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Wei Wang, Ph.D., Staff Research Scientist

Specialization: Physical Chemistry, Nano-Materials Chemistry

Research Interests:

- Synthesis, characterization and assembly of nanocrystals with controllable morphology, composition, dimensionality, microstructure and novel properties.
- Fabrication of nanocatalysts and inorganic/organic hybrid nanostructures for applications in solar cells, fuel cells, biomass conversion, and photodegradation of organic pollutants and microorganisms.
- Design and development of miniaturized sensing devices and intelligent sensors with composite nanoparticles for nonlinear optics, biological species identification, trace chemical detection, and environmental contaminant monitoring.
- Probe of interfacial processes at nanoscales in complex environmental systems with advanced neutron and spectroscopic techniques (small-angle neutron scattering, small-angle X-ray scattering, neutron reflectometry, surface enhanced Raman scattering, and fluorescence, etc.)
- Fabrication, transfer and transformation of nanoparticles in subsurface systems and evaluation of toxicity of nanomaterials to natural environment and human health.

Education:

- 1987–1993: Ph.D., Changchun Institute of Applied Chemistry, Chinese Academy of Sciences (CAS).
(Dissertation: Structures and Vibrational Spectroscopy of Mimetic Bio-membrane Systems, *CAS Presidential Award for outstanding doctoral dissertation in 1992*)
- 1979–1983: B.S., Department of Chemistry, Shandong Normal University, China.
(Thesis: A theoretical study on electronic structure of transition metal-cluster compounds)

Professional Experience:

2001–present: Research Associate/Research Scientist III, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN.
1998–2001: Research Associate, Department of Chemistry, University of Pittsburgh, Pittsburgh, PA.
1995–1998: Research Associate, Department of Chemistry, Ben-Gurion University, Beer-Sheva, Israel.
1993–1995: Postdoctoral Fellow/Associate Professor, Institute of Marine Chemistry, Ocean University of Qingdao, China.
1987–1992: Research Assistant, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences.
1983–1987: Assistant Lecturer/Lecturer, Department of Chemistry, Zaozhuang Teachers' College, China.

Research Projects/Funding (in past 5 years):

- “Microbially Mediated Transformation of Metal and Metal Oxide Nanoparticles” [co-PI with Doktycz M. J. (PI) and others], funded by EPA-NSF-DOE, 2008-2011.
- “Nanoparticle-Hydrogen Sensors for Trace Detection of Explosives in Groundwater” [PI with Liang L. (co-PI)], funded by ORNL-SEED, 2009-2010.
- “Multi-Scale Toxicology: Building the Next Generation of Tools for Toxicology” [team member with Doktycz M. J. (PI) and others], funded by Battelle, 2008-2010.
- “Nanopillar Platform for Enhanced Fluorescent Detection of Biomarkers” [collaborator with Zhou X. (PI) and others], funded by NIH-SBIR, 2008-2009.
- “Probing Molecular Interaction between Microbial-Cell Protein and Mineral Surfaces with Neutrons” [co-PI with Liang L. (PI) and others], funded by ORNL-LDRD, 2006-2009.
- “Novel, Intelligent Nanoparticle-Hydrogel Sensors for In-situ U(VI) Detection” [PI with Gu B. (co-PI)], funded by DOE-ERSP, 2006-2008.
- “Tracing Nanoparticle Transport in Porous Media by Neutron Radiography and SANS” [co-PI with Gu B. (PI) and others], funded by ORNL-SEED, 2007-2008.
- “Nanoscale Complexity at the Oxide-Water Interface” [co-PI with Wesolowski D. J. (PI) and others], funded by DOE-BES, 2004-2008.

- “*Destroying Pathogenic Bacteria Using Targeted-Nanoparticles*” [co-PI with Doktycz M. J. (PI) and others], funded by ORNL-SEED, 2006-2007.
- “*Effects of Confinement on the Statistical Physics of Nanoparticles—From Idealized Models to Real Materials: Application to Antiferromagnetic Oxides*” [co-PI with Stocks G. M. (PI) and others], funded by ORNL-LDRD, 2005-2006.
- “*Scalable Surface Enhanced Raman Spectroscopy (SSERS) for Single Molecule Detection and Characterization*” [collaborator with Zhang Z. (PI) and others], ORNL-SEED, 2005-2006.
- “*Rapid and Sensitive Detection of Perchlorate at Trace Concentrations*” [co-PI with Gu B (PI) and others, funded by Office of Technology Transfer and Commercialization (OTTC) at California State University, 2004-2005.
- “*Novel Tunable Ultrafast Nonlinear Optical Switching*” [PI with Gu, B (co-PI) and others], funded by ORNL-SEED, 2004-2005.

