

Jinsong Xia

Research Scientist at Caltech

Contact

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Education

PhD	Mining Engineering Queen's University	09/2019 – 05/2023 Kingston, Ontario, Canada
MS	Materials Science and Engineering Hainan University	09/2015 – 06/2018 Haikou, Hainan, China
BS	Materials Science and Engineering Hainan University	09/2011 – 06/2015 Haikou, Hainan, China

Professional Experience

Research Scientist	Liquid Sunlight Alliance (LiSA), Caltech	10/2023 – Present Pasadena, California, USA
Main duties: Design and conduct independent research projects related to renewable energy and solar fuels; Prepare grant proposals; Writing research papers; Collaborate with team members and external partners		
Casual Research Associate	Department of Mining, Queen's University	07/2023 – 09/2023 Kingston, Ontario, Canada
Main duties: Design and conduct independent research projects related to gold recovery and waste recycling; Writing and publishing research papers		
Teaching Fellow	Department of Mining, Queen's University	09/2022 – 12/2022 Kingston, Ontario, Canada
Main duties: Teach MNTC P05 Foundational Physics with full responsibility		
Teaching Assistant	Queen's University	05/2020 – 04/2022 Kingston, Ontario, Canada
Main duties: Assist in teaching several undergraduate courses		
Compound Design Engineer	Giti Tire R&D Center	11/2018 – 05/2019 Hefei, Anhui, China
Main duties: Design tire compounds for commercial passenger vehicles; Design and conduct lab-scale experiments; Supervise plant-scale operations; Collaborate with team members and external partners		

Research Projects

Research Scientist Period (10/2023 – present)

- **Development of Bipolar Membranes for Electrodialysis and Reverse Electrodialysis**
Through customizing bipolar membranes, we achieve state-of-the-art performance in both electrodialysis and reverse electrodialysis systems for acid base production and harvesting of acid base neutralization energy.
 - **Reactive Carbon Capture and Conversion Technologies**
I am working on electrocatalyst development for an electrochemical reactive carbon capture system for simultaneous carbon capture and conversion, which delivers significant cost advantages compared to conventional sequential capture and utilization technologies.
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Doctoral Period (09/2019 – 06/2023)

- **The Application of Magnetic Adsorbents in Gold Recovery**
The existing gold recovery process in the industry suffers from low efficiency and separation challenges. To revolutionize the conventional gold recovery process, the idea of using magnetic adsorbents was proposed. I developed several magnetic adsorbents, such as magnetic iron sulfide, magnetic activated carbon, core-shell structured $\text{Fe}_3\text{O}_4@\text{CuS}$. In addition to the improved capacity, selectivity, and kinetics, the adsorbents have favorable magnetism for effective magnetic separation.
 - **The Recycling of Precious Metals from Secondary Resources**
To achieve a circular economy, valuable secondary resources must be properly recycled. I investigated the extraction and recovery technologies for the recycling of precious metals from e-waste and spent automotive catalysts. I also performed hydrometallurgical experiments to extract copper and gold from printed circuit boards.
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Master's Period (09/2015 – 06/2018)

- **Conversion of Biocarbon to Graphene and Its Application in a Supercapacitor**
Biocarbon has a hard carbon structure, which is hard to graphitize even at 3000 °C. In this project, biocarbon derived from coconut shell, was effectively converted to graphene at just 900 °C via the catalytic effect of potassium carbonate. With the high specific surface area and high conductivity, the fabricated graphene was an ideal electrode material for electrostatic double-layer capacitors.
- **Chemical Activation Synthesis and Electrochemical Testing of Porous Carbon**
Coconut shell-based carbon materials are widely used activated carbon for various applications, including supercapacitors. I fabricated porous carbon with high specific surface area using potassium hydroxide as the chemical activation reagent. The activated carbon materials were characterized using various material characterization approaches and tested in coin cell supercapacitors as the electrode materials.

Teaching Experience

As Course Instructor

09/2022 – 12/2022

MNTC P05 Foundational Physics**Department of Mining, Queen's University**

Course overview: A bridge course for students entering the Bachelor of Mining Engineering Technology program from a college diploma program or the workforce. The course is comprised of a combination of videos, readings and learning activities, providing learners with the knowledge and skills in physics that will be necessary for future technical engineering courses.

Duties: Full responsibility of the course. Develop course syllabus and extra-curriculum learning activities; teach and supervise students using lectures, projects, assignments, discussion forums; provide feedback; prepare and grade the reports, assignments, and final exam.

As Teaching Assistant

01/2022 – 04/2022

MINE 268 Analytical Methods in Mining**Department of Mining, Queen's University**

Course overview: This course exposes the students to the analytical techniques utilized in the mining and the mineral processing industries, the content includes the principles of the analytical technique and the practical use of the technique.

Duties: Prepare and demonstrate the experiments; supervise and assist students to perform the experiments safely and successfully; grade the reports and provide feedback.

01/2022 – 04/2022

CHEM 112 General Chemistry**Department of Chemistry, Queen's University**

Course overview: This course explores the foundations of modern chemistry: structure and bonding, phases of matter, thermodynamics, acids, bases, electrochemistry, equilibria, kinetics and organic chemistry.

Duties: Lead the laboratory experiments; assist students to conduct the experiments safely and successfully; grade lab reports; answer questions; provide feedback.

10/2021 – 12/2021

APSC 100 Module 2 Introduction to Experimentation**Faculty of Engineering and Applied Science, Queen's University**

Course overview: This course is meant to serve as an introduction to experimental practices, data collection, error analysis, and results interpretation as well as provide additional experience using Excel, Word, and MatLab.

Duties: Lead the laboratory experiments, grade lab reports, provide feedback, assist students to conduct the experiments safely and successfully.

01/2021 – 04/2021

MNTC 306 Mineral Processing Unit Operations**Department of Mining, Queen's University**

Course overview: This course focuses on unit operations of mineral processing, introduce mineral separation processes of a physical and physicochemical nature.

Duties: Grade the assignments, reports, and final exam; answer students' questions regarding course materials and assignments; assist in setting up and running the final exam.

09/2020 – 12/2020 **MINE 422 Mining and Sustainability**
Department of Mining, Queen's University

Course overview: This course describes the evolution of policies, operational procedures and management systems related to sustainability and the social, economic, environmental, ethical, and technical design challenges facing the mining industry.

Duties: Grade the reports; answer questions; provide feedback.

05/2020 – 08/2020 **CHEM 113 General Chemistry**
Department of Chemistry, Queen's University

Course overview: This course provides a quantitative treatment of chemical phenomena and materials. Topics include atomic structure and molecular bonding, organic chemistry, and condensed phases.

Duties: Grade the assignments; answer questions regarding the assignments and course content; provide feedback; assist the preparation of the final exam questions.

Management and Leadership Experience

Supervisor of an Undergraduate Research Assistant at Queen's U. 05/2021 – 12/2021

Supervisor of an Undergraduate Research Assistant at Caltech. 02/2025 – present

Duties: Train the RA in lab and research skills, supervise the RA's research, collaborate on several research projects, and write and publish research papers.

Honors and Awards

Margaret Anderson Graduate Scholarship 08/2022

School of Graduate Studies, Queen's University

Pickles Family Scholarship 03/2022

Department of Mining, Queen's University

Dean's Teaching Assistant Award 06/2021

Faculty of Engineering and Applied Science, Queen's University

Peer-Reviewed Journal Articles (*Corresponding author)

1. **Jinsong Xia***, Ahmad Ghahreman, Sustainable Technologies for the Recycling and Upcycling of Precious Metals from E-waste, *Science of the Total Environment*, 2024, 916, 170154
<https://doi.org/10.1016/j.scitotenv.2024.170154>
2. **Jinsong Xia***, Ahmad Ghahreman, Core-Shell Structured Fe₃O₄@CuS for Effective Gold Capture and Recovery. *ACS Applied Nano Materials*, 2023, 6, 12, 10837–10844

