

JOHN L. FULTON
Staff Scientist
Supercritical Fluids Group
Environmental and Energy Sciences Division
Battelle, Pacific Northwest National Laboratories

Education

B. S. Chemical Engineering, Montana State University, 1976
M. S. Chemical Engineering, University of Washington, 1985

Experience

Since joining Battelle in 1985, John Fulton has been conducting fundamental studies of solvation in supercritical fluids with special emphasis on the determination of the intermolecular forces governing the formation of molecular aggregates, reverse micelles, microemulsions, ion hydration, ion pairs and other organized molecular assemblies in supercritical fluids. He has been instrumental in the development of new spectroscopic techniques for determination of the structure of multi-molecular aggregates in supercritical fluids. Amongst the unique high pressure capabilities that he has developed at Battelle's supercritical fluid laboratory are (i) Fourier transform-infrared and (ii) Raman spectroscopy, (iii) small angle x-ray and (iv) neutron scattering, (v) static and (vi) time-resolved fluorescence, (vii) x-ray absorption fine structure. As a direct result of these studies several new applications of these systems have evolved including new polymerization techniques, a new microemulsion-based separation technique, and a method to produce ultra-small catalyst particles. Currently, his research interests include the fundamental studies of supercritical fluid properties for the eventual development of improved separation and reaction processes.

Presentations

John Fulton has presented over 40 lectures at national scientific meetings.

Honors

Battelle Northwest Directors Award for Excellence (1989)

IR&D 100 Award for Development of a New Technology "Rapid Thermal Decomposition of Precursors in Solution" (RTDS), (1993)

Editorial Board of the *Journal of Supercritical Fluids* (1995-)

1997 Presidential (Clinton/Gore) Green Chemistry Challenge Award for "Design and Application of Surfactants for Carbon Dioxide."

Battelle "Outstanding Team Performance Award" Nitrem Demonstration Project, (1998).

IR&D 100 Award for Development of a New Technology "Reverse Micelles in Carbon Dioxide as a Cleaning Solvent" (RTDS), (1998)

FLC Award (Federal Laboratory Consortium for Technology Transfer -Award for Excellence for Technology Transfer, Reverse Micelle Technology to Micell Inc. 1999.

Patents

“Processes for Microemulsion Polymerization Employing Novel Microemulsion Systems” issued June 12, 1990, to E. J. Beckman, J. L. Fulton, and R. D. Smith, U.S. Patent No. 4,933,404.

“Supercritical Fluid Reverse Micelle Systems” issued October 27, 1992, to R. D. Smith and J. L. Fulton, U. S. Patent No. 5,158,704.

“Supercritical Fluid Reverse Micelle Separations” issued November, 30, 1993 to J. L. Fulton and R. D. Smith, U. S. Patent No. 5,266,205.

“Chemical Reactions in Reverse Micelle Systems.,” issued August 24, 1993, John Fulton, Richard Smith, Dean Matson, Keith Consani. U. S. Patent Number 5,238,671

“Chemical Reactions in Reverse Micelle Systems” issued October 10, 1995, John Fulton, Richard Smith, Dean Matson. Canadian Patent # 1,337,235

“Catalyst Material and Method of Making,” Issued July 29, 1997, John L. Fulton, Dean Matson, John Linehan, U. S. Patent No. 5,652,192.

“Process of Forming Compounds using Reverse Micelle or Reverse Microemulsion Systems,” Issued June 23, 1998, John L. Fulton, John Linehan, Roger M. Bean, U. S. Patent No. 5,770,172.

“Method for Sizing and Desizing Yarns with Liquid and Supercritical Carbon Dioxide Solvent,” Issued January 26, 1999 to John L. Fulton, Clement R. Yonker, Richard R. Hallen, Eddie G. Baker, Lawrence E. Bowman, Laura J. Silva, U. S. Patent No. 5,863,298.