Instrumentation Skills:

- Spectroscopy (Raman, FTIR, fluorescence)
- Neutron and X-ray (SANS, SAXS, XRD, neutron reflectometry)
- Microscopy (TEM, SEM, AFM)
- Others (L-B trough, DLS, DSC, TGA, IC, CE)
- Experimental experience at international synchrotron and neutron facilities (NCNR-NIST, LANSCE-Los Alamos, INPS-ANL, APS-ANL, HFIR-ORNL, SNS-ORNL, FRM-II-Germany)

Professional Affiliations and Activities:

- Member of American Chemical Society
- Member of Neutron Scattering Society of American
- Technical reviewer for numerous international scientific journals and funding agents, including:
 - ACS Book Series
 - *Angewandte Chemie (International Ed in Eng.)*
 - Applied Physics A
 - Canadian Journal of Chemical Engineering
 - Chemical Engineering Journal
 - Chemistry - A European Journal
 - Chemosphere
 - Colloids and Surfaces A
 - Environmental Engineering Science
 - *Inorganica Chimica Acta*
 - Journal of Applied Electrochemistry
 - Journal of Colloid & Interface Sciences
 - Journal of Materials Chemistry
 - Journal of Nanoscience and Nanotechnology
 - Journal of Physical Chemistry C
 - Langmuir
 - Materials Chemistry and Physics
 - Nanotechnology
 - Physica E
 - Spectroscopy Letters
 - Advanced Materials
 - Applied Catalysis B: Environmental
 - Australian Journal of Chemistry
 - Catalysis Letters
 - Chemical Letters
 - Chemistry of Materials
 - Clays and Clay Minerals
 - Crystal Growth & Design
 - Environmental Science & Technology
 - Journal of American Chemical Society
 - Journal of Applied Polymer Science
 - Journal of Crystal Growth
 - Journal of Materials Science
 - Journal of Physical Chemistry B
 - Journal of Physics D: Applied Physics
 - Luminescence
 - Materials Research Bulletin
 - Particle & Particle Systems Characterization
 - Sensors & Actuators: B. Chemical
 - Water, Air & Soil Pollution

Selected Publications (from 60+ peer-reviewed papers, 5 book chapters, 800+ citations, H-index: 14):

1. Mamontov, E.; Vlcek, L.; Wesolowski, J. D.; Cummings, P. T.; Rosenqvist, J.; Wang, W.; Cole, D. R.; Anovitz, L. M.; Gasparovic, G. Suppression of the dynamic transition in surface water at low hydration levels: A study of water on rutile, *Phys. Rev. E* **2009**, 79 (5), 051504.
2. Peterson, J. W.; O’Meara, T. A.; Seymour, M. D.; Wang, W.; Gu, B. Sorption Mechanisms of Cephapirin, a Veterinary Antibiotic, onto Quartz and Feldspar Minerals as Detected by Raman Spectroscopy, *Environ. Pollut.* **2009**, 157 (6), 1849-1856.
3. Gu, B.; Ruan, C.; Wang W. Perchlorate Detection at Nanomolar Concentrations by Surface-Enhanced Raman Scattering, *Appl. Spectrosc.* **2009**, 63 (1), 98-102.
4. Yu, K. O.; Grabinski, C. M.; Schrand, A. M.; Murdock, R. C.; Wang, W.; Gu, B.; Schlager, J. J.; Hussain, S. M. Toxicity of amorphous silica nanoparticles in mouse keratinocytes, *J. Nanopart. Res.* **2009**, 11 (1), 15-24.
5. Wang W.; Gu, B.; Johs, A.; Liang L. Thin Films of Uniform Hematite Nanoparticles: Controls on Surface Hydrophobicity and Self-Assembly, *J. Mater. Chem.* **2008**, 18 (47), 5770-5775.

6. **Wang, W.**; Howe, J. Y.; Gu, B. H.; Structure and morphology evolution of hematite ($\alpha\text{-Fe}_2\text{O}_3$) nanoparticles in forced hydrolysis of ferric chloride, *J. Phys. Chem. C* **2008**, 112 (25) 9203-9208.
7. Mamontov, E.; Wesolowski, D. J.; Vlcek, L.; Cummings, P. T.; Rosenqvist, J.; **Wang, W.**; Cole, D. R. Dynamics of hydration water on rutile studied by backscattering neutron spectroscopy, *J. Phys. Chem. C* **2008**, 112 (32), 12334-12341.
8. Ruan, C.; Luo, W.; **Wang, W.**; Gu, B. Surface-enhanced Raman spectroscopy for uranium detection and analysis in environmental samples, *Anal. Chim. Acta* **2007**, 605 (1), 80-86.
9. Ruan, C.; Eres, G.; **Wang, W.**; Zhang, Z.; Gu, B. Controlled Fabrication of Nanopillar Array Substrates for Surface-Enhanced Raman Spectroscopy, *Langmuir* **2007**, 23 (10), 5757-5760.
10. **Wang W.**; Gu, B.; Liang L. Effect of anionic surfactants on synthesis and self-assembling of silica colloidal nanoparticles, *J. Colloid Interface Sci.*, **2007**, 313 (1), 169-173.
11. Ruan, C.; **Wang, W.**; Gu, B. Single-molecule detection of thionine on aggregated gold nanoparticles by surface enhanced Raman scattering, *J. Raman Spectrosc.* **2007**, 38 (5), 568-573.
12. Mamontov, E.; Vlcek, L.; Wesolowski, D. J.; Cummings, P. T.; **Wang, W.**; Anovitz, L. M.; Rosenqvist, J.; Brown, C. M.; Saka, V. G. Dynamics and structure of hydration water on rutile and cassiterite nano-powders studied by quasielastic neutron scattering and molecular dynamics simulations, *J. Phys. Chem. C* **2007**, 111 (11), 4328-4341.
13. Ruan, C.; **Wang, W.**; Gu, B. Rapid and Ultra-sensitive Detection of Alkaline Phosphatase Based on Surface Enhanced Raman Scattering, *Anal. Chem.* **2006**, 78 (10), 3379-3384.
14. **Wang W.**; Ruan, C.; Gu, B. Synthesis of Gold-Silica Composite Nanoparticle Substrates for SERS Detection of Perchlorate in Water, *Anal. Chim. Acta* **2006**, 567 (1), 121-126.
15. Ruan, C.; **Wang, W.**; Gu, B. Surface-Enhanced Raman Scattering for Perchlorate Detection using Cystamine-Modified Gold Nanoparticles, *Anal. Chim. Acta* **2006**, 567 (1), 114-120.
16. **Wang, W.**; Gu, B. Self-assembly of Two- and Three-Dimensional Particle Arrays by Manipulating Hydrophobicity of Silica Nanoparticles, *J. Phys. Chem. B* **2005**, 109 (47), 22175-22180.
17. **Wang, W.**; Gu, B. New SERS Substrates via Self-Assembly of Silver Nanoparticles for Perchlorate Detection in Water, *Appl. Spectros.* **2005**, 59 (12), 1509-1515.
18. **Wang, W.**; Gu, B.; Liang, L.; Hamilton, W. A.; Wesolowski, D. J. Synthesis of Rutile ($\alpha\text{-TiO}_2$) Nanocrystals with Highly Controlled Size and Shape by Low Temperature Hydrolysis: Effects of Solvent Composition, *J. Phys. Chem. B.* **2004**, 108 (39), 14789-14792.
19. **Wang, W.**; Gu, B.; Liang, L.; Hamilton, W. A. Adsorption and Structural Arrangement of Cetyltrimethylammonium Cations at the Silica Nanoparticle-Water Interface, *J. Phys. Chem. B* **2004**, 108 (45), 17477-17483.
20. **Wang, W.**; Gu, B.; Liang, L.; Effect of Surfactants on the Formation, Morphology and Surface Property of Synthesized SiO_2 Nanoparticles, *J. Disper. Sci. Technol.* **2004**, 25(5), 595-603.
21. Gu, B.; Tio, J.; **Wang, W.**; Ku, Y. -K.; Dai, S. Raman Spectroscopic Detection for Perchlorate at Low Concentration, *Appl. Spectros.* **2004**, 58 (6), 741-744.
22. **Wang, W.**; Gu, B.; Liang, L. Y.; Hamilton, W. Fabrication of Two- and Three-Dimensional Silica Nanocolloidal Particle Arrays, *J. Phys. Chem. B* **2003**, 107 (15), 3400-3404.
23. **Wang, W.**; Gu, B.; Liang, L. Y.; Hamilton, W. Fabrication of Near Infrared Photonic Crystals using Highly-Monodispersed Submicrometer SiO_2 Spheres, *J. Phys. Chem. B* **2003**, 107 (44), 12113-12117.
24. **Wang, W.**; Asher, S. A. Photochemical Incorporation of Silver Quantum Dots in Monodisperse Silica Colloids for Photonic Crystal Applications, *J. Am Chem. Soc.* **2001**, 123 (50): 12528-12535.
25. **Wang, W.**; Chen, X.; Efrima, S. Fabrication of Semiconductor Nanoparticles in a Three-Dimensional Organic-Layered Solid Crystal, *Chem. Mater.* **1999**, 11 (7): 1883-1889.
26. **Wang, W.**; Efrima, S.; Regev, O. Directing Silver Nanoparticles into Colloid-Surfactant Lyotropic Lamellar Systems, *J. Phys. Chem. B* **1999**, 103 (27): 5613-5621.
27. **Wang, W.**; Chen, X.; Efrima, S. Silver Nanoparticles Capped by Long-Chain Unsaturated Carboxylates, *J. Phys. Chem. B.* **1999**, 103 (34): 7238-7246.
28. **Wang, W.**; Efrima, S.; Regev, O. Directing Oleate Stabilized Nanosized Silver Colloids into Organic Phases, *Langmuir* **1998**, 14 (3): 602-610.