

# Lu Zhang, Ph.D.

张鲁 · Battery scientist & data engineer

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Battery scientist with 14+ years at Argonne National Laboratory developing redox flow batteries, lithium-ion electrolytes, and silicon-anode binders; now applying machine learning to industrial-scale energy storage. R&D 100 Award (2014) for redox-shuttle technology. Built cross-institution Sprint teams under JCESR (DOE BES).

89 peer-reviewed papers 28 US patents & applications 52 conference talks (incl. 14 invited) 4,700+ citations

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## Education

Ph.D., Organic Chemistry — **Chinese Academy of Sciences (Technical Institute of Physics and Chemistry)** 2001 – 2006

Advisor: Prof. 李娜 (Yi Li). Combined master/PhD program; photochemistry / organic photophysics group.

B.S., Chemistry — **Shandong University** 1996 – 2000

## Professional Experience

Data Science Engineer — **American Academy of Orthopaedic Surgeons (AAOS)** Feb 2026 – present

Voice agents and clinical data systems.

Senior Data Scientist — **Mercury Insurance** Nov 2024 – Jan 2026

Pricing and risk models; production ML pipelines.

Data Scientist — **Cincinnati Insurance** Aug 2023 – Nov 2024

Loss prediction and analytics platforms.

Chemist → Senior Chemist — **Argonne National Laboratory** Jan 2009 – Aug 2023

Total tenure 14 years 7 months. JCESR Theme Lead, Sprint team leader, Y3 milestone lead. R&D 100 Award (2014).

Postdoctoral Researcher — **Florida State University** 2006 – 2008

Department of Chemistry and Biochemistry. PI: Prof. Lei Zhu.

## Awards & Recognition

- **R&D 100 Award (2014)** — for redox-shuttle additive technology (the "Oscars of Innovation"). Core inventor on lithium-battery overcharge-protection redox-shuttle patents.
- **R&D 100 Award Finalist (2015)** — for high-voltage lithium-battery fluorinated electrolyte technology.
- Featured in Argonne Today, JCESR Research Highlights, EurekAlert, Tech Xplore, PV Magazine, ScienceDaily.

## Selected Publications (top 10 by citations)

Full list of 89 peer-reviewed papers + book chapters at [rockyzl.github.io/lu-zhang-site/publications](https://rockyzl.github.io/lu-zhang-site/publications).

Radical Compatibility with Nonaqueous Electrolytes and Its Impact on an All-Organic Redox Flow Battery — *Angewandte Chemie International Edition*, 2015; 322 citations.

A High-Current, Stable Nonaqueous Organic Redox Flow Battery — *ACS Energy Letters*, 2016; 237 citations.

**Polyanthraquinone-Based Organic Cathode for High-Performance Rechargeable Magnesium-Ion Batteries** — , 2016; 203 citations.

**A symmetric organic-based nonaqueous redox flow battery and its state of charge diagnostics by FTIR** — Journal of Materials Chemistry A, 2016; 198 citations.

**"Wine-Dark Sea" in an Organic Flow Battery: Storing Negative Charge in 2,1,3-Benzothiadiazole Radicals Leads to Improved Cyclability** — , 2017; 160 citations.

**Liquid Catholyte Molecules for Nonaqueous Redox Flow Batteries** — , 2015; 138 citations.

**Molecular engineering towards safer lithium-ion batteries: a highly stable and compatible redox shuttle for overcharge protection** — Energy & Environmental Science, 2012; 126 citations. [\[first author\]](#)

**Re-Engineering Poly(Acrylic Acid) Binder toward Optimized Electrochemical Performance for Silicon Lithium-Ion Batteries: Branching Architecture Leads to Balanced Properties of Polymeric Binders** — Advanced Functional Materials, 2019; 114 citations.

**2,5-Dimethoxy-1,4-Benzoquinone (DMBQ) as Organic Cathode for Rechargeable Magnesium-Ion Batteries** — Journal of The Electrochemical Society, 2016; 108 citations.

**The existence of optimal molecular weight for poly(acrylic acid) binders in silicon/graphite composite anode for lithium-ion batteries** — Journal of Power Sources, 2018; 104 citations. [\[corresponding\]](#)

## Book Chapters

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**Electrolytes used in silicon anodes** — in Lithium-ion Batteries Enabled by Silicon Anodes, Institution of Engineering and Technology (IET), 2021; ISBN 9781785619557.

**Redox Shuttle Additives for Lithium-Ion Battery** — in Lithium Ion Batteries — New Developments, InTechOpen, 2012; ISBN 978-953-307-900-4.

## US Patents (selected – 25 issued of 28 total)

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**US 12,322,757** — Isatin derivative redoxamer for electrochemical device (2025). Inventors: Bheemireddy, S.R.; Zhang, L.; Zhang, Z..

**US 12,015,156** — Solvents and slurries comprising a poly(carboxylic acid) binder for silicon electrode manufacture (2024). Inventors: Zhang, L.; Shi, Z.; Jansen, A.; Trask, S..

**US 11,715,844** — Isatin derivative redoxmer for electrochemical device (2023). Inventors: Bheemireddy, S.R.; Zhang, L.; Zhang, Z..

**US 11,271,237** — Organic redox molecules for flow batteries (2022). Inventors: Zhang, L.; Zhang, J.; Shkrob, I.A..

**US 11,532,818** — Solvents and slurries comprising a poly(carboxylic acid) binder for silicon electrode manufacture (2022). Inventors: Zhang, L.; Shi, Z.; Jansen, A.; Trask, S..

