**Feifei Shi**

Assistant Professor in Department of Energy and Mineral Engineering, College of Earth and Mineral Sciences, Pennsylvania State University  
510-260-5277 • feifeishi@psu.edu • <https://sites.psu.edu/feifeilab/>

**Education**

**University of California**, Berkeley, Berkeley, CA 2010-2015Ph.D. in Mechanical Engineering, Major: Materials, Minor: Chemistry/MEMS

**Fudan University**, Shanghai, China 2006-2010B.S.in Chemistry, Department of Chemistry

**Professional Experience**

**Pennsylvania State University** 2019 – present

Assistant Professor, Department of Energy and Mineral Engineering

Department of Material Science and Engineering (courtesy appointment)

Mechanical Engineering Department (courtesy appointment)

**Stanford University** 2016 – 2019

Postdoctoral research fellow, Department of Material Science and Engineering

**Lawrence Berkeley National Lab**, Berkeley, CA 2010 – 2015

Graduate student researcher, Material Science Division

**Honors**

CAREER award, NSF 2023

J&J WiSTEM2D Scholars, Johnson & Johnson 2022

Virginia S. and Philip L. Walker Faculty Fellow, Penn State University 2019

Chinese Government Award for Outstanding Self-Financed Students Abroad 2016

John and Janet McMurtry Fellowship, UC Berkeley 2013

Honors for B.S. degree, Fudan University 2010

Sumitomo Corporation Scholarship, Fudan University 2008 &2009

**RESEARCH FIELDS**

In-situ diagnosis tools and protocols for renewable energy (Nuclear Energy and Electric Vehicles (EV))

Manufacturing innovation for sustainable energy conversion and storage systems

Securing the supply chain of critical elements (CM) with sustainable electrochemical-extraction process

**Professional activities**

* Guest Editor, *Energy & Environmental Materials (EEM)*, Special Issue on *New Energy Materials and Device*, 2020.
* Guest Editor, *Frontiers in Energy Research,* Special Issue on *Solid-State Electrolytes for Next-generation Energy Storage*, 2019
* Editorial Board, *Energy Material,* since 2021
* Discussion Leader, “*Energy Generation and Storage*”, Gordon Research Seminar, Ventura, CA, 2019
* NSF Panel reviewer in “*Electrochemical system program*”, *“Interfacial Engineering”* and “*SBIR/STTR* *program*”
* Reviewer for ORAU Ralph E. Powe Junior Faculty Enhancement Awards, ACS PRF, DOE AMMTO
* Journal reviewer of *Science, Nature Energy, Nature Communications*, *Joule, Nano letters, ACS Energy Letter, ACS Nano, ACS Applied Polymer Materials, ACS Applied Energy Materials, Energy & Environmental Materials, Energy Materials, Journal of Materials Chemistry A, Carbon, Communications Materials, Catalysis Letter, Journal of Electrochemical Society, and Energy &Environmental Materials*, *RSC Advances*

**Publications (**Google scholar citation metrics: total citation 9843, h-index 40, i10-index 46**)**

**Peer-reviewed Book chapters**

**Shi, F.**; Ross, Philip N., Solid electrolyte interphase in lithium-based batteries. ***Inorganic Battery Materials***, John Wiley & Sons, Ltd: Chichester, UK, 2019. (Invited Book chapter)

**Selective Journal Publications**

***Publications after joining Penn State*** *(Underlining indicates students or postdoc in my group. \*Denotes corresponding author)*

**2024**

1. *Zhang, H.*; Han, Y.; *Lai, J.; Wolf, J*.; Yang, Y.; **Shi, F.\***, Direct electrochemical extraction of lithium from ores.*,* ***Nature Communication****,* 2024,15, 5066.
2. *Zhang, H.; Ulusel, M*.; **Shi, F.\***, Nucleation of Pitting and Evolution of Stripping on Lithium Metal Anodes.*,* ***ACS Applied Materials & Interfaces****,* 2024. doi.org/10.1021/acsami.4c01530
3. *Lai, J.; Zhang, H.*; Xu, K.; **Shi, F**.\*, Unveiling the Nexus between Interfacial Structure and Electrochemical Behaviors by Time-resolved Electrocapillarity. ***Journal of the American Chemical Society***2024, *https://doi.org/10.1021/jacs.4c03791*
4. *Liao, J.*; Longchamps, R. S.; McCarthy, B. D.; **Shi, F. \***; Wang, C.-Y., Lithium Iron Phosphate Superbattery for Mass-Market Electric Vehicles. ***ACS Energy Letters***2024, 771-778.
5. Zhang, Q.; Jin, Y.; Qi, S.; Ma, Q.; Wang, Z.; Lv, P.; **Shi, F.**\*; Wei, W., Overview of fiber-shaped energy storage devices: From fabrication to application. ***Nano Energy***2024, *128*, 109896.
6. Tao, L.; Xia, D.; Sittisomwong, P.; *Zhang, H.; Lai, J.;* Hwang, S.; Li, T.; Ma, B.; Hu, A.; Min, J.; Hou, D.; Shah, S. R.; Zhao, K.; Yang, G.; Zhou, H.; Li, L.; Bai, P.; **Shi, F.** \*; Lin, F., Solvent-Mediated, Reversible Ternary Graphite Intercalation Compounds for Extreme-Condition Li-Ion Batteries. ***Journal of the American Chemical Society*** 2024, *146* (24), 16764-16774.
7. Zheng, J.; Cao, H.; Zhang, S.; Lu, J.; Cao, S.; Li, W.; Yu, K.; **Shi, F.**; Wei, W., High Mechanical Strength Thermally Regenerated Fiber Bragg Gratings for High-Temperature Stress Monitoring. ***IEEE Transactions on Instrumentation and Measurement***2024, *73*, 1-7.

**2023**

1. Xiao, J.; **Shi, F.**; Glossmann, T.; Burnett, C.; Liu, Z. From laboratory innovations to materials manufacturing for lithium-based batteries. ***Nature Energy***2023**,** 8, (4), 329-339.
2. Wu, T., Liu, B., Liu, C., Wan, J., Yang, A., Liu, K., **Shi, F.**, Zhao, J., Lu, Z., Chen, G., Pei, A., Hwang, H. Y., & Cui, Y. Solar-driven efficient heterogeneous subminute water disinfection nanosystem assembled with fingerprint MoS2. ***Nature Water***2023**,** *1*(5), 462-470.
3. Cui, P.; Sun, C.; Lv, P.; **Shi, F. \***; Wei, W. Interfacial superionic conductor towards solidified lithium-ion batteries with superb rate performance and long cycle life. ***Journal of Power Sources***2023**,** 581, 233446.

**2021**

1. Wang, J.; Sun, Y.; *Lai, J.*; Pan, R.; Fan, Y.; Wu, X.; Ou, M.; Zhu, Y.; Fu, L.; **Shi, F. \***; Wu, Y., Two-dimensional graphitic carbon nitride/N-doped carbon with a direct Z-scheme heterojunction for photocatalytic generation of hydrogen. ***Nanoscale Advances***2021**,** *3* (23), 6580-6586.

**2020**

1. *Chen A.; Qu, C;* Shi, Y; **Shi, F.\*,** Manufacturing strategies for solid electrolyte in batteries. ***Frontiers in Energy Research***, 2020, 8, 571440 (Invited review paper)
2. Rozelle, P. L., **Shi, F.**, Rezaee, M., & Pisupati, S. V., Availability and Estimate of Resources of Cobalt in Pennsylvania**. *Final Report for Center for Critical Minerals****, DOE,* 2020.
3. Li, G.; Chen, W.; Zhang, H.; Gong, Y.; **Shi, F.**; Wang, J.; Zhang, R.; Chen, G.; Jin, Y.; Wu, T., Membrane‐Free Zn/MnO2 Flow Battery for Large‐Scale Energy Storage. ***Advanced Energy Materials***2020, *10* (9), 1902085.
4. Boyle, D. T.; Kong, X.; Pei, A.; Rudnicki, P. E.; **Shi, F.**; Huang, W.; Bao, Z.; Qin, J.; Cui, Y., Transient voltammetry with ultramicroelectrodes reveals the electron transfer kinetics of lithium metal anodes. ***ACS Energy Letters***2020**,** *5* (3), 701-709.

