Talk)	Aug 2018
Princeton E-ffiliates 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

Princeton Inclusive Leadership Learning Cohort 2020

NGenE (Next Generation Electrochemistry) Workshop 2019

Judge for Princeton Energy Case Competition 2018
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 Thorsteinnson 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)