

Zhen Xiao, PhD

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Summary

Eager for knowledge, particular about research, and passionate about life. 7+ years of experience in nanomaterials synthesis and characterizations. 4+ years of experience in applying nanomaterials toward environmental and biomedical applications. I am especially interested in the in vivo imaging of tumors and pathogens. I always solve problems with a positive attitude and am able to coordinate teamwork quickly and efficiently.

Research Experience

June 2022- Present

Postdoctoral Scholar

[Molecular Imaging Program at Stanford](#), Advisor: Prof. Jianghong Rao

- Applying magnetic nanomaterials for cancer imaging using magnetic resonance imaging (MRI), magnetic particle imaging (MPI), and magnetically targeted drug delivery for cancer treatment
- Developing smart MRI and MPI probes for various biological activity monitoring, including granzyme B activity in tumor response to cancer immunotherapy
- Applying gold nanomaterials-based Raman probes for the detection of Mycobacterium tuberculosis and extended-spectrum beta-lactamase-producing bacteria. Achieved 1000-fold improvement in sensitivity and shortened assay time from days to 1 hour in small volumes of biological samples
- Developing new formulation of lipid nanoparticles that depletes the mitochondrial copper in the tumor cells for efficient and safe cancer treatment

Sept 2017- May 2022

Graduate Researcher

[Brown University](#). Advisor: Prof. Vicki L. Colvin

- Achieved systematic synthesis of magnetic nanoclusters with ten times higher magnetic susceptibility than conventional magnetic nanoparticles. Also demonstrated that these nanoclusters have excellent magnetic separation and heating efficiency
- Developed sulfonated copolymers as coatings for these nanoclusters and achieved high colloidal stability, making them useful as MRI T2 contrast agents and photonic crystals
- Explored the potentials of magnetic nanoclusters for drug delivery, cancer treatment, and in-vivo imaging
- Synthesized manganese-doped iron oxide nanoclusters with higher magnetic susceptibilities and applied them for magnetothermal degradation of environmental

contaminants

- Prepared hierarchical magnetic assemblies of one-dimensional chains with controlled length, which are able to affect rapid mixing as nanoscale stir bars

Mar 2015- June 2017

Undergraduate Researcher

Beihang University. Advisor: Prof. Ying Zhu

Research Project: Nanomaterial for energy conversion devices

- Synthesized porous carbon nanomaterials derived from biomass as efficient electrocatalysts

Jun 2016- Sept 2016

Research Intern

University of New Brunswick, Advisor: Prof. David I. MaGee

Research Project: Pest Management Using Green Technology

- Designed green synthetic route for natural compound (Blueberry beetle pheromone)

Education Background

Sept 2017- Doctor of Philosophy, PhD in Chemistry

May 2022 Brown University, Department of Chemistry, Providence, Rhode Island, USA
Thesis: Magnetic nanocrystal clusters: understanding, shaping, and exploiting their giant susceptibility [🔗](#)

Aug 2018 Summer School for Electron Microscopy

Harvard University, Center for Nanoscale Systems, Boston, Massachusetts, USA

Jun 2016- Research Intern

Sept 2016 University of New Brunswick, Department of Chemistry, New Brunswick, Canada

Sept 2013- Bachelor of Science in Chemistry, GPA: **3.85/4.00**

June 2017 Beihang University (BUAA), School of Chemistry and Environment, Beijing, China

Thesis: Plant derived cobalt doped carbon nanomaterial as an efficient electrocatalysts for oxygen reduction reaction

Publications

Total Citations: 265 (as of 03/20/2023)

h-index: 7

- 1) The Giant Susceptibility of Magnetic Nanoclusters. Zhang, Q., **Xiao, Z.** (co-first), Colvin, V.L., et al. *Nature*, in preparation
- 2) Sensitive T2 MRI Contrast Agents from the Rational Design of Iron Oxide Nanoparticle Surface Coatings. Minjung Cho, Jake Villanova, Dylan M. Ines, Jingge Chen, Seung Soo Lee,

