

Yue Gao 高悦

青年研究员, 博士生导师 Professor
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EDUCATION

Ph.D., Chemistry, The Pennsylvania State University, US 2014/08-2018/12
B.S., Chemistry, Lanzhou University, CN 2008/08-2012/06

RESEARCH EXPERIENCE

青年研究员 **Professor**, Department of Macromolecular Science, Fudan University 2021/01-present

- My group widely pursues transformative advances in energy storage, energy conversion, and robotics by designing organic and polymer materials.

Vagelos Institute Postdoctoral Fellow, University of Pennsylvania 2019/12-2020/12

Advisor: Prof. James Pikul (Mechanical Engineering) and Prof. Karen Winey (Materials Science and Engineering)

- Designing electrochemical digestive system that provides energy for robots
- 3D printing stable rechargeable metal batteries

Postdoctoral, Penn State University 2019/01-2019/11

Advisor: Prof. Donghai Wang (Mechanical Engineering)

- Developed low-temperature batteries, involving the design of advanced battery materials.

Ph.D., Penn State University 2014/08-2018/12

Advisors: Prof. Donghai Wang (Mechanical Engineering) and Prof. Thomas Mallouk (Chemistry)

- Developed stable solid-electrolyte interphase (SEI) layer for lithium metal anodes, which involves the design of electrochemically reactive polymer-graphene oxide composites as SEI precursors.
- Build up organic-inorganic hybrid materials to stabilize the interface between lithium metal anodes and solid-state electrolyte (e.g. $\text{Li}_{10}\text{GeP}_2\text{S}_{12}$), which enables stable cycling of solid-state batteries.
- Design stable SEI layers for silicon anodes by bonding functional oligomers or ion pairs on the silicon surface as SEI components. The designed SEI layers have enhanced passivation and self-healing capability.

Graduate Research, Tsinghua University 2012/01-2014/06

Advisor: Prof. Yanmei Li (Chemistry)

- Synthesized and evaluated oligosaccharides, glycopeptides, and lipopeptides for anti-cancer vaccine design

B.S., Lanzhou University 2010/06-2011/12

Advisor: Prof. Hongbin Zhai (Chemistry)

- Learned the total synthesis of a natural product, (\pm)-Fawcettimine ($\text{C}_{16}\text{H}_{25}\text{NO}_2$).

PUBLICATIONS (<https://scholar.google.com/citations?user=GOz0VeYAAAAJ&hl=en>)

at Penn State:

1. Gao, Y.; Yan, Z.; Gray, J.; He, X.; Chen, T.; Huang, Q.; Li, Y.; Wang, H.; Kim, S.; Mallouk, T.; Wang, D. Polymer-inorganic solid-electrolyte interphase for stable lithium metal batteries under lean electrolyte conditions. **Nat. Mater.** 2019, 18(4), 384.
2. Gao, Y.; Wang, D.; Li, G.; Mallouk, T.; Wang, D. Low-temperature and high-rate-charging lithium metal batteries enabled by a fluorine-donating anode host with lithiophilic surface. **Nat. Energy**. Just accepted
3. Gao, Y.; Zhao, Y.; Li, Y. C.; Huang, Q.; Mallouk, T. E.; Wang, D. Interfacial chemistry regulation via a skin-grafting strategy enables high-performance lithium-metal batteries. **J. Am. Chem. Soc.** 2017, 139 (43), 15288.
4. Gao, Y.; Wang, D.; Li, Y.; Yu, Z.; Mallouk, T.; Wang, D. Salt-based organic-inorganic nanocomposites: towards a stable lithium metal/ $\text{Li}_{10}\text{GeP}_2\text{S}_{12}$ solid electrolyte interface. **Angew. Chemie Int. Ed.** 2018, 57 (41), 13608.