Publications

1. "Performance of Capillary Restrictors in Supercritical Fluid Chromatography," R. D. Smith, J. L. Fulton, R. C. Petersen, A. J. Kopriva, and B. W. Wright, **Anal. Chem.**, 58, 2057-2064 (1986).
2. "Organized Molecular Assemblies in the Gas Phase: Reverse Micelles and Microemulsions in Supercritical Fluids," R. W. Gale, J. L. Fulton, and R. D. Smith, **J. Amer. Chem. Soc.**, 109, 920-921 (1987).
3. "Reverse Micelle Supercritical Fluid Chromatography," R. W. Gale, J. L. Fulton, and R. D. Smith, **Anal. Chem.**, 59, 1977-1979 (1987).
4. "Rapid Expansion of Supercritical Fluid Solutions; Solute Formation of Powders, Thin Films and Fibers," D. W. Matson, J. L. Fulton, R. C. Petersen, and R. D. Smith, **Indust. Eng. Chem Res.**, 26, 2298-2306 (1987).
5. "Formation of Fine Particles in Supercritical Fluid Reverse Micelle Systems," D. W. Matson, J. L. Fulton and R. D. Smith, **J. Mat. Sci. Lett.**, 6, 31-33 (1987).
6. "Organized Molecular Assemblies in Supercritical Fluids; Metal Ion Chelates and Reverse Micelles," R. D. Smith, C. R. Yonker, J. L. Fulton and J. M. Tingey, **J. Supercritical Fluids**, 1, 7-14 (1988).
7. "Reverse Micelle Supercritical Fluid Separations," R. D. Smith, J. L. Fulton, and H. K. Jones, **Sep. Sci. Tech.**, 23, 2015-2030 (1988).

8. "Analytical Supercritical Fluid Extraction Methodologies," B. W. Wright, J. L. Fulton, A. J. Kopriva, and R. D. Smith, in: "Supercritical Fluid Extraction and Chromatography" (Eds. B. A. Charpentier and M. R. Sevenants), **ACS Symposium Series**, Vol. 366, 44-62 (1988).
9. "Organized Surfactant Assemblies in Supercritical Fluids" J. L. Fulton and R. D. Smith, in: "Surfactant Based Mobility Control; Progress in Miscible-Flood Enhanced Oil Recovery," D. H. Smith, Ed., **ACS Symposium Series**, 373, Chp. 5, 91-107 (1988).
10. "Supercritical Fluid Chromatography with Reversed Micelle Mobile Phases," R. D. Smith, J. L. Fulton and R. W. Gale, **LC-GC**, 6, 134-142 (1988).
11. "Reverse Micelle and Microemulsion Phases in Supercritical Fluids" J. L. Fulton and R. D. Smith, **J. Phys. Chem.**, 92, 2903-2907 (1988).
12. "Dynamic Light Scattering Measurements of Reverse Micelle Phases in Liquid and Supercritical Ethane," J. P. Blitz, J. L. Fulton and R. D. Smith, **J. Phys. Chem.**, 92, 2707-2710 (1988).
13. "Reverse Micelle and Microemulsion Phases in Supercritical Xenon and Ethane: Light Scattering and Spectroscopic Probe Studies," J. L. Fulton, J. P. Blitz, J. M. Tingey, and R. D. Smith, **J. Phys. Chem.**, 93, 4198-4204 (1989).
14. "The Potential of Reverse Micelle Mobile Phases for Supercritical Fluid Chromatography," R. D. Smith, J. L. Fulton, H. K. Jones, R. W. Gale, and B. W. Wright, **J. Chromatogr. Sci.**, 27, 309-317 (1989).
15. "Near and Mid Infrared High Pressure Cell for Studies of Reverse Micelle Phases in Supercritical Fluids," J. P. Blitz, J. L. Fulton and R. D. Smith, **J. App. Spectroscopy**, 43, 812-815 (1989).
16. "Structure of Reverse Micelle and Microemulsion Phases in Near-Critical and Supercritical Fluids as Determined from Dynamic Light Scattering," R. D. Smith, J. P. Blitz, and J. L. Fulton, Eds., K. P. Johnston, and J. M. L. Penninger, **ACS Symposium Series** No. 406, 165-183, (1989) .
17. "Inverse Emulsion Polymerization of Acrylamide in Near-Critical and Supercritical Continuous Phases," E. J. Beckman, J. L. Fulton, D. W. Matson, and R. D. Smith, in: "Supercritical Fluid Science and Technology (K. P. Johnson and J. M. L. Penninger, Eds.) **ACS Symposium Series**, Vol.406, 184-206 (1989).
18. "Reverse Micelle and Microemulsion Phases in Near-Critical and Supercritical Fluids," R. D. Smith, J. L. Fulton, J. P. Blitz, and J. M. Tingey, **J. Phys. Chem.**, 94, 781-787 (1990).
19. "Interdroplet Attractive Forces in AOT Water-in Oil Microemulsions Formed in Subcritical and Supercritical Solvents," J. M. Tingey, J. L. Fulton, and R. D. Smith, **J. Phys. Chem.**, 94, 1997-2004 (1990).
20. "Inter- and Intra-Molecular Hydrogen Bonding of Polyethylene Glycol Dodecyl Ethers in Supercritical Fluids," J. L. Fulton, G. G. Yee, and R. D. Smith, **J. Supercritical Fluids**, 3, 169-174 (1990).
21. "Micellar and Bicontinuous Microemulsions Formed in Both Near-Critical and Supercritical Propane Using Didodecyldimethylammonium Bromide (DDAB) and Water," J. M. Tingey, J. L. F. Fulton, D. W. Matson, and R. D. Smith, **J. Phys. Chem.**, 95, 1445-1448 (1991).
22. "A Small Angle Neutron Scattering Study of Intermicellar Interactions in Microemulsions of AOT, Water, and Near-Critical Propane," E. W. Kaler, J. F. Billman, J. L. Fulton, and R. D. Smith, **J. Phys. Chem.**, 95, 458-462 (1991).
23. "Microemulsions in Near-Critical and Supercritical Fluids," E. J. Beckman, J. L. Fulton, and R. D. Smith, In **Supercritical Fluid Technology**, CRC Press, 405-449, (1991).