**US 11,411,221** — Binders for silicon electrodes in lithium-ion batteries (2022). Inventors: Shi, Z.; Zhang, L..

**US 10,840,531** — Two-electron redox active molecules with high capacity and energy density for energy storage (2020). Inventors: Huang, J.; Zhang, L.; Burrell, A.K.; Zhang, Z..

**US 10,535,891** — Two-electron redox catholyte for redox flow batteries (2020). Inventors: Zhang, J.; Zhang, L.; Shkrob, I.A..

**US 10,637,099** — Annulated tetra-substituted hydroquinone ether-based redox shuttle additives (2020). Inventors: Zhang, L.; Zhang, J.; Shkrob, I.A.; Zhang, Z..

**US 10,622,676** — Functional organic salt for lithium-ion batteries (2020). Inventors: Zhang, L.; Zhang, J.; Shkrob, I.A..

## Funded Research Projects (selected)

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<b>Advanced Electrolyte Additives for PHEV/EV Lithium-ion Battery</b> DOE ABR (Applied Battery Research) · Researcher → Co-investigator	2010 – 2014
<b>Organic Molecular Engineering for Non-Aqueous Redox Flow Batteries (NRFBs / ROMs)</b> JCESR — DOE BES Energy Frontier Research Center · Theme Lead · Sprint team leader · Y3 milestone lead	2013 – 2020
<b>Silicon Consortium Project — Science of Manufacturing for Silicon Anodes</b> DOE EERE / Vehicle Technologies Office · Principal Investigator (binders sub-thrust)	2014 – 2021
<b>Flow Batteries Technology Strategy Assessment / Storage Innovations 2030</b> DOE — long-duration storage roadmap · Co-author · DOE flow-battery information lead	2022 – 2023
<b>High-Density Energy Storage in Solvent-Free Redox Flow Batteries for Flexible Electric Grid</b> Argonne LDRD (2018-100) · Principal Investigator (with Ilya A. Shkrob)	2018 – 2020
<b>Hybrid Membranes for Flow Batteries</b> Argonne LDRD (2021-0087) · Project member · membrane sub-thrust (with Jeffrey Elam)	2021 – 2023

## Invited Talks (top 8)

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- Invited speaker (title not yet captured) — MRS Spring Meeting — ES05, Seattle, WA, 2024.
- Invited speaker (title not yet captured) — ECS 241st Meeting — Lithium Ion Batteries, Vancouver, Canada, 2022.
- A Data-Driven Approach to Probe the Stability of Dialkoxy Benzene Catholytes for Nonaqueous Redox Flow Batteries** — International Battery Seminar — Battery Mgmt Systems, Online, 2021.
- Invited speaker (title TBD; recording on YouTube) — MRS Fall Meeting (Virtual), Online (Nov 27 – Dec 4, 2020), 2020.
- Invited speaker (title not yet captured) — ECS 235th Meeting — Large-Scale Energy Storage 10, Dallas, TX, 2019.
- Stable Dialkoxybenzenes as Catholyte Materials for Non-Aqueous Redox Flow Batteries** — MRS Spring Meeting, Phoenix, AZ, 2018.
- Stable Annulated Dialkoxybenzenes as Catholyte Materials for Non-Aqueous Redox Flow Batteries** — International Battery Seminar & Exhibit, Fort Lauderdale, FL, 2018.
- Recent Advances in Organic Redox-Active Materials for Flow Batteries** — ICESI Annual Meeting, Dalian, China, 2018.

## Service & Peer Review

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- **Co-author, DOE Flow Batteries Technology Strategy Assessment (2023)** — long-duration storage roadmap.
- Storage Innovations 2030 contributor (DOE framework, 2022).
- JCESR Theme / Sprint team leadership (3 universities + 2 national labs, 2015 – 2017).
- JCESR 2.0 self-reporting redoxmer Y3 milestone leader (2020).
- **DOE SBIR Reviewer** (2013 – 2022, 10 years).
- **NSF Review Panel for Energy Systems** (2019).
- **DOE Energy Storage Innovations Prize Reviewer** (2023).
- Reviewer for 10+ international journals: J. Power Sources, ACS Energy Lett., Chem. Commun., Adv. Energy Mater., Nano Energy, J. Mater. Chem. A, Chemistry of Materials, ChemSusChem, Electrochim. Acta, ACS Appl. Energy Mater.

## Mentorship

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Direct mentees at ANL (2013 – 2023): **8 postdoctoral fellows + 5 graduate students** (13 total).

**Postdocs:** Zhangxing Shi, Peng Du, Zhongbo Zhang, Jinhua Huang, Bin Hu, Lily A. Robertson, Yuyue Zhao, Jingjing Zhang.

**Graduate students** (advised or co-advised; several were later co-advised with Xiaoliang Wei @ Purdue, Lei Zhu @ FSU, Shrayesh Patel @ UChicago): Zhiguang Li, Sisi Jiang, Xiaoting Fang, Quinton J. Meisner, Andrea Diaz.

Other current placements: Tesla (Sisi Jiang, Quinton J. Meisner), Factorial Energy (Zhangxing Shi), Wildcat Discovery Technologies (Jinhua Huang), Living Proof Inc. (Jingjing Zhang), CNPC JICAI POWER (Yuyue Zhao), ORNL (Bin Hu), ANL CSE Division Assistant Chemist + 2021 Argonne Postdoc Performance Award (Lily A. Robertson). Cross-institution JCESR Sprint teams spanned MIT, PNNL, UIUC, UMichigan, Purdue.

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