**2019**

1. Wan, J.; Xie, J.; Kong, X.; Liu, Z.; Liu, K.; **Shi, F.**; Pei, A.; Chen, H.; Chen, W.; Chen, J., Ultrathin, flexible, solid polymer composite electrolyte enabled with aligned nanoporous host for lithium batteries. ***Nature nanotechnology***2019, *14* (7), 705-711.
2. Wang, J.; Huang, W.; Pei, A.; Li, Y.; **Shi, F.**; Yu, X.; Cui, Y., Improving cyclability of Li metal batteries at elevated temperatures and its origin revealed by cryo-electron microscopy. ***Nature Energy*** 2019, *4* (8), 664-670.
3. Xu, Y.; Zhou, G.; Zhao, S.; Li, W.; **Shi, F**.; Li, J.; Feng, J.; Zhao, Y.; Wu, Y.; Guo, J., Improving a Mg/S battery with YCl3 additive and magnesium polysulfide. ***Advanced Science***2019, *6* (4), 1800981.
4. Weng, Y.-T.; Liu, H.-W.; Pei, A.; **Shi, F**.; Wang, H.; Lin, C.-Y.; Huang, S.-S.; Su, L.-Y.; Hsu, J.-P.; Fang, C.-C., An ultrathin ionomer interphase for high efficiency lithium anode in carbonate based electrolyte. ***Nature communications***2019, *10* (1), 1-10.
5. Liu, N.; Zhou, G.; Yang, A.; Yu, X.; **Shi, F.**; Sun, J.; Zhang, J.; Liu, B.; Wu, C.-L.; Tao, X.; Sun, Y.; Cui, Y.; Chu, S., Direct electrochemical generation of supercooled sulfur microdroplets well below their melting temperature. ***Proceedings of the National Academy of Sciences***2019, *116* (3), 765-770.
6. Xu, Y.; Zhou, G.; Zhao, S.; Li, W.; **Shi, F.**; Li, J.; Feng, J.; Zhao, Y.; Wu, Y.; Guo, J., Improving a Mg/S battery with YCl3 additive and magnesium polysulfide. ***Advanced Science***2019, *6* (4), 1800981.
7. Wang, J.; Huang, W.; Pei, A.; Li, Y.; **Shi, F.**; Yu, X.; Cui, Y., Improving cyclability of Li metal batteries at elevated temperatures and its origin revealed by cryo-electron microscopy. ***Nature Energy***2019, *4* (8), 664-670.
8. Wan, J.; Xie, J.; Kong, X.; Liu, Z.; Liu, K.; **Shi, F.**; Pei, A.; Chen, H.; Chen, W.; Chen, J., Ultrathin, flexible, solid polymer composite electrolyte enabled with aligned nanoporous host for lithium batteries. ***Nature nanotechnology***2019, *14* (7), 705-711.

***Publications prior to joining Penn State***

1. **Shi, F.**; Pei, A.; Boyle, D. T.; Xie, J.; Yu, X.; Zhang, X.; Cui, Y., Lithium metal stripping beneath the solid electrolyte interphase. ***Proceedings of the National Academy of Sciences*** 2018, 115 (34) 8529-8534
2. Wu, D. S.; **Shi, F.**; Zhou, G.; Zu, C.; Liu, C.; Liu, K.; Liu, Y.; Wang, J.; Peng, Y.; Cui, Y., Quantitative investigation of polysulfide adsorption capability of candidate materials for Li-S batteries. ***Energy Storage Materials*** 2018, *13*, 241-246.
3. Zhang, J.; Yang, A.; Wu, X.; van de Groep, J.; Tang, P.; Li, S.; Liu, B.; **Shi, F**.; Wan, J.; Li, Q., Reversible and selective ion intercalation through the top surface of few-layer MoS2. ***Nature communications***2018, *9* (1), 1-9.
4. Wu, D. S.; **Shi, F.**; Zhou, G.; Zu, C.; Liu, C.; Liu, K.; Liu, Y.; Wang, J.; Peng, Y.; Cui, Y., Quantitative investigation of polysulfide adsorption capability of candidate materials for Li-S batteries. ***Energy Storage Materials***2018, *13*, 241-246.
5. Zhang, X.; Xie, J.; **Shi, F.**; Lin, D.; Liu, Y.; Liu, W.; Pei, A.; Gong, Y.; Wang, H.; Liu, K.; Xiang, Y.; Cui, Y., Vertically Aligned and Continuous Nanoscale Ceramic–Polymer Interfaces in Composite Solid Polymer Electrolytes for Enhanced Ionic Conductivity. ***Nano Letters***2018, *18* (6), 3829-3838.
6. **Shi, F.**; Pei, A.; Vailionis, A.; Xie, J.; Liu, B.; Zhao, J.; Gong, Y.; Cui, Y., Strong texturing of lithium metal in batteries. ***Proceedings of the National Academy of Sciences*** 2017, *114*, 12138-12143.
7. **Shi, F.**; Ross, P. N.; Somorjai, G. A.; Komvopoulos, K., The chemistry of electrolyte reduction on silicon electrodes revealed by in situ ATR-FTIR spectroscopy. ***The Journal of Physical Chemistry C*** 2017, *121* (27), 14476-14483.
8. Liu, W.; Lee, S. W.; Lin, D.; **Shi, F.**; Wang, S.; Sendek, A. D.; Cui, Y., Enhancing ionic conductivity in composite polymer electrolytes with well-aligned ceramic nanowires. ***Nature energy***2017, *2* (5), 1-7.
9. Jin, Y.; Zhou, G.; **Shi, F.**; Zhuo, D.; Zhao, J.; Liu, K.; Liu, Y.; Zu, C.; Chen, W.; Zhang, R., Reactivation of dead sulfide species in lithium polysulfide flow battery for grid scale energy storage. ***Nature communications***2017, *8* (1), 1-9.
10. **Shi, F.**; Song, Z.; Ross, P. N.; Somorjai, G. A.; Ritchie, R. O.; Komvopoulos, K., Failure mechanisms of single-crystal silicon electrodes in lithium-ion batteries. ***Nature communications*** 2016, *7*, 11886.
11. **Shi, F.**; Ross, P. N.; Zhao, H.; Liu, G.; Somorjai, G. A.; Komvopoulos, K., A catalytic path for electrolyte reduction in lithium-ion cells revealed by in situ attenuated total reflection-Fourier transform infrared spectroscopy. ***Journal of the American Chemical Society***2015, *137* (9), 3181-3184.
12. **Shi, F**.; Zhao, H.; Liu, G.; Ross, P. N.; Somorjai, G. A.; Komvopoulos, K., Identification of diethyl 2, 5-dioxahexane dicarboxylate and polyethylene carbonate as decomposition products of ethylene carbonate based electrolytes by Fourier transform infrared spectroscopy. ***The Journal of Physical Chemistry C***2014, *118* (27), 14732-14738.
13. **Shi, F.**; Baker, L. R.; Hervier, A.; Somorjai, G. A.; Komvopoulos, K., Tuning the electronic structure of titanium oxide support to enhance the electrochemical activity of platinum nanoparticles. ***Nano letters***2013, *13* (9), 4469-4474.