24. "Hydrogen Bonding of Methyl Alcohol-d in Supercritical Carbon Dioxide and Supercritical Ethane Solution," Fulton, J.L., Yee, G.G., Smith, R.D., **J. Am. Chem. Soc.**, 113, 8327-8334 (1991).
25. "Microparticle Formation in Reverse Micelles and (W/O) Microemulsions in Supercritical Alkanes," Zemanian, T. S., Bean, R. M. Fulton, J. L., Linehan, J. C., Smith, R. D. In Proceedings of the 2nd International Symposium on Supercritical Fluids, McHugh, M. A. Ed., Dept. Ch. E, Johns Hopkins University, Baltimore, 193-195, (1991)
26. "Fourier Transform Infrared Spectroscopy of Molecular Level Interactions of Heptafluoro-1-butanol or 1-Butanol in Supercritical Carbon Dioxide and Supercritical Ethane," Yee, G.G., Fulton, J.L., Smith, R.D., **J. Phys. Chem.**, 96, 6172-6181 (1992).
27. "The Aggregation of Polyethylene Glycol Ethers in Supercritical Carbon Dioxide and Ethane," Fulton, J.L., Yee, G.G., Smith, R.D., **Langmuir**, 8, 377-384 (1992).
28. "FT-IR Investigation of the Partitioning of Sodium Bis (2-ethylhexyl) Sulfosuccinate between Water and Propane by Phases," Yee, G.G., Fulton, J.L., Blitz, J.P., Smith, R.D., **J. Phys. Chem.**, 95, 1403-1409 (1991).
29. "Protein Structural Effects in Gas Phase Ion/Molecule Reactions with Dethylamine," Ogorzalek-Loo, R. R., Loo, J. A., Udseth, H. R., Fulton, J. L., Smith, R. D., **Rapid Comm. Mass Spectrometry**, 6, 159-165, (1992).
30. "Aggregation of Simple Alcohols in Supercritical Fluid: A Molecular Dynamics Study," D.M. Pfund, J.L. Fulton, R.D. Smith in: "Supercritical Fluid Engineering Science" (E. Kiran, J. F. Brennecke, Eds.) **ACS Symposium Series**, Vol. 514, 158-174, (1993).
31. "Dynamic Fluorescence Quenching in Reverse Microemulsions in Propane," T.S. Zemanian, J.L. Fulton, R.D. Smith in: "Supercritical Fluid Engineering Science" (E. Kiran, J. F. Brennecke, Eds.) **ACS Symposium Series**, Vol. 514, 258-270, (1993).
32. "Hydrogen Bonding of Simple Alcohols in Supercritical Fluids: An FT-IR Study.," J.L. Fulton, G.G. Yee, R.D. Smith in: "Supercritical Fluid Engineering Science" (E. Kiran, J. F. Brennecke, Eds.) **ACS Symposium Series**, Vol. 514, 175-187, (1993).
33. "Characterization of a Water-in-Oil Microemulsion Containing a Concentrated Ferric Ion Aqueous Phase," J. L. Fulton, J. G. Darab, J. C. Linehan, M. Capel, Y. Ma, **Langmuir**, 10, 135-141, (1994).
34. "Reverse Micelle Synthesis of Nano-scale Metal Containing Catalyst" John Darab, John Fulton and John Linehan, Preprint, Division Fuel Chemistry, **ACS**, 38, 27(1993).
35. "Iron Oxyhydroxide Particle Formation in a Modified Reverse Micelle; Structural Implications from EXAFS Spectroscopy and Geometrical Modeling," J. G. Darab, J. L. Fulton, J. C. Linehan, D. W. Matson, Y. Ma, **J. Mat. Sci. Lett.**, submitted, 1993.
36. "A Small Angle X-ray Scattering Study of the Effect of Pressure on the Aggregation of Asphaltene Fractions in Petroleum Fluids Under Near-Critical Solvent Conditions." , J. L. Fulton, D. M. Pfund, R. D. Smith, N. F. Carnahan, L. Quintero, M. Capel, K. Leontaritis, **Langmuir**, 9, 2035-2044, (1993)

