

Zhe Gao, PhD

gaoxx656@umn.edu

Cell: (801) 574-7678

Area of Interest

Nanomaterials, degradable materials, drug delivery

Education

Ph.D. in Chemistry, (May 2013), University of Utah, Salt Lake City, Utah GPA: 3.96

B.S. in Chemistry (July 2007), Jilin University, Changchun, Jilin Province, China

Technical Skills

- Synthesis, surface modification and characterization of nanoparticles
- Experienced in instruments: NMR spectroscopy, High-Resolution Scanning Electron Microscope, Transmission Electron Microscopy, Cyclic Voltammetry, Dynamic Light Scattering, Fluorescence Spectrometer, UV-Vis Spectroscopy, FT-IR Spectrometer, Thermogravimetric Analysis, X-Ray Diffraction, Nitrogen Sorption Measurements.
- Knowledge of materials chemistry, surface science, nanomaterials, drug delivery, proteins and polymer materials.

Research and Teaching Experiences

Graduate research

- Synthesis of large-pore tannic acid-templated mesoporous silica nanoparticles

Tannic acid (TA) was used as a pore-directing agent for the very first time. The TA-templated mesoporous silica nanoparticles (TA-SiNPs) revealed a unique mesoporous structure, good monodispersity and an average size of approximately 200 nm, which make them good candidates for bio-molecule carriers.

- Immobilization of enzymes in TA-SiNPs

Several enzymes were physically adsorbed into the pores of TA-SiNPs ultrafast. The stability and catalytic activity of the immobilized proteins were investigated.

- Bio-compatible boron nanoparticles for boron neutron capture therapy (BNCT)

The boron nanoparticles were first produced via ball milling approach followed by ligand exchange to convert the particle from hydrophobic to hydrophilic. The surface ligands provided active sites for further functionalization of the particles with imaging and targeting ligands. Together with its low toxicity, these boron nanoparticles carry the largest amount of boron among other BNCT agents is considered as a promising boron delivery agent to treat cancer. Silica-coated boron nanoparticles were also produced as a potential boron delivery agent.

- Preparation of hybrid degradable silsesquioxane nanoparticles

Bio-accumulation of silica materials is always a concern in their applications as bio-medicine or drug carriers. A silsesquioxane with cleavable bridge was synthesized to develop a new kind of silica material that degrades in water and simulated blood fluid.

- Mixed matrix membranes incorporating calixarene-silica nanoparticles for biofuel recovery

Novel membranes were prepared by mixing silica nanoparticles, surface modified with supramolecular receptors, calixarenes, and poly(dimethylsiloxane) to possess superior permeability and selectivity for alcohols. The goal of this project is to develop the pervaporation membranes for isolation and purification of biomass-produced biofuels, sustainable materials of worldwide importance.

Undergraduate research

Multiple Fluorescent Dye doped Silica Nanoparticles as bio-imaging agents

Teaching experience

- 2007-2008, 2013-present: Teaching assistant (Physical Chemistry, Advanced Physical Chemistry Lab, General Chemistry Lab I, General Chemistry Lab II) at the University of Utah

- 2003-2005: High school student tutor in English, Mathematics, Physics, and Chemistry

Publications and Presentations

1. **Zhe Gao**, Nathan I. Walton, Alexander Malugin, Hamidreza Ghandehar and Ilya Zharov, Preparation of dopamine-modified boron nanoparticles, *Journal of Material Chemistry.*, **2012**, 22, 877-882.
2. Zharov, I.; **Gao. Z.**; Walton, N. I. Method for Preparation of Water-Dispersible Boron Nanoparticles, Patent Disclosure to the University of Utah, 10/25/11.
3. **Zhe Gao**, Ilya Zharov, Preparation of degradable silsesquioxane nanoparticles. Being submitted.
4. **Zhe Gao**, Ilya Zharov, Tannic Acid-Templated Mesoporous Silica Nanoparticles. Being submitted.
5. Nathan Walton, **Zhe Gao** and Ilya Zharov, Boron-Silica Core-Shell Nanoparticles. Being submitted.
6. **Zhe Gao** and Ilya Zharov, Tannic Acid-Templated Mesoporous Silica Nanoparticles. NanoUtah 2012, Salt Lake City, UT, October 2012 (poster).
7. **Zhe Gao** and Ilya Zharov, Preparation of Degradable Silsesquioxane Nanoparticles. The 243rd ACS National Meeting, San Diego, CA, March 2012 (oral). **Received University of Utah Graduate School Travel Award to attend this conference.**
8. **Zhe Gao**, Nathan Walton and Ilya Zharov, Preparation of Biocompatible Boron Nanoparticles as a New Generation of Boron Delivery Agent. nanoUtah 2011, Salt Lake City, UT, October 2011 (poster). **Received Best Poster Award for this presentation.**
9. Zharov, I.; Brozek, E. M.; Gao, Z.; Walton, N. I. Biocompatible Boron Nanoparticles for Boron Neutron Capture Therapy. The 9th International Nanomedicine and Drug Delivery Symposium, Salt Lake City, UT, October 2011 (poster).
10. **Zhe Gao** and Ilya Zharov, Biocompatible Boron Nanoparticles for Boron Neutron Capture Therapy. The 241st ACS National Meeting, Anaheim, CA, March 2011 (oral)
11. **Zhe Gao**, Nathan Walton and Ilya Zharov, Biocompatible Boron Nanoparticles. nanoUtah 2010, Salt Lake City, UT, October 2010 (poster).

Computer Skills

ChemDraw, Chem 3D, C (Chinese National Computer Rank Examination, grade 2), Auto CAD, Adobe Acrobat Photoshop, Adobe Audition, MS office (Word, Excel, PowerPoint).

Language Skills

Chinese, English and Japanese

Professional Membership

American Chemistry Society