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Assistant Professor, Priti and Mukesh Chatter '82 Career Development Chair

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Education

Ph.D. Chemical Engineering, University of Maryland College Park, 2018

Advisor: Dr. Chunsheng Wang, **Thesis:** Revisiting the Electrochemical Stability Window of Solid Electrolytes for the Development of Bulk-Type All-Solid-State Lithium Batteries

MS Materials Science and Engineering, Shandong University, 2012

BS Materials Science and Engineering, Shandong University, 2009

Research and Professional Experience

08/16/2019 – present Assistant professor, Department of Mechanical, Aerospace, and Nuclear Engineering, Rensselaer Polytechnic Institute

08/16/2019 – present Priti and Mukesh Chatter '82 Career Development Chair, Rensselaer Polytechnic Institute

03/20/2019 – 08/15/2019 Guest Scientist, Materials for Energy and Sustainable Development Group, National Institute of Standards and Technology

05/21/2018 – 08/15/2019 Postdoctoral Associate, Department of Chemical and Biomolecular Engineering, University of Maryland College Park, Advisor: Dr. Chunsheng Wang

Research Interests

Advanced Materials, Sustainability, Batteries, Electrochemistry, Neutron Techniques

Awards and Honors

- 1) Materials Research Society Nelson “Buck” Robinson Science and Technology Award for Renewable Energy, 2024
- 2) School of Engineering Research Excellence Award, Rensselaer Polytechnic Institute, 2024

- 2) ARPA-E IGNIITE Award, 2024
- 3) NSF CAREER Award, 2023
- 4) Highly Cited Researcher in Cross-Field by Clarivate, 2022, 2023, 2024
- 5) Journal of Materials Chemistry A – Emerging Investigator, 2023
- 6) Electrochemical Society Electrodeposition Division Early Career Investigator Award, 2022
- 7) International Society for Solid State Ionics Young Scientist Award Finalist, 2022
- 8) Electrochemical Society Battery Division Student Research Award, 2018
- 9) Dean’s Doctoral Research Award, A. James Clark School of Engineering, 2018
- 10) Materials Research Society Graduate Student Gold Award, 2017
- 11) NASA Tech Brief Certificate, 2016
- 12) All-S.T.A.R. Fellowship, University of Maryland College Park, 2016
- 13) Harry K. Wells Fellowship, A. James Clark School of Engineering, 2016
- 14) Future Faculty Fellow, A. James Clark School of Engineering, 2016
- 15) TA of the Year, Department of Chemical and Biomolecular Engineering, 2014

Book Chapters:

2, Y. Huang, B. Shao, F. Han, Solid State Batteries – An Introduction, in “Solid State Batteries: Emerging Materials and Applications”, Chapter 1, pp 1-20, 2022, American Chemical Society Symposium Series Vol. 1413.

1, B. Shao, Y. Huang, F. Han, Lithium-Sulfur Solid-State Batteries, in “Solid State Batteries: Emerging Materials and Applications”, Chapter 12, pp 267-288, 2022, American Chemical Society Symposium Series Vol. 1414.

Publications (Citations: 21,347, H-index = 59, data from Google Scholar:

<https://scholar.google.com/citations?user=TSWDzy4AAAAJ&hl=en>)

84. Y. Huang, Y. Zhang, R. Wu, B. Shao, R. Deng, R. Das, F. Han, Hydride-Based Interlayer for Solid-State Anode-Free Battery, *ACS Energy Letters*, 9, (2024), 3409.

83. S. T. Fuller, Y. Huang, R. Wu, F. Han, J. X. K. Zheng, N. Vasiljevic, Engineering Electrodeposition for Next-Generation Batteries, *The Electrochemical Society Interface*, 33, (2024) 55.

82. B. Shao, R. Das, Y. Huang, R. Deng, S. Seelman, F. Han, Structural Evolution During Solution-Based Synthesis of $\text{Li}_7\text{P}_3\text{S}_{11}$ Solid Electrolyte by Synchrotron X-ray Total Scattering, *Journal of Materials Chemistry A*, 11 (2023) 17035.
81. B. Shao, Y. Huang, F. Han, Electronic Conductivity of Lithium Solid Electrolytes, *Advanced Energy Materials*, 13 (2023) 2204098.
80. Y. Huang, B. Shao, Y. Wang, F. Han, Solid-State Silicon Anode with Extremely High Initial Coulombic Efficiency, *Energy & Environmental Science*, 16 (2023) 1569.
79. D. Zhao, M. T. Benson, K. Yang, Y. Huang, F. G. Di Lemma, B. Gong, F. Han, J. Lian, Grain Growth Kinetics of the Gamma Phase Metallic Uranium, *Journal of Nuclear Materials*, 574 (2023) 154185.
78. B. Shao, S. Tan, Y. Huang, L. Zhang, J. Shi, X.-Q. Yang, E. Hu, F. Han, Enabling Conversion-Type Iron Fluoride Cathode by Halide-Based Solid Electrolyte, *Advanced Functional Materials*, 32 (2022) 2206845.
77. Y. Huang, B. Shao, F. Han, Li Alloy Anodes for High-Rate and High-Areal-Capacity Solid-State Batteries, *Journal of Materials Chemistry A*, 10 (2022) 12350.
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75. Y. Huang, B. Shao, F. Han, Interfacial Challenges in All-Solid-State Lithium Batteries, *Current Opinion in Electrochemistry*, 33 (2022) 100933. Invited Review.
74. X. Liu, R. Garcia-Mendez, A. R. Lupini, Y. Cheng, Z. D. Hood, F. Han, A. Sharafi, J. C. Idrobo, N. J. Dudney, C. Wang, C. Ma, J. Sakamoto, M. Chi, Local Electronic Structure Variation Resulting in Li "Filament" Formation within Solid Electrolytes, *Nature Materials*, 20 (2021) 1485.
73. R. Jain, Y. Yuan, Y. Singh, S. Basu, D. Wang, A. Yang, X. Wang, M. Rong, H. J. Lee, D. Frey, R. Khadka, P. Hundekar, S. O. Kim, F. Han, L.-W. Wang, D. Mitlin, R. Shahbazian-Yassar, N. Koratkar, Alloying of Alkali Metals with Tellurene, *Advanced Energy Materials*, 11 (2020) 2003248.
72. J. Wu, S. Liu, F. Han, X. Yao, C. Wang, Lithium/Sulfide All-Solid-State Batteries Using Sulfide Electrolytes, *Advanced Materials*, 33 (2020) 2000751.
71. J. Yang, G. Liu, M. Avdeev, H. Wan, F. Han, L. Shen, Z. Zou, S. Shi, Y.-S. Hu, C. Wang, X. Yao, Ultrastable All-Solid-State Sodium Rechargeable Batteries, *ACS Energy Letters*, 5 (2020) 2835.
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69. J. Zhang, C. Cui, P.-F. Wang, Q. Li, L. Chen, F. Han, T. Jin, S. Liu, H. Choudhary, S. R. Raghavan, N. Eidson, A. von Cresce, L. Ma, J. Uddin, D. Addison, C. Yang, C. Wang, "Water-in-Salt" Polymer Electrolyte for Li-Ion Batteries, *Energy Environmental Science*, 13 (2020) 2878.
68. H. Wan, W. Weng, F. Han, L. Cai, C. Wang, X. Yao, Bio-Inspired Nanoscaled Electronic/Ionic Conduction Networks for Room-Temperature All-Solid-State Sodium-Sulfur Battery, *Nano Today*, 33 (2020) 100860.
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65. S. Liu, X. Ji, J. Yue, S. Hou, P. F. Wang, C. Cui, J. Chen, B. Shao, J. Li, F. Han, J. Tu, C. Wang, High Interfacial-Energy Interphase Promoting Safe Lithium Metal Batteries, *Journal of the American Chemical Society*, 142 (2020) 2438.
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55. R. Xu, F. Han, X. Ji, X. Fan, J. Tu, C. Wang, Interface Engineering of Sulfide Electrolytes for All-Solid-State Lithium Batteries, *Nano Energy*, 53 (2018) 958.
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51. X. Fan, E. Hu, X. Ji, Y. Zhu, F. Han, S. Hwang, J. Liu, S. Bak, Z. Ma, T. Gao, S. Liou, J. Bai, X. Yang, Y. Mo, K. Xu, D. Su, C. Wang, High Energy-Density and Reversibility of Iron Fluoride Cathode Enabled via an Intercalation-Extrusion Reaction, *Nature Communications*, 9 (2018), 2324.
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11. F. Han, B. Yao, Y. Bai, Preparation of Carbon Nano-Onions and Their Application as Anode Materials for Rechargeable Lithium-Ion Batteries, *The Journal of Physical Chemistry C*, 115 (2011) 8923.
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5. H. Zhu, N. Lun, Z. Zhang, R. Liu, X. Meng, B. Zhang, F. Han, Y. Bai, J. Bi, R. Fan, A Catalyst-Free Method to Silicon Nanowires at Relative Low Temperature, *Journal of Crystal Growth*, 312 (2010) 3579.
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2. H. Zhu, F. Han, J. Bi, Y. Bai, Y. Qi, L. Pang, C. Wang, S. Li, C. Lu, Facile Synthesis of Si_3N_4 Nanocrystals via an Organic-Inorganic Reaction Route, *Journal of the American Ceramic Society*, 92 (2009) 535.
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Presentations

25. F. Han, “Solidifying Batteries for Safe and Reliable Energy Storage”, 2024 MRS Fall Meeting, Boston, MA, 12/04/2024.
24. F. Han, “Understanding (Electro)chemical Stability and Electronic transport of Solid Electrolytes for Solid-State Battery Development”, *International Battery Material Association Conference (IBA 2024)*, Halifax, Canada, 09/09/2024.
23. F. Han, Developing Low Cost and High Energy Density Solid-State Batteries, *2024 Solid State Battery Summit*, Chicago, IL, 08/13/2024.
22. F. Han, Electronic Transport in Lithium Solid Electrolytes, *The American Ceramic Society Electronic Materials and Applications (EMA-2024)*, Denver, CO, 02/15/2024.
21. F. Han, Ceramic Electrolytes for Solid-State Batteries: Fundamental Challenges and Design Strategies, *2023 NSF Professional Development Workshop in Ceramics*, Boston, MA, 11/26/2023.
20. F. Han, Lithium Thiophosphate Glass and Glass-Ceramic Electrolytes for Safe, Energy-Dense Batteries, *10th International Conference on Borate Glasses, Crystals, and Melts and 3rd International Conference on Phosphate Materials*, Corning, NY, 07/17/2023 - 07/21/2023.
19. F. Han, Solidifying Batteries for Safe Energy Storage, *3M Tech Forum of Automotive Electrification*, 3M, 11/08/2022.
18. F. Han, Electronic Transport in Lithium Solid Electrolytes, *23rd International Conference on Solid State Ionics*, Boston, US, 07/20/2022.

17. F. Han, Electronic Conduction Induced Dendrite Formation in Solid Electrolytes, *23rd International Conference on Solid State Ionics*, Boston, US, 07/19/2022.
16. F. Han, Solidifying Batteries for Safe Energy Storage, *Department of Physics & Atmospheric Science, Dalhousie University*, Halifax, Canada, 01/13/2022.
15. F. Han, Mechanistic Understanding of Dendrite Formation in Solid Electrolytes, *2021 MRS Fall Meeting*, Boston, 12/01/2021
14. F. Han, “All-Solid-State Battery”, *Department of Physics, Applied Physics & Astronomy Colloquium, Rensselaer Polytechnic Institute*, 10/28/2020
13. F. Han, Solid Electrolyte for Safe and Energy-Dense Batteries, *Department of Mechanical and Aerospace Engineering, Syracuse University*, Syracuse, NY, Oct. 23, 2020.
12. F. Han, T. Yi, R. G. Downing, R. Briber, C. Wang, H. Wang, Visualization and Quantification of Spatial Distribution of Dendrites in Polymer Electrolytes for Lithium Metal Batteries, *ACNS 2020*, Virtual, Jul. 13–Jul. 16, 2020.
11. F. Han, “Solidifying Batteries for Safe Energy Storage”, *Department of Materials Science and Engineering, Rensselaer Polytechnic Institute*, 02/05/2020
10. F. Han, “On the Route to Solid State Batteries”, Department of Mechanical, Aerospace and Nuclear Engineering, Rensselaer Polytechnic Institute, 11/20/2019
9. F. Han, T. Yi, R. G. Downing, R. Briber, C. Wang, H. Wang, Structure of Lithium Dendrites in Polymer Electrolytes, *2019 APS March Meeting*, Boston, MA, Mar. 4–Mar. 8, 2019.
8. F. Han, Revisiting the Electrochemical Stability of Solid Electrolytes for Safe Energy Storage, *Department of Chemical Engineering, University of California Davis, Davis, CA*, Jan. 24, 2019.
7. F. Han, All-Solid-State Batteries for Next-Generation Electrochemical Energy Storage, *2018 AIChE Annual Meeting*, Pittsburgh, PA, Oct. 28–Nov. 2, 2018.
6. F. Han, Revisiting the Electrochemical Stability Window of Solid Electrolytes, *2018 AiMES Meeting*, Cancun, Mexico, Sep. 30–Oct. 4, 2018.
5. F. Han, J. Yue, X. Zhu, C. Wang, Lithium Dendrite Suppression in Solid Electrolytes, *2017 MRS Fall Meeting & Exhibit*, Boston, MA, Nov. 26–Dec. 1, 2017.
4. F. Han, J. Yue, C. Wang, Improved Cathode/Electrolyte Interfaces in All-Solid-State Batteries, *2017 MRS Fall Meeting & Exhibit*, Boston, MA, Nov. 26–Dec. 1, 2017.
3. F. Han, J. Yue, X. Fan, Z. Ma, T. Gao, C. Wang, Cathode/Electrolyte Interface: Revisiting the Electrochemical Stability of Solid Electrolytes, *2017 MRS Spring Meeting & Exhibit*, Phoenix, AZ, Apr. 17-21, 2017.