- (<https://doi.org/10.1021/acsanm.3c01772>)
3. **Jinsong Xia***, Ahmad Ghahreman, Platinum Group Metals Recycling from Spent Automotive Catalysts: Metallurgical Extraction and Recovery Technologies. *Separation and Purification Technology*, 2023, 311, 123357
(<https://doi.org/10.1016/j.seppur.2023.123357>)
 4. **Jinsong Xia***, Julia Twinney, Rajashekhar Marthi, Ahmad Ghahreman, *Ultra-efficient and Selective Recovery of Au(III) Using Magnetic Fe₃S₄/Fe₇S₈*. *Separation and Purification Technology*, 2023, 306, Part A, 122611
(<https://doi.org/10.1016/j.seppur.2022.122611>)
 5. **Jinsong Xia***, Rajashekhar Marthi, Julia Twinney, Ahmad Ghahreman, A Review on Adsorption Mechanism of Gold Cyanide Complex onto Activation Carbon. *Journal of Industrial and Engineering Chemistry*, 2022, 111, 35-42
(<https://doi.org/10.1016/j.jiec.2022.04.014>)
 6. **Jinsong Xia**, Harshit Mahandra, Ahmad Ghahreman, Efficient Gold Recovery from Cyanide Solution Using Magnetic Activated Carbon. *ACS Applied Materials & Interfaces*, 2021, 13, 40, 47642–47649
(<https://doi.org/10.1021/acsami.1c13920>)
 7. **Jinsong Xia**, Na Zhang, Shaokun Chong, De Li, Yong Chen, Chenghua Sun, Three-dimensional porous graphene-like sheets synthesized from biocarbon via low-temperature graphitization for a supercapacitor. *Green Chemistry*, 2018, 20, 694-700
(<https://doi.org/10.1039/C7GC03426A>)
- 2018 Green Chemistry Hot Articles**
8. Na Liu, Yanli Su, Zhiqiang Wang, Zhen Wang, **Jinsong Xia**, Yong Chen, Zhigang Zhao, Qingwen Li, Fengxia Geng, Electrostatic-Interaction-Assisted Construction of 3D Networks of Manganese Dioxide Nanosheets for Flexible High-Performance Solid-State Asymmetric Supercapacitors. *ACS Nano*, 2017, 11, 7879–7888
(<https://doi.org/10.1021/acs.nano.7b02344>)
 9. Chao Yao, Yan Mo, Xiaobo Jia, Xianglei Chen, **Jinsong Xia**, Yong Chen, LiMnPO₄ surface coating on LiNi_{0.5}Co_{0.2}Mn_{0.3}O₂ by a simple sol-gel method and improving electrochemical properties. *Solid State Ionics*, 2018, 317, 156-163
(<https://doi.org/10.1016/j.ssi.2018.01.018>)
 10. Bo Hou, Lihong Yin, **Jinsong Xia**, Rongwei Yan, Yong Chen, Research progress of electrode materials for Super-capacitor. *Journal of Henan University (Natural Science)*, 2016, 46, 286-299
(<https://doi.org/10.15991/j.cnki.411100.2016.03.004>)
 11. Rongwei Yan, Bo Hou, **Jinsong Xia**, Shuo Yang, Feng Yu, Yong Chen, Adjustment of Pore Structure of Coconut Shell Activated Carbon and Its Influence on the Performance of Supercapacitors. *Journal of synthetic crystals*, 2018, 47, 550-555
(<http://doi.org/10.16553/j.cnki.issn1000-985x.2018.03.016>)

Patent

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1. Yong Chen, **Jinsong Xia**, Chenhua Sun, *A method of preparing three-dimensional porous graphene sheets and its application*. Publication Number: CN108002370A, 2018-05-08 (<https://patents.google.com/patent/CN108002370A/zh>)

Selected Professional Services

Role	Journal	Publisher
Guest editor	Sustainability https://www.mdpi.com/journal/sustainability/special_issues/2TOTYOL507	MDPI
Reviewer	Nature Communications	Nature Portfolio
	Journal of Materials Chemistry A	Royal Society of Chemistry
	ChemComm	Royal Society of Chemistry
	Inorganic Chemistry Frontiers	Royal Society of Chemistry
	Desalination	Elsevier
	Chemical Engineering Journal	Elsevier
	Journal of Colloid and Interface Science	Elsevier
	Separation and Purification Technology	Elsevier
	Materials Today Chemistry	Elsevier
	Journal of Water Process Engineering	Elsevier

Selected Conference Presentations

Jinsong Xia, Zishuai Bill Zhang, Éowyn Lucas, Harry Atwater, Chengxiang Xiang, “Bipolar Membranes in Forward-bias Mode for Energy Storage & Thermochemical CO₂ Hydrogenation to Liquid Fuels”, LiSA 2023 All Hands Meeting, Pacific Grove, CA 11/2023

Jinsong Xia, Rajashekhar Marthi, Julia Twinney, Ahmad Ghahreman, “The study of Au(III) recovery using iron sulfide materials”, Gold 2022 Conference, Québec city, Canada, 07/2022

Jinsong Xia, “Magnetic Activated Carbon for Efficient Gold Recovery”, Canada National - Young Person’s Lecture Competition, received the 3rd place, Virtual, 06/2021

Jinsong Xia, Na Zhang, Shaokun Chong, De Li, Yong Chen, “Porous graphene-like sheets prepared by low-temperature catalytic graphitization from biocarbon and its application in supercapacitor”, The 1st International Conference on Energy Storage Materials, Shenzhen, China, 11/2017