- Zhen Xiao**, Xiaoting Guo, Joshua A. Dunn, Deanna D. Stueber, Paolo Decuzzi, Vicki L. Colvin. *The Journal of Physical Chemistry C*, 2023 [↗](#)
- 3) Multifunctional Magnetic Nanoclusters Can Induce Immunogenic Cell Death and Suppress Tumor Recurrence and Metastasis. Linlin Zhang, Qingbo Zhang, Daniel T. Hinojosa, Kaiyi Jiang, Quoc-Khanh Pham, **Zhen Xiao**, Vicki L. Colvin, Gang Bao. *ACS Nano*, 2022 [↗](#)
 - 4) Increasing the antioxidant capacity of ceria nanoparticles with catechol-grafted poly (ethylene glycol). Yue Hu, Qingbo Zhang, Daniel Garcia-Rojas, Vivian Ling, Caitlin M Masterson, Yidan Bi, **Zhen Xiao**, Xiaoting Guo, Jake Villanova, Joshua Dunn, Vicki L Colvin. *Journal of Materials Chemistry B*, 2022, 10, 10042-10053 [↗](#)
 - 5) Stable Aqueous Suspensions of Manganese Ferrite Clusters with Tunable Nanoscale Dimension and Composition. Samuel Effman, Shawn Avidan, **Zhen Xiao** (co-first), Vicki Colvin. *Journal of Visualized Experiments*, 2022, e63140 [↗](#)
 - 6) When function is biological: Discerning how silver nanoparticle structure dictates antimicrobial activity. Qingbo Zhang, Yue Hu, Caitlin M Masterson, Wonhee Jang, **Zhen Xiao**, Arash Bohloul, Daniel Garcia-Rojas, Hema L Puppala, George Bennett, Vicki L Colvin. *Iscience*, 2022, 25, 104475 [↗](#)
 - 7) Sub-second Multi-channel Magnetic Control of Select Neural Circuits in Behaving Flies. Charles Sebesta, Daniel Torres Hinojosa, Boshuo Wang, Joseph Asfour, Zhongxi Li, Guillaume Duret, Kaiyi Jiang, **Zhen Xiao**, Linlin Zhang, Qingbo Zhang, Vicki L. Colvin, Stefan M. Goetz, Angel V. Peterchev, Herman A. Dierick, Gang Bao & Jacob T. Robinson. *Nature Materials*, 2022, 21, 951-958 [↗](#)
 - 8) Synthesis and Application of Magnetic Nanocrystal Clusters. **Zhen Xiao**, Linlin Zhang, Vicki L Colvin, Qingbo Zhang, Gang Bao. *Industrial & Engineering Chemistry Research*, 2022, 61, 22, 7613 [↗](#)
 - 9) Controlled oxidation and surface modification increase heating capacity of magnetic iron oxide nanoparticles. Kaiyi Jiang, Qingbo Zhang, Daniel Torres Hinojosa, Linlin Zhang, **Zhen Xiao**, Yu Yin, Sheng Tong, Vicki L Colvin, Gang Bao. *Applied Physics Reviews*, 2021, 8, 031407 [↗](#)
 - 10) Nanoparticle-Catalyzed Green Chemistry Synthesis of Polybenzoxazole. Mengqi Shen, Chao Yu, Huanqin Guan, Xiang Dong, Cooro Harris, **Zhen Xiao**, Zhouyang Yin, Michelle Muzzio, Honghong Lin, Jerome R Robinson, Vicki L Colvin, Shouheng Sun. *Journal of the American Chemical Society*, 2021, 143, 4, 2115–2122 [↗](#)
 - 11) 2D Gadolinium Oxide Nanoplates as T1 Magnetic Resonance Imaging Contrast Agents. Gary Stinnett, Nasim Taheri, Jake Villanova, Arash Bohloul, Xiaoting Guo, Edward P Esposito, **Zhen Xiao**, Deanna Stueber, Carolina Avendano, Paolo Decuzzi, Robia G Pautler, Vicki L Colvin. *Advanced Healthcare Materials*, 2021, 10, 2001780 [↗](#)
 - 12) Magnetic nanoparticles in biology and medicine: past, present, and future trends. Deanna D Stueber, Jake Villanova, Itzel Aponte, **Zhen Xiao**, Vicki L Colvin. *Pharmaceutics*, 2021, 13, 943 [↗](#)
 - 13) Forming Libraries of Uniform Magnetic Multicore Nanoparticles with Tunable Dimensions and their Applications. **Zhen Xiao**, Qingbo Zhang, Xiaoting Guo, Jake Villanova, Yue Hu, Indrek Külaots, Daniel Garcia-Rojas, Wenhua Guo, Vicki L Colvin. *ACS Applied Materials & Interfaces*, 2020, 12, 41932 [↗](#)
 - 14) Homogeneously Dispersed Co₉S₈ Anchored on Nitrogen and Sulfur Co-Doped Carbon Derived from Soybean as Bifunctional Oxygen Electrocatalysts and Supercapacitors. **Zhen Xiao**, Guozheng Xiao, Minhao Shi, Ying Zhu. *ACS Applied Materials & Interfaces*, 2018, 10, 16436 [↗](#)