5. Gao, Y.; Yi, R.; Li, Y. C.; Song, J.; Chen, S.; Huang, Q.; Mallouk, T. E.; Wang, D. General method of manipulating formation, composition, and morphology of solid-electrolyte interphases for stable Li-alloy anodes. *J. Am. Chem. Soc.* 2017, *139* (48), 17359.
6. Gao, Y.; Chen, T.; Song, J.; Mallouk, T.; Wang, D. Self-sealing bilayer solid-electrolyte interphase stabilizes silicon microparticle anodes in lithium ion batteries. *in submission*.
7. Gao, Y.; Wang, D.; Shin, Y.; Hossain, J.; Han, Z.; Shen, S.; Van Duin, A.; Mallouk, T.; Wang, D. Conjugated-anion modified graphene allowing guided metal deposition and stable interface for metal anodes. *PNAS just accepted 2020*.
8. Li, G.; Liu, Z.; Huang, Q.; Gao, Y.; Regula, M.; Wang, D.W.; Chen, L.Q.; Wang, D. Stable metal anodes enabled by electrokinetic phenomena. *Nat. Energy* 2018, *3*, 1076.
9. Li, G.; Gao, Y.; He, X.; Chen, S.; Kim, S. H.; Wang, D. Organosulfide-plasticized solid-electrolyte interphase layer enables stable lithium metal anodes for long-cycle lithium-sulfur batteries. *Nat. Commun.* 2017, *8* (1), 850.
10. Huang, Q.; Song, J.; Gao, Y.; Wang, D.; Liu, S.; Peng, S.; Usher, C.; Goliaszewski, A.; Wang, D. Supremely elastic gel polymer electrolyte enables a reliable electrode structure for silicon-based anodes *Nat. Commun.* 2019, *10*, 5586.
11. Yang, X.; Liu, T.; Gao, Y.; Ge, S.; Leng, Y.; Wang, D.; Wang, C.; Asymmetric Temperature Modulation for Extreme Fast Charging of Lithium-Ion Batteries. *Joule* 2019, 1–18.
12. Ge, S.; Leng, Y.; Liu, T.; Longchamps, R.; Yang, X.; Gao, Y.; Wang, D.; Wang, D.; Wang, C. A new approach to both high safety and high performance of lithium-ion batteries. *Sci. Adv.* 2019, just accepted
13. Chen, S.; Dai, F.; Gordin, M. L.; Yu, Z.; Gao, Y.; Song, J.; Wang, D. Functional organosulfide electrolyte promotes an alternate reaction pathway to lithium-sulfur batteries. *Angew. Chemie Int. Ed.* 2016, *55* (13), 4231.
14. Chen, S.; Gao, Y.; Yu, Z.; Gordin, M. L.; Song, J.; Wang, D. High capacity of lithium-sulfur batteries at low electrolyte/sulfur ratio enabled by an organosulfide containing electrolyte. *Nano Energy* 2017, *31*, 418.
15. Zhao, Y.; Li, G.; Gao, Y.; Wang, D.; Huang, Q.; Wang, D. Stable Li Metal Anode by a Hybrid Lithium Polysulfidophosphate/Polymer Cross-Linking Film. *ACS Energy Lett.* 2019, *4*, 1271.
16. Yu, Z.; Shang, S. L.; Gao, Y.; Wang, D.; Li, X.; Liu, Z. K.; Wang, D. A quaternary sodium superionic conductor- $\text{Na}_{10.8}\text{Sn}_{1.9}\text{PS}_{11.8}$ *Nano Energy* 2018, *47*, 325.
17. Li, G.; Huang, Q.; He, X.; Gao, Y.; Wang, D.; Kim, S. H.; Wang, D. Self-Formed Hybrid Interphase Layer on Lithium Metal for High-Performance Lithium–Sulfur Batteries. *ACS Nano* 2018, *12* (2), 1500.
18. Yu, Z.; Shang, S.; Wang, D.; Li, Y.; Yennawar, H.; Li, G.; Gao, Y.; Mallouk, T.; Liu, Z.; Wang, D.; Synthesis and Understanding of $\text{Na}_{11}\text{Sn}_2\text{PSe}_{12}$ with Enhanced Ionic Conductivity. *Energy Storage Mater.*, 2019, *17*, 70.
19. Zhao, Y., Wang, D., Gao, Y., Chen, T., Huang, Q., & Wang, D. Stable Li metal anode by a polyvinyl alcohol protection layer via modifying solid-electrolyte interphase layer. *Nano Energy*, 2019, *64*, 103893.

at Tsinghua:

20. Gao, Y.; Sun, Z.; Huang, Z.; Chen, Y.; Zhao, Y.; Li, Y. Covalent Bond or Noncovalent Bond: A Supramolecular Strategy for the Construction of Chemically Synthesized Vaccines. *Chem.-A Eur. J.* 2014, *20*, 13541.
21. Huang, Z.; Sun, Z.; Gao, Y.; Chen, P.; Liu, Y.; Chen, Y.; Zhao, Y.; Li, Y. Strategy for designing a synthetic tumor vaccine: Multi-component, multivalency and antigen modification. *Vaccines*. 2014, *2*, 549.
22. Liu, Y.; Sun, Z.; Chen, P.; Huang, Z.; Gao, Y.; Shi, L.; Zhao, Y.; Chen, Y.; Li, Y. Glycopeptide nanoconjugates based on multilayer self-assembly as an antitumor vaccine. *Bioconjug. Chem.* 2015, *26*, 1439.

CONFERENCE PRESENTATIONS

1. Gao, Y.; Mallouk, T.; Wang, D., “Interfacial chemistry regulation via a skin-grafting strategy enables stable lithium-metal batteries.” Materials Research Society Fall Meeting. 2017. Boston. (Oral presentation)
2. Gao, Y.; Mallouk, T.; Wang, D., “Solid-electrolyte interphase reinforcement through introducing covalently anchored components for Li-alloy anodes.” 232nd Electrochemical Society Fall Meeting. 2017. Oxon Hill. (Poster)
3. Gao, Y.; Mallouk, T.; Wang, D., “Design of a stable solid-electrolyte interphase for the lithium metal battery anode.” Materials Research Society Fall Meeting. 2018. Boston. (Oral presentation)
4. Gao, Y.; Mallouk, T.; Wang, D., “Design stable solid-electrolyte interphase for anodes in rechargeable lithium batteries” Materials Research Society Fall Meeting. 2018. Boston. (Student Award talk)

PATENT APPLICATION

1. Wang, D.; Gao, Y., Functionalized Alloy Anode with Artificial SEI Components Li-ion Batteries; PSU 2017-4633.
2. Wang, D.; Mallouk, T.; Gao, Y., Reactive Polymer Composite for Metal Anode Protection for metal Batteries; PSU 2019-4890.

HONORS AND AWARDS

Vagelos Institute Postdoctoral Fellowship at the University of Pennsylvania	<i>2020</i>
Young Investigator of Department of Energy Battery500 Consortium	<i>2019</i>
Materials Research Society Graduate Student Award, Silver	<i>2018</i>
Chinese government award for outstanding self-financed students abroad	<i>2018</i>
Penn State Graduate Student Award (ranked 1 st in Chemistry Department)	<i>2018</i>
Undergraduate Scholarship, Lanzhou University	<i>2011</i>

PROFESSIONAL SERVICE

Independent reviewer for Scientific Reports, Macromolecules, Advanced Energy Materials	<i>2015-Present</i>
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CLASS WORK AND TEACHING

Penn State Teaching Assistant, "Experimental Chemistry"	<i>Fall 2015, Fall 2018</i>
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