37. "A Luminescence Quenching Study of a Percolation Transition in a Propane/Didodecyldimethylammonium Bromide/Water Microemulsion" J. L. Fulton, R. D. Smith, J. Zhang, **J. Phys. Chem.**, 97, 12331-12338 (1993)
38. "Raman Spectroscopic Studies in Supercritical Water." L. E. Bowman, J. L. Fulton, Proceedings of the 3rd International Symposium on Supercritical Fluids, G. Brunner, M. Perrut, Eds, Strasbourg, 197-202 (1994).
39. "Small Angle X-ray Scattering Studies of Reverse Micelles in Supercritical Fluids" D. M. Pfund, J. L. Fulton, Proceedings of the 3rd International Symposium on Supercritical Fluids, G. Brunner, M. Perrut, Eds, Strasbourg, Institut National Polytechnique De Lorraine 235-240 (1994).
40. "Small Angle X-ray Scattering Studies of Aggregation in Supercritical Fluid Solutions" J. L. Fulton, D. M. Pfund, Proceedings of the 3rd International Symposium on Supercritical Fluids, G. Brunner, M. Perrut, Eds, Strasbourg, 391-396 (1994)
41. "An XAFS Study of Strontium Ions and Krypton in Supercritical Water," D. M. Pfund, J. G. Darab, and J. L. Fulton, **J. Phys. Chem.**, 98, 13102-13107, (1994)
42. "A Spectroscopic Investigation of an L-alpha-Phosphatidyl Choline Gel Formed in Near-Critical Propylene." J. Zhang, G. L. White, J. L. Fulton, **J. Phys. Chem.**, 99, 5540-5547, (1995).
43. "Fluid Structure in Supercritical Xenon by Nuclear Magnetic Resonance Spectroscopy and Small Angle X-ray Scattering." D. M. Pfund, T. S. Zemanian, J. C. Linehan, J. L. Fulton, C. R. Yonker, **J. Phys. Chem.**, 98, 11846-11857 (1994).
44. "Hydrothermal Oxidation of Ammonium by Nitrate: A Raman Spectroscopic Study" L.E. Bowman and J.L. Fulton, Proceedings of the 12th International Conference on the Properties of Water and Steam, . H.J. White Jr., J.V. Sengers, D.B. Neumann, J.C. Bellows Eds, Begell House, NY 1995, p 625-631.
45. "Aggregation of Amphiphilic Molecules in Supercritical Carbon Dioxide: A Small Angle X-Ray Scattering Study" Fulton, J. L.; Pfund, D. M.; McClain, J. B.; Romack, T. J.; Maury, E. E.; Combes, J. R.; Samulski, E. T.; DeSimone, J. M.; Capel, M. **Langmuir** , 11, 4241-4249 (1995).
46. "Water Solubility Measurements in Supercritical Fluids and High-Pressure Liquids Using Near-Infrared Spectroscopy" K. Jackson, L. E. Bowman, J. L. Fulton, **Anal. Chem.**, 67, 2368-2372, (1995)
47. "Dramatic Density-Induced Structural Changes in Microemulsions Formed in Near-Critical and Supercritical Solvents," J. Zhang and J. L. Fulton (K. W. Hutchenson, N. R. Foster, Eds.) **ACS Symposium Series**, Vol. 608, 111-125, (1995).
48. "A Diamond-Window XAFS Cell for Studies of High-Temperature, High-Pressure, Aqueous Solutions" J. L. Fulton, D. M. Pfund, Y. Ma, **Rev. Sci Instruments**, 67, 1-5, CD-ROM Issue, (1996).
49. "A High-Pressure, Capillary XAFS Cell for Studies of Liquids and Supercritical Fluid Solutions," S. L. Wallen, D. M. Pfund, J. L. Fulton, C. R. Yonker, M. Newville, Y. Ma, **Rev. Sci Instruments**, 67, 2843-2845, (1996).