- 15) Natural tea-leaf-derived, ternary-doped 3D porous carbon as a high-performance electrocatalyst for the oxygen reduction reaction. Zhaoyan Guo, **Zhen Xiao** (co-first), Guangyuan Ren, Guozheng Xiao, Ying Zhu, Liming Dai, Lei Jiang. *Nano Research*, 2016, 9, 1244 [🔗](#)
- 16) China rose-derived tri-heteroatom co-doped porous carbon as an efficient electrocatalysts for oxygen reduction reaction. **Zhen Xiao**, Xiaoyu Gao, Minhao Shi, Guangyuan Ren, Guozheng Xiao, Ying Zhu, Lei Jiang. *RSC advances*, 2016, 6, 86401 [🔗](#)


Advisory Committee and Mentorship Experience

- Guest Editor
Special Issue "Semiconductor Nanomaterials for Energy Conversion and Environmental Applications" in *Crystal*, MDPI, 2022 [🔗](#)
- Manuscript Reviewer: RSC Advances
 - Nano-Structures & Nano-Objects
 - Magnetochemistry
 - Crystals
 - Molecules
 - Pharmaceutics
 - Nanoscience and Nanometrology
 - Journal of Advances in Biotechnology
 - Journal of Advances in Physics
 - Journal of Advances in Biology
 - Journal of Visualized Experiments
- Faculty collaborator on SPRINT|UTRA project(s), Brown University
Project title: Supersusceptible Magnetic Nanoclusters: Optimizing Dimension and Composition to Form Highly Responsive Magnetic Materials
Students Mentored: Samuel Effman, Junior in Chemical Engineering, Brown University, samuel_effman@brown.edu; Shawn Avidan, Junior in Chemistry, Brown University, shawn_avidan@brown.edu

Conference

- ACS Spring, March 2022, Poster presentation - Virtual
Highly Responsive Manganese Ferrite Clusters toward Efficient Magnetic Heating using Battery-operated Inductive Heaters [🔗](#)
- Pharma R&D, February 2022, San Francisco, CA, Oral presentation
Highly Responsive Magnetic Nanoclusters for Biomedical Applications [🔗](#)
- ACS Spring 2020 National Meeting, Philadelphia, PA, Poster presentation - Virtual
Magnetic Multicore Iron Oxide Nanoparticles with Tunable Dimensions and their Biomedical Applications [🔗](#)
- TechConnect World Innovation, July 2019, Boston, MA, Poster presentation

Magnetic Multicore Iron Oxide Nanoparticles with Tunable Dimensions and their Biomedical Applications 

- Northeast Bioengineering Conference, March 2019, New Brunswick, NJ, Oral presentation Forming Libraries of Magnetic Multicore Nanoparticles with Tunable Dimensions and their Biomedical Applications 

Professional Skills

Nanotechnology/Materials Chemistry

Synthesis of various nanomaterials, including porous carbon nanomaterials, iron oxide nanoparticles, gold and silver nanoparticles, polymeric and lipid nanoparticles

Synthesis of polymers for nanoparticle functionalization and stabilization

Bioconjugation of nanoparticles for in vitro and in vivo studies

Electron Microscopy

Transmission electron microscopy (TEM), TEM tomography, scanning electron microscopy (SEM), Cryo-SEM, focused ion beam (FIB-SEM)

Able to acquire high-resolution images

Cell Culture

Human and murine cancer cell culture
Cytotoxicity assays, IC50 determination, dose response studies

Nanoparticles cellular uptake studies

Pre-clinical Studies

Xenograft of tumors on mice
Introtumoral, intravenous, and subcutaneous injection on mice
Post-mortem surgical procedures

Materials Characterization

X-ray photoelectron spectroscopy (XPS), X-ray crystallography (XRD), nuclear magnetic resonance (NMR), infrared spectroscopy (IR), UV-Vis spectroscopy, Raman spectroscopy, thermal gravimetric analysis (TGA), vibrating-sample magnetometer (VSM)

Measurement of particle size, coating and stability in media using DLS and zeta potential
Chromatography, GC, GC-MS and HPLC

Imaging Technique

Magnetic resonance imaging (MRI), magnetic particle imaging (MPI), X-ray Computed Tomography (CT)

Preparation of efficient MRI and MPI contrast agent for in vivo bioimaging

Microbiological Culture

Broth culture of lactam-resistant E. coli and Mycobacterium

Software

Origin, GraphPad Prism, ImageJ, Photoshop, Blender, Microsoft Office

Proficient in making graphics/schematics for academic presentations and publications

AWARDS

- Outstanding Student Poster Award, ACS Division of Colloid and Surface Chemistry, 2022
- Philip A. Smith '26 Chemistry Fellowship, Brown University, 2018
- Shenyuan Medal, Beihang University, 2017
The highest honor for undergraduate students
- Outstanding Award in Baosteel Education Fund, 2016
Only five among 14,000 undergraduate students
- Nano Research Paper of the Month Award, Tsinghua University Press, 2016