**Patent**

Zhang, H.& **Shi, F.** U.S. patent application. PCT/US2023/022350. “Direct Electrochemical extraction of Lithium from ores.” Submitted: 07/05/2023.

**Selected Invited Talks**

1. *" Unravelling Battery Interface: Speciation and Structure*,*"* MRS Spring, Seattle, 2024
2. “*Characterization strategies for sensitive Battery materials*” Livermore National Laboratory, LEAF seminar, June, 2023
3. *“Understanding the Interfacial Structure of the Molten Chloride Salts by in-situ Electrocapillarity and Resonant Soft X-ray Scattering”* Argonne National Laboratory, Molten Salt NEUP PI Meeting, April, 2023
4. "*Diagnosis of Failure in Battery Systems*," Google PIE meeting, Google, 2022
5. "*Characterization strategies for lithium metal anode*," ACS Fall 2022, ACS, Chicago
6. "*Catalysis effect on the solid electrolyte interphase (SEI) in lithium-ion batteries*," ACS Fall 2020
7. Mechanical Engineering Department, University of California, Berkeley, Berkeley, CA, USA, 2019
8. Advance Light Source (ALS), Lawrence Berkeley National Lab, Berkeley, CA, USA, 2019
9. Mechanical and Aerospace Engineering Department, Princeton University, Princeton, NJ, 2019

**Invited Talks in Workshops**

1. Li metal manufacturing workshop, Mercedes-Benz Research & Development North America (MBRDNA),University of California, San Diego, Feb, 2024
2. “*Roundtable: Battery Manufacturing Science in Accelerating Technology Translation from Lab to Market*” DOE, Advanced Materials & Manufacturing Technologies Office (AMMTO), University of Washington & Pacific Northwest National Laboratory, Seattle, September, 2023
3. Li metal manufacturing workshop, Mercedes-Benz Research & Development North America (MBRDNA),University of California, San Diego, Feb, 2023
4. J&J WiSTEM2D award Ceremony, Johnson & Johnson, New Brunswick, NJ, 2022
5. Materials Today Nano Young Investigator's Forum: Young Women's Day, Elsevier, 2021

**Media**

Penn State News: [Engineer receives NSF CAREER award to improve lithium-ion battery performance](https://www.psu.edu/news/earth-and-mineral-sciences/story/engineer-receives-nsf-career-award-improve-lithium-ion-battery/?utm_audience=Combined&utm_source=newswire&utm_medium=email&utm_campaign=EMS%20headlines%20issue&utm_content=06-07-2023-11-18&utm_term=featured)

Johnson & Johnson News: [Powering Implantable Medical Devices: Meet Dr. Feifei Shi, WiSTEM2D Scholars Award Winner in the Field of Technology](https://www.jnj.com/wistem2d/powering-implantable-medical-devices-meet-dr-feife-shi-wistem2d-scholars-award-winner-in-the-field-of-technology)

Penn State News: [Professor awarded DOE grant to study corrosion in nuclear salt reactors](https://www.psu.edu/news/earth-and-mineral-sciences/story/professor-awarded-doe-grant-study-corrosion-nuclear-salt-reactors/)