50. "Direct Modeling of XAFS Spectra from Molecular Dynamics Simulations," B. J. Palmer, D. M. Pfund, J. L. Fulton, **J. Phys. Chem.**, 100, 13393-13398, (1996).
51. "Microemulsions in Supercritical Hydrochlorofluorocarbons," K. Jackson, J. L. Fulton, **Langmuir**, 12, 5289-5295, (1996).
52. "Infrared and Molecular Dynamics Study of D₂O Rotational Relaxation in Supercritical CO₂ and Xe." L. E. Bowman, B. J. Palmer, B. J. Garrett, J. L. Fulton, C. R. Yonker, D. M. Pfund, S. L. Wallen, **J. Phys. Chem.** 100, 18327-18334, (1996).
53. "The Hydrothermal Destruction of Ammonium in Municipal Waste: A Raman Spectroscopic Investigation" Lawrence E. Bowman, Alex G. Fassbender, and John L. Fulton, **Ind. and Eng. Chem. Research** 1996, submitted.
54. "Sizing and Desizing Polyester/Cotton Blend Yarns Using Liquid Carbon Dioxide" L. E. Bowman, C. Caley, R. Hallen, J. L. Fulton, **Textile Research Journal**, 66, 795-802 (1996).
55. "Surfactants and Micromemulsion in Supercritical Fluids," K. Jackson, J. L. Fulton, In "Supercritical Cleaning," (J. McHardy, S.P. Sawan Eds), Noyes,NJ, 1998, 87-120
56. "Rubidium Ion Hydration in Ambient and Supercritical Water," J. L. Fulton, D. M. Pfund, S. L. Wallen, M. Newville, E. A. Stern, Y. Ma, **J. Chem. Phys.**, 105, 2161-2166, (1996).
57. "Hydration of Ions in Supercritical Water," J. L. Fulton, S. L. Wallen , Y. Ma, D. M. Pfund, M. Newville, Extented Abstracts of Emerging Technologies in Hazardous Waste Management VIII, . D. William Tedder, Editor, ACS,Birmingham, Sept 9-11, 1996.
58. "XAFS Measurements of Rb-O Bonds in Ambient and Supercritical Water," M. Newville, J. L. Fulton, D. M. Pfund, S. L. Wallen, E.A. Stern and Y. Ma, **J. de Physique IV**, 7, C2-1007-1008, (1997)
59. "Structure and Reactions in Microemulsions formed in Near-critical and Supercritical Fluids," J. L. Fulton, In **Handbook of Microemulsion Science and Technology**, P. Kumar, K.L. Mittal Ed., Marcel Dekker, New York, 629-650, (1999).
60. "Hydration of Bromide Ion in Supercritical Water: An X-ray Absorption Fine Structure Study" S. L. Wallen, B. J. Palmer, D. M. Pfund and J. L. Fulton, M. Newville, E. Stern, Y. Ma, **J. Phys. Chem. A**, 101, 9632-9640, (1997).
61. "Hydration of Ions in Supercritical Water," J. L. Fulton, S. L. Wallen, B. J. Palmer, Proceedings of the Fifth International Symposium on Hydrothermal Reactions, D. A. Palmer and D. J. Wesolowski Eds. (Oak Ridge National Laboratory), Gatlinburg, TN, 1997, 167-170.
62. "The Ion Pairing and Hydration of Ni²⁺ in Supercritical Water at 425°C and 690 bar determined by X-ray Absorption Fine Structure and Molecular Dynamics Studies," S. L. Wallen, B. J. Palmer, J. L. Fulton, **J. Chem. Phys.**, 108, 4039-4046, (1998).
63. "Solubility of a Fullerene, C₆₀, in Ethane, Propane and Other Supercritical Fluids.," G. L. White, G. G. Yee, J. L. Fulton, **Fluid Phase Equilibria**, 1997, submitted.
65. "The Use of High-Pressure NMR for the Determinations of Phase Behavior from Select Binary Solvent Systems.," Yonker, C. R. Fulton, J. L., **J. Supercritical Fluids**, 14, 9-16, (1998).

