

CURRICULUM VITAE

Caibin Xiao

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Employment

Principal Scientist, GE Power and Water, General Electric Company, Trevose, PA,
2000 to present

Postdoctoral Fellow, Oak Ridge National Laboratory, 1998 to 2000

Postdoctoral Fellow, University of Delaware, 1997 to 1998

Education

1992 – 1997, Memorial University of Newfoundland, St. John's, Canada
Ph.D./Physical Chemistry

1985 – 1988, Central China Normal University, Wuhan, China
M.S./Physical Chemistry

1980 – 1983, Yangtze University, Jingzhou, China

Awards

Giauque Award, 50th Calorimetry Conference, 1995

Fellow of the School of Graduate Studies (Dean List), 1995

J. Beryl Truscott Graduate Award for "best graduate students in chemistry and
biochemistry", 1995

Personal

Born August 3, 1964

Married; two children

Citizen of USA

Experience

12/07 to present, Principal Scientist, GE Power and Water, General Electric Company, Trevose, PA

Worked with senior commercial and marketing managers to lay out new product development strategies and led teams to conduct feasibility study of new products and solutions that require integration of technologies cross a range of disciplines such as membrane, chemical treatment, and remote monitoring and control.

6/03 to 12/07, Senior Research Scientist, GE Water and Process Technologies, General Electric Company, Trevose, PA

Project Leader – Online Chemical Sensors and Application of Sensors in Automation of Industrial Water Systems: Responsibilities include working with commercial teams to define the project goal, supervising a team of 12 scientists and engineers to develop new online colorimetric sensor systems for the direct determination of water treatment additives, managing beta production and filed trials, and coordinating cross functional teams to transfer laboratory prototypes to production. Contributed as a lead inventor to major technical breakthroughs that make it possible for the first time to directly monitor and control treatment chemicals in the industrial water systems

Team Leader – Chemical Detection at GEWPT: Recruited and trained scientists at GE China Technology Center: Responsible for managing a four PHD chemist team at CTC to develop thin film sensors for water analysis. Designed and prototyped portable/handheld sensor systems consisting of optical read-out units, thin film sensor elements, fluidic sampling devices through collaborating with scientists and engineers of multidisciplinary backgrounds. Contributed to a suite of patents that define the landscape of a disruptive technology, which is in the final stage of productization and will bring unprecedented tools and methods to water analysis in the industrial field

6/00 – 8/03, Senior Staff Scientist, GE Water and Process Technologies, General Electric Company, Trevose, PA

Led a project in development of novel water-soluble polymers for corrosion and deposit control in water systems; discovered proprietary polymers that prevent iron oxide deposition in boilers

5/98 - 6/00, Postdoctoral Fellow, Oak Ridge National Laboratory, Oak Ridge, TN

Supervisors: Donald Palmer and David Wesolowski, Studied thermodynamic properties of metal oxides and spinels by solubility and in-situ potentiometric pH measurements; provided data and insight for understanding the effect of zinc addition on the inhibition of stress corrosion cracking and cobalt transport mechanisms in pressurized water reactors; Constructed state-of-the-art equipment that allows solubility measurement of sparingly soluble materials in high-temperature water at the parts-per-billion level; developed a novel chemiluminescence method for ultra-trace metal analysis at the ppt level; discovered new chemiluminescence systems and contributed significantly to the overall understanding of hydrogen peroxide -based chemiluminescence.

5/97 to 5/98. Postdoctoral Fellow, University of Delaware, Newark, DE

Supervisor: Robert Wood, Developed theoretical models for thermodynamic and transport properties of aqueous solutions at high temperature, which have been since then used to study speciation and chemical equilibrium of complex electrolyte systems that are significant to power cycle chemistry and hydrothermal geochemistry

9/92 to 5/97, Ph.D. student and research associate, Memorial University of Newfoundland, St. John's, Canada.

Supervisor: Peter Tremaine, Constructed a high-temperature vibrating-tube densitometer; investigated the thermodynamic properties of a variety of aqueous systems that are important to the fundamental understanding of aqueous chemistry at high temperature; synthesised maricite in pressure vessels under the hydrothermal condition; studied the heat capacity and the heats of solution of boiler corrosion products maricite and sodium iron (III) phosphate with calorimeters for projects sponsored by EPRI and Ontario Hydro.

8/88 to 9/92, Chemist, Jingzhou Institute of Chemistry, Hubei, China

Managed R&D operations, supervised three B.Sc. chemists, and held total responsibility for new product development projects; personally directed all aspects of planning, equipment selection/purchasing, and setting-up for an analytical laboratory for metallurgical quality control; optimized the process of the silicoaluminothermic production of ferromolybdenum alloy from low-grade molybdenite and improved the overall yield of FeMo alloy; pilot scale development of a new method to manufacture 1,4-phenylenediamine by catalytic hydrogenation of 4-phenylazoaniline in an autoclave system.

8/83 to 8/85, Chemistry teacher, Liuliping Railway High School, Hubei, China

Refereed Publications

Caibin Xiao, Donald A. Palmer, David J. Wesolowski, Sara B. Lovitz, and D. Whitney King, Carbon Dioxide Effects on Luminol and 1,10-phenanthroline Chemiluminescence, *Anal.Chem.* 2002, 74, 2210-2216.

Caibin Xiao, David J. Wesolowski, and Donald A. Palmer, Formation Quotients of Aluminum Sulfate Complexes in NaCF_3SO_3 Media at 10, 25 and 50 °C from Potentiometric Titrations Using a Mercury/Mercurous Sulfate-Electrode Concentration Cell, *Environ. Sci. Technol.* 2002, 36, 166-173.

Caibin Xiao, Tram Pham, Wei Xie, and Peter R. Tremaine, Apparent Molar Volumes and Heat Capacities of Aqueous Trifluoromethanesulfonic Acid and Its Sodium Salt from 283 to 328 K, *J. Solution Chem.*, 2001, 30, 201-211.

Andrei V. Sharygin, Ilham Mokbe, **Caibin Xiao**, and Robert H. Wood, Tests of Equations for the Electrical Conductance of Electrolyte Mixtures: Measurements of Association of NaCl (aq) and Na_2SO_4 (aq) at High Temperatures, *J. Phys. Chem. B* 2001, 105, 229-237.

Caibin Xiao and R. H. Wood, A Compressible Continuum Model for Ion Transport in High Temperature Water, *J. Phys. Chem. B* 2000, 104, 918-925.

Caibin Xiao, D. Whitney King, Donald A. Palmer, and David J. Wesolowski, Study of enhancement effects in the chemoluminescence method for Cr(III) in the ng/l range, *Analytica Chimica Acta*, 2000, 425, 209-219.

Moira K. Ridley, **Caibin Xiao**, Donald A. Palmer, and David J. Wesolowski, Thermodynamic Properties of the Ionization of Morpholine as a Function of Temperature and Ionic Strength, *J. Chem. Eng. Data* 2000, 45, 502-507.

Caibin Xiao and P. R. Tremaine, Apparent Molar Heat Capacities and Volumes of $\text{LaCl}_3(\text{aq})$, $\text{La}(\text{ClO}_4)_3(\text{aq})$, and $\text{Gd}(\text{ClO}_4)_3(\text{aq})$ from the Temperatures between 283 K and 338 K, *J. Chem. Thermodynamics*, 1996, 28, 43-66.

Caibin Xiao, H. Bianchi, and P. R. Tremaine, Excess Molar Volumes and Densities of (Methanol + water) at Temperatures between 323 K and 573 K and Pressures of 7.0 MPa and 13.5 MPa, *J. Chem. Thermodynamics*, 1997, 29, 261-286.

Caibin Xiao, P. R. Tremaine, and J. M. Simonson, Apparent molar volumes of $\text{La}(\text{CF}_3\text{SO}_3)_3(\text{aq})$ and $\text{Gd}(\text{CF}_3\text{SO}_3)_3(\text{aq})$ at 278, 298 K, and 318 K at Pressures to 30.0 MPa, *J. Chem. Eng. Data*, 1996, 41, 1075-1078.

Caibin Xiao and P. R. Tremaine, Apparent Molar Volumes of Aqueous Trifluoromethanesulfonate and Aqueous Trifluoromethanesulfonic acid at Temperatures from 283 K to 600 K and Pressures up to 20 MPa, *J. Solution Chem.*, 1997, 26, 277-294.

Caibin Xiao and P. R. Tremaine, The thermodynamics of Aqueous Trivalent Rare Earth elements: Apparent Molar Heat Capacities and Apparent Molar Volumes of $\text{Nd}(\text{ClO}_4)_3(\text{aq})$, $\text{Eu}(\text{ClO}_4)_3(\text{aq})$, $\text{Er}(\text{ClO}_4)_3(\text{aq})$, and $\text{Yb}(\text{ClO}_4)_3(\text{aq})$ between the Temperatures 283 K and 328 K, *J. Chem. thermodynamics*, 1997, 29, 827-852.

P. R. Tremaine, D. Shvedov, and **Caibin Xiao**, Thermodynamic Properties of Aqueous Morpholine and Morpholinium Chloride at Temperature from 10 to 300 °C: Apparent Molar Volumes, Heat Capacities and the Temperature Dependence of Ionization, *J. Phys. Chem.*, 1997, B101, 409.

Caibin Xiao, J. M. Simonson, and Peter R. Tremaine, Densities and apparent molar volumes of $\text{Gd}(\text{CF}_3\text{SO}_3)_3(\text{aq})$ at $T = (373, 423, \text{ and } 472 \text{ K})$ and $p = (7 \text{ and } 26 \text{ MPa})$, *J. Chem. Thermodynamics*, 1999, 31, 1055-1065.

Peter Tremaine and **Caibin Xiao**, Enthalpies of Formation and Heat Capacity Functions for Maricite, $\text{NaFePO}_4(\text{cr})$, and Sodium Iron(III) Hydroxyphosphate, $\text{Na}_3\text{Fe}(\text{PO}_4)_2(\text{Na}_{4/3}\text{H}_{2/3}\text{O})(\text{cr})$, *J. Chem. Thermodynamics*, 1999, 31, 1307-1320.

Radislav Potyrailo, William G. Morris, Andrew M. Leach, Kasi Krishnan, Cheryl Surman, Lamyaa Hassib, Ronald Wroczynski, Scott Boyette, **Caibin Xiao**, Alan Agree, Prashant Shrikhande, and Ted Cecconie, Theory and Practice of Ubiquitous Quantitative Chemical Analysis Using Conventional Computer Optical Disk Drives, *Applied Optics* 2007, 46(28), 7007-7017.

Radislav Potyrailo, William G. Morris, Ronald Wroczynski, Lamyaa Hassib, Peter Miller, Benjamin Dworken, Andrew M. Leach, Scott Boyette, **Caibin Xiao**, Multi-Wavelength Operation of Optical Disk Drives for Chemical and Biological Analysis, *Sensors and Actuators B: Chemical* 2009, 136, 203-208.

Andrei V. Sharygin, Brian K. Grafton, **Caibin Xiao**, Robert H. Wood, and Victor N. Balashov, Dissociation Constant and Speciation in Aqueous Li_2SO_4 and K_2SO_4 from Measurements of Electrical Conductance to 673 K and 29 MPa, *Geochim. Cosmochim. Acta* 2006, 70, 5169 – 5182.

Pascale Benezeth, Donald A. Palmer, David J. Wesoloski, and **Caibin Xiao**, New Measurement of the Solubility of Zinc Oxide from 150 oC to 350 oC, *Journal of Solution Chemistry*, 2002, 31, 947-973.

Conference Proceedings

A. V. Shargin, B. K. Grafton, **Caibin Xiao**, and R. H. Wood, Conductance of Aqueous Solutions of Potassium Sulfate and Lithium Sulfate at Elevated Temperatures, *Steam, Water and Hydrothermal Systems: Physics and Chemistry Meeting the Needs of Industry*, P. Tremaine, P. Hill, D. E. Irish, and P. V. Balakrishnan Eds., NRCC Press, Ottawa, pp 488-493.

P. Benezeth, **Caibin Xiao**, D. A. Palmer, and D. J. Wesolowski, Potentiometric Studies of Zinc Oxide Solubility to High Temperatures, *Steam, Water and Hydrothermal Systems: Physics and Chemistry Meeting the Needs of Industry*, P. Tremaine, P. Hill, D. E. Irish, and P. V. Balakrishnan Eds., NRCC Press, Ottawa.

P. R. Tremaine, D. Schvedov, L. Trevani, and **Caibin Xiao**, The Solubility and Redox Behavior of Marcite and Sodium Iron Hydroxy Phosphate from 225 to 325 °C: Thermodynamics of the Sodium-Iron-Phosphate-Water System under Hydrothermal Conditions, *Steam, Water and Hydrothermal Systems: Physics and Chemistry Meeting the Needs of Industry*, P. Tremaine, P. Hill, D. E. Irish, and P. V. Balakrishnan Eds., NRCC Press, Ottawa.

P. R. Tremaine and **Caibin Xiao**, Standard Partial Molar Heat Capacities and Volumes of Aqueous Divalent and Trivalent Ions from Measurements near 25 °C, *Physical Chemistry of Aqueous System*, Edited by White, H. J. Jr. et al., Begell House, 1995.

Pascale Bénézech, David J. Wesolowski, Donald A. Palmer, Moira K. Ridley, and Caibin Xiao, Effect of Amines on the Surface Charge Properties of Iron Oxides, *Power Plant Chemistry*, 2006, 8.

Pascale Benezeth, Donald A. Palmer, David J. Wesoloski, and **Caibin Xiao**, The solubility of Zinc Oxide to 350 °C, *Power Plant Chemistry*, 2003, 5.

Donald A. Palmer, Pascale Benezeth, David J. Wesolowski, Scott A. Wood, and **Caibin Xiao**, The Solubility of Metal Oxides and Hydroxides at High Temperature: Results and Implications of Recent ORNL Measurements, *Power Plant Chemistry* 2000, 2, 517-521.

Book Chapter

Peter Tremaine, Pascale Bénézech, and Caibin Xiao, Dissociation Equilibria of Weak Acids and Bases, Chapter 13, *Aqueous Systems at Elevated Temperatures and Pressures: Physical Chemistry in Water, Steam and Hydrothermal Solutions*, D.A. Palmer, R. Fernandez-Prini and A.H. Harvey (editors), Elsevier (2004)

Technical Reports

P. R. Tremaine, D. Shvedov, L. Trevani, and C. Xiao, Sodium Phosphate Hideout Mechanisms: Data and Models for the Solubility and Redox Behavior of Iron (II) and Iron (III) Sodium-Phosphate Hideout Reaction Products, Final Report, Electric Power Res. Inst (EPRI) Research Project WO 2712-18, (Submitted May 15, 1998) 166 pp.

C. Xiao, D. J. Wesolowski, D. A. Palmer, L. M. Anovitz, and P. Benezeth, Solubility of Zinc Chromate Spinel at High Temperatures, a report for Department of Energy, 1999, 69 pp.

C. Xiao, D. J. Wesolowski, D. A. Palmer, L. M. Anovitz, and P. Benezeth, Solubility of Cobalt Chromate Spinel at High Temperatures, a report for Department of Energy, 2000.

US Patents/Applications

Caibin Xiao, David C. Little, and Scott M. Boyette, Deposition sensor based on differential heat flux measurement, US7077563

Caibin Xiao, Scott M. Boyette, and Radislav A. Potyrailo, A handheld device with a disposable element for chemical analysis of multiple analytes, US7283245

Caibin Xiao, Radislav A. Potyrailo, William G. Morris, Scott M. Boyette, Lijie Yu, Theodore J. Cecconie, Andrew M. Leach, and Prahant Shrikhande, Optical sensor array system and method for parallel processing of chemical and biochemical information, US20070092407

Radislav A. Potyrailo, Timothy M. Sivavec, Caibin Xiao, Theodore J. Cecconie, Lamyaa Hassib, Andrew M. Leach, and David B. Engel, Material compositions for sensors for determination of chemical species at trace concentrations and method of using sensors, US20070092973

Caibin Xiao, Timothy M. Sivavec, David B. Engel, Self-Contained Phosphate Sensors and Method for Using Same, US20070092972

Andrew M. Leach, Thomas Paul Danton, Christopher David Goewey, Radislav A. Potyrailo, Caibin Xiao, and Prahant Shirkhande, Microfluidic Devices and Methods of Making the Same, US20070092411

Radislav A. Potyrailo, Prahant Shirkhande, Scott M. Boyette, Caibin Xiao, and Andrew M. Leach, Methods and systems for delivery of fluidic samples to sensor arrays, US20070092975

Radislav A. Potyrailo, Scott M. Boyette, Caibin Xiao, William G. Morris, Andrew M. Leach, and Ronald J. Wroczynski, Sensor Systems for Quantification of Physical Parameters,

Chemical and Biochemical Volatile and NonVolatile Compounds in Fluids,
US20070146715

Selected Presentation

P. R. Tremaine and Caibin Xiao, Standard Partial Molar Heat Capacities and Volumes of Aqueous Divalent and Trivalent Ions from Measurements near 25 °C, 12th International Conference on the Properties of Water and Steam, Fla. Orlando, Fla., USA, 1994.

Caibin Xiao and P. R. Tremaine, Excess Volumes of the Methanol-Water System at Elevated Temperatures and Pressures, 50th Calorimetry Conference, Gaithersberg, MD, USA, 1995.

Caibin Xiao and P. R. Tremaine, Densities and Excess Volumes of CH₃OH/H₂O, A Corresponding-States Treatment, the 79th Canadian Society for Chemistry Conference and Exhibition, St. John's, NF, Canada, 1996.

Caibin Xiao, P. R. Tremaine and J. M. Simonson, Apparent Molar Volumes and Heat Capacities of Aqueous Sodium Triflate, Gadolinium Triflate and Triflic Acid at Temperatures from 10 to 320 °C and Pressures up to 200 Bar, Annual IAPWS Meeting, Frederick, Denmark, 1996.

D. Shvedov, Caibin Xiao and P. R. Tremaine, Thermodynamics of Aqueous Amines from Apparent Molar Volume Measurements at Temperatures up to 300 °C and Elevated Pressures, the Fifth International Symposium on Hydrothermal Reactions, Gatlinburg, Tennessee, U.S.A., 1997.

Caibin Xiao and R. H. Wood, A Compressible Continuum Model for Ion Transport in High Temperature Water, 13th International Conference on the Properties of Water and Steam, Toronto, Ontario, Canada, 1999.

Caibin Xiao, D. J. Wesolowski, and D. A. Palmer, 13th International Conference on the Properties of Water and Steam, Toronto, Ontario, Canada, 1999.

S. B. Lovitz, C. Xiao, D. W. King, Free Radical Intermediates in the Fe(II)-Luminol Chemiluminescence System: Application to Ultra-Trace Analysis of Fe(II), 221st ACS National Meeting, 2001.

A. M. Isham, C. Xiao, D. W. King, Mechanistic Investigation of Copper-1,10-phenanthroline Chemiluminescence, 221st ACS National Meeting, 2001.