2. F. Han, T. Gao, Y. Zhu, J. Yue, Y. Zhu, Y. Mo and C. Wang, Electrochemical Stability of $\text{Li}_{10}\text{GeP}_2\text{S}_{12}$ and $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$ Solid Electrolytes, *18th International Meeting on Lithium Batteries*, Chicago, IL, Jun. 19-24, 2016.

1. F. Han, T. Gao, Y. Zhu, K. J. Gaskell, and C. Wang, A Battery Made from a Single Material, *20th International Conference on Solid State Ionics*, Keystone, CO, Jun. 14-19, 2015.

Patents and Patent Applications

1. C. Wang, F. Han, Battery Made from a Single Material, US 2017/0317382 A1.

Work as Reviewer of other works

- Reviewer: Department of Energy ARPA-E, 2024
- Reviewer: European Research Council, 2023
- Reviewer: Department of Energy Advanced Materials and Manufacturing Technologies Office, 2023
- Reviewer: Department of Energy Office of Science, 2022, 2023
- Reviewer: NSF CBET, 2021, 2024
- Reviewer: NSF DMR, 2023
- Reviewer: Department of Energy Vehicle Technology Office, 2021, 2023, 2024
- Reviewer: ACS Petroleum Research Fund, 2021

Academic External Reviewer

- Tenure and promotion candidate, Catholic University of America (2024)

I have also reviewed >100 papers in a number of journals, including *Nature Materials*, *Nature Communications*, *Nature Sustainability*, *Chemical Reviews*, *Materials Today*, *Advanced Materials*, *Advanced Energy Materials*, *Nano Energy*, *Energy Storage Materials*, *Chemistry of Materials*, *Journal of Power Sources*, *ACS Applied Materials & Interfaces*, *ACS Applied Energy Materials*, *Carbon*, *Chemical Engineering Journal*, *Journal of Materials Chemistry A*, *Nanotechnology*, *Vacuum*, *Ionics*, *Journal of Nanoparticle Research*, *Journal of Physics D Applied Physics*, *Materials Research Express*, *Journal of Crystal Growth*, *Ceramics International*, *Electrochimica Acta*, and *Energy & Environmental Materials*.

Editorial Boards

Electrochem (ISSN 0008-0008)

Batteries (ISSN 2313-0105)

Professional Society Committee

1. Materials Research Society Early Career Professional Subcommittee, Member, 2/2022 to present
2. Electrochemical Society Electrodeposition Division Early Career Forum Organizing Committee, Member, 9/2022 to present

Conference Organization

1. Organizer of the “Electronic and Ionic Materials for Energy Storage and Conversion System” symposium of the American Ceramic Society Electronic Materials and Applications 2025: at Denver Colorado, 02/25/2025 to 02/28/2025.
2. Organizer of the “Solid State Batteries – Materials, Interfaces, and Cell Integration” symposium of the 2024 American Chemical Society Spring meeting at New Orleans, 03/17/2024 to 03/21/2024.
3. Organizer of the “Energy Storage Beyond Li-ion Batteries” symposium of the 2022 American Chemical Society Fall meeting at Chicago, 08/21/2022 to 08/25/2022.
4. Lead Organizer of the “Solid State Batteries: Electrodes, Electrolytes, and Interphases” Symposium of the 2021 Materials Research Society Fall Meeting at Boston, MA, 11/29/2021 to 12/02/2021.

Institutional Administrative Responsibilities

1. Secretary of Faculty, Rensselaer Polytechnic Institute, 9/2023 to present
2. Secretary of Faculty Senate, Rensselaer Polytechnic Institute, 9/2022 to 8/2023
3. Faculty Senate Recording Secretary, Rensselaer Polytechnic Institute, 9/2021 to 8/2022
4. MANE Doctoral Qualifying Exam Committee for Solid Mechanics and Heat Transfer/Thermodynamics, 9/2019 to present
5. MANE Technical Committee for Thermal & Fluids and Mechanics, 1/2024 to present

Professional Memberships

- 1) Electrochemical Society
- 2) Materials Research Society
- 3) International Society of Electrochemistry
- 4) American Chemistry Society
- 5) American Institute of Chemical Engineers
- 6) American Society of Mechanical Engineers
- 7) American Physics Society
- 8) The Minerals, Metals & Materials Society