66. "Synthesizing and Dispersing Silver Nanoparticles in a Water-in-Supercritical Carbon Dioxide Microemulsion" M. Ji, X. Chen, C. M. Wai, J. L. Fulton, **J. Am. Chem. Soc.**, 121, 2631-2632, (1999).
68. "Studying *in situ* Hydrothermal Reactions with X-ray Absorption Spectroscopy," Hoffmann, M. M.; Darab, J. G.; Fulton, J. L.; Stern, E. A., **Mineralogical Magazine**, 62A, 636-637 (1998).
69. "Spectroscopic Techniques for Supercritical Fluids" (UV-vis, Fluorescence, EPR, XAFS, X-ray and Neutron Scattering Spectroscopies) J. C. Linehan, C. R. Yonker, J. L. Fulton, In **Chemical Synthesis using Supercritical Fluids**, P. Jeossep, W. Leitner, Eds.), Wiley-VCH 1999, 195-212
70. "Transition in the Solvation Structure about Ions in Supercritical Water and their Effects on Reactivity," J. L. Fulton, M. M. Hoffmann, J. G. Darab, In "Proceedings ACS Meeting," Anaheim, M. Lewan, G. Cody, Eds. 1999.
71. "A Transition in the Ni^{2+} Complex Structure from Six- to Four-Coordinate upon Formation of Ion Pair Species in Supercritical Water: An XAFS, NIR and MD Study" M. M. Hoffmann, J. G. Darab, B. J. Palmer, and J. L. Fulton, **J. Phys. Chem. A**, 103, 8471-8482, (1999)
72. "New Experimental Developments for *in situ* XAFS Studies of Chemical Reactions under Hydrothermal Conditions," Hoffmann, M. M.; Darab, J. G.; Heald, S. M.; Yonker, C. R.; Fulton, J. L., **Chemical Geology**, 167, 89-103, (2000)
73. "Short-pathlength, High-pressure Flow Cell for Static and Time-Resolved Infrared Spectroscopy Suitable for Supercritical Fluid Solutions including Hydrothermal Systems," Hoffmann, M. M.; Addleman, R. S., Fulton, J. L., **Rev. Sci Instruments**, 71, 1552-1556, (2000).
74. "XAFS Studies of Aqueous Tungstate and Chrome Solutions at High Temperatures and Pressures," Hoffmann, M. M.; Darab, J. G.; Fulton, J. L., **Proceedings of the 13th International Conference on the Properties of Water and Steam**, Tremaine, P. R., Hill, P. G. Irish, D. E., Balakrishnan, P. V., Eds., NRC Press, Ottawa, 2000, In press.
75. "A Transition from a Six- to a Four-Coordinate Ni^{2+} Complex in High-Temperature Aqueous Solutions from X-ray Absorption Spectroscopy," Fulton, J. L.; Darab, J. G.; Hoffmann, M. M., **Proceedings of the 13th International Conference on the Properties of Water and Steam**, Tremaine, P. R., Hill, P. G. Irish, D. E., Balakrishnan, P. V., Eds., NRC Press, Ottawa, 2000, In press.
76. "Unusual Dysprosium Ceramic Nano-Fiber Growth in a Supercritical Aqueous Solution," Hoffmann, M. M.; Young, J. S.; Fulton, J. L., **J. of Materials Science**, 35, 4177-4183, (2000).
77. "Corrosion of Nickel Metal by Hydrothermal Sodium Tungstate Solution Observed by *In Situ* Infrared Spectroscopy," Hoffmann, M. M.; Fulton, J. L., **Corrosion**, 56, 501-504, (2000).
78. "Speciation of a Cu(I) Compound in Heterogenous Hydrothermal Mixture using X-ray Imaging and X-ray Absorption Spectroscopy through a Diamond Micro-Reactor Cell," Fulton, J. L., Hoffmann, M. M., Darab, J. G., **Chemistry of Materials**, (2000), submitted.

79. "Copper(I) and Copper(II) Coordination Structure under Hydrothermal Condition at 325°C: An XAFS, and MD Study," Fulton, J. L., Hoffmann, M. M., Darab, J. G., Palmer, B. J., Stern, E. A., **J. Phys. Chem. A**, (2000), In press.
80. "Imaging and Micro-XAFS of Hydrothermal Solutions in a Diamond Reactor Cell," Fulton, J. