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## Wei Wang, Ph.D., Staff Research Scientist

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**Specialization:** Physical Chemistry, Nano-Materials Chemistry, Molecular Spectroscopy

### 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 energy conversion, bio-energy conversion, and environmental cleanup.
- Probe of interfacial processes at nanoscales in complex environmental systems with advanced neutron and spectroscopic scattering techniques (SANS, SAXS, SERS, DLS).
- Design and development of miniaturized sensing devices and intelligent sensors with advanced nanomaterials for nonlinear optics, biological species identification, trace chemical detection, and environmental contaminant monitoring.
- Formation, transfer and transformation of nanomaterials in subsurface systems and evaluation of toxicity of nanomaterials to natural environment and human health.

### Education:

- 1987–1993: Ph.D. in Physical Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences (CAS).
- 1979–1983: B.S. in Chemistry, Department of Chemistry, Shandong Normal University, China.

### Professional Experience:

2001–now: Research Associate/Staff 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.

### Awards and Honors:

- Stanley I. Auerbach Award for Excellence in Environmental Sciences, ORNL, 2009.
- Outstanding Postdoctoral Scholarship (A-Grade), China Postdoctoral Council, 1994.
- Presidential Award for Excellence in Graduate Research, Chinese Academy of Sciences, 1992.
- Outstanding Teaching/Research Award in the Decade (1977-87), Zaozhuang Teachers' College, 1987.

### Professional Affiliations and Activities:

- Member of American Chemical Society
- Member of Neutron Scattering Society of American
- Technical reviewer for 40+ international scientific journals and 5+ funding agencies.

### Research Projects/Funding:

- Wang W. (PI) with Phelps T. J. (co-PI) and others, *Catalytic Conversion of Lignin Feedstocks for Bioenergy Applications*, funded by LDRD-ORNL, 2009-2011.
- Wang W. (co-PI) with Doktycz M. J. (PI) and others, *Multi-Scale Toxicology: Building the Next Generation of Tools for Toxicology*, funded by BATTELLE, 2008-2011.
- Wang W. (co-PI) with F. He (PI) and L. Liang, *Air Stable Fe-C Core-Shell Nanocomposite for Degradation of Chlorinated Solvents*, funded by SEED-ORNL, 2010-2011.
- Wang W. (co-PI) with Doktycz M. J. (PI) and others, *Microbially Mediated Transformation of Metal and Metal Oxide Nanoparticles*, funded by BER-DOE, 2008-2011.
- Wang W. (PI) with Liang L. (co-PI), *Nanoparticle-Hydrogen Sensors for Trace Detection of Explosives in Groundwater*, funded by SEED-ORNL, 2009-2010.

- Wang W. (co-PI) with Ruan C. (PI) and others, *Nanoparticle-Hydrogel Strips for Detection of Staphylococcal Enterotoxins*, funded by STTR-NIH, 2009-2010.
- Wang W. (co-PI) with Zhou X. (PI) and others, *Nanopillar Platform for Enhanced Fluorescent Detection of Biomarkers*, funded by SBIR-NIH, 2008-2009.
- Wang W. (co-PI) with Liang L. (PI) and others, *Probing Molecular Interaction between Microbial-Cell Protein and Mineral Surfaces with Neutrons*, funded by LDRD-ORNL, 2006-2009.
- Wang W. (co-PI) with Gu B. (PI) and others, *Tracing Nanoparticle Transport in Porous Media by Neutron Radiography and SANS*, funded by SEED-ORNL, 2007-2008.
- Wang W. (PI) and Gu B. (co-PI), *Novel, Intelligent Nanoparticle-Hydrogel Sensors for In-situ U(VI) Detection*, funded by ERSP-DOE, 2006-2008.
- Wang W. (participant) with Wesolowski D. J. (PI) and others, *Nanoscale Complexity at the Oxide-Water Interface*, funded by BES-DOE, 2001-2008.
- Wang W. (co-PI) with Doktycz M. J. (PI) and others, *Destroying Pathogenic Bacteria Using Targeted-Nanoparticles*, funded by SEED-ORNL, 2006-2007.
- Wang W. (co-PI) with Stocks G. M. (PI) and others, *Effects of Confinement on the Statistical Physics of Nanoparticles—From Idealized Models to Real Materials: Application to Antiferromagnetic Oxides*, funded by LDRD-ORNL, 2005-2006.
- Wang W. (co-PI) with Zhang Z. (PI) and others, *Scalable Surface Enhanced Raman Spectroscopy (SSERS) for Single Molecule Detection and Characterization*, SEED-ORNL, 2005-2006.
- Wang W. (co-PI) with Gu B. (PI) and others, *Rapid and Sensitive Detection of Perchlorate at Trace Concentrations*, funded by Office of Technology Transfer and Commercialization (OTTC) at California State University, 2004-2005.
- Wang W. (PI) with Gu, B. (co-PI) and others, *Novel Tunable Ultrafast Nonlinear Optical Switching*, funded by SEED-ORNL, 2004-2005.

#### **Selected Publications (60+ peer-reviewed papers, 5 book chapters, 1000+ citations, H-index: 18):**

1. **Wang, W.**; Howe, J. Y.; Li, Y.; Qiu, X.; Joy, D. C.; Paranthaman, M. P.; Doktycz, M. J.; Gu, B. A Surfactant and Template-Free Route for Synthesizing Ceria Nanocrystals with Tunable Morphologies, *J. Mater. Chem.* **2010**, 20 (36), 7776-7781.
2. Suresh, A. K.; Pelletier, D. A.; **Wang, W.**; Moon, J. W.; Gu, B.; Mortensen, N. P.; Allison, D. P.; Joy, D. C.; Phelps, T. J.; Doktycz, M. J. Silver Nanocrystallites: Biofabrication using *Shewanella oneidensis*, and an Evaluation of Their Comparative Toxicity on Gram-negative and Gram-positive Bacteria, *Environ. Sci. Technol.* **2010**, 44 (13), 5210-5215.
3. **Wang, W.**; Li, Z.; Gu, B.; Zhang, Z.; Xu, H. Spatial Distribution of Electromagnetic Field Enhancement as Probed via Dynamic Evolution of Surface-enhanced Raman Scattering in Porous Ag@Silica Nanoshells, *ACS Nano* **2009**, 3 (11), 3493-3496.
4. Zhu, W.; Qiu, X.; Iancu, V.; Chen, X. Pan, H.; **Wang, W.**; Dimitrijevic, N.; Rajh, T.; Meyer III, H. M.; Paranthaman, M. P.; Stocks, G. M.; Weitering, H.; Gu, B.; Eres, G.; Zhang, Z. Bandgap Narrowing of Titanium Oxide Semiconductors by Non-Compensated Anion-Cation Codoping for Enhanced Visible-Light Photoactivity, *Phys. Rev. Lett.* **2009**, 103 (26), 226401.
5. Pan, H.; Qiu, X.; Ivanov, I. N.; Meyer, H. M.; **Wang, W.**; Zhu, W.; Paranthaman, M. P.; Zhang, Z.; Eres, G.; Gu, B. Fabrication and characterization of brookite-rich, visible light-active TiO<sub>2</sub> films for water splitting, *Appl. Catalysis B.* **2009**, 93(1-2), 90-95.
6. 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.
7. 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.
8. Gu, B.; Ruan, C.; **Wang W.** Perchlorate Detection at Nanomolar Concentrations by Surface-Enhanced Raman Scattering, *Appl. Spectrosc.* **2009**, 63 (1), 98-102.
9. 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.
10. **Wang, W.**; Howe, J. Y.; Gu, B. H.; Structure and morphology evolution of hematite (alpha-Fe<sub>2</sub>O<sub>3</sub>) nanoparticles in forced hydrolysis of ferric chloride, *J. Phys. Chem. C* **2008**, 112 (25) 9203-9208.

11. 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.
12. 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.
13. Johs, A.; Liang, L.; Gu, B.; Ankner, J.; Wang, W. Application of neutron reflectivity for studies of biomolecular structures and functions at interfaces, in *Neutron Applications in Earth, Energy and Environmental Sciences*, Liang L. Y.; Rinaldi, R.; Schober, H. Eds., Chapter 16, pp. 461-486, **2008**, Springer.
14. 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.
15. 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.
16. 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.
17. 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.
18. 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.
19. 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.
20. 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.
21. 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.
22. 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.
23. 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.
24. Wang, W.; Gu, B.; Liang, L.; Hamilton, W. A.; Wesolowski, D. J. Synthesis of Rutile ( $\alpha$ -TiO<sub>2</sub>) Nanocrystals with Highly Controlled Size and Shape by Low Temperature Hydrolysis: Effects of Solvent Composition, *J. Phys. Chem. B.* **2004**, 108 (39), 14789-14792.
25. 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.
26. Wang, W.; Gu, B.; Liang, L.; Effect of Surfactants on the Formation, Morphology and Surface Property of Synthesized SiO<sub>2</sub> Nanoparticles, *J. Disper. Sci. Technol.* **2004**, 25(5), 595-603.
27. 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.
28. 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.
29. Wang, W.; Gu, B.; Liang, L. Y.; Hamilton, W. Fabrication of Near Infrared Photonic Crystals using Highly-Monodispersed Submicrometer SiO<sub>2</sub> Spheres, *J. Phys. Chem. B* **2003**, 107 (44), 12113-12117.
30. 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.
31. 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.
32. Wang, W.; Efrima, S.; Regev, O. Directing Silver Nanoparticles into Colloid-Surfactant Lyotropic Lamellar Systems, *J. Phys. Chem. B* **1999**, 103 (27): 5613-5621.
33. Wang, W.; Chen, X.; Efrima, S. Silver Nanoparticles Capped by Long-Chain Unsaturated Carboxylates, *J. Phys. Chem. B.* **1999**, 103 (34): 7238-7246.
34. Wang, W.; Efrima, S.; Regev, O. Directing Oleate Stabilized Nanosized Silver Colloids into Organic Phases, *Langmuir* **1998**, 14 (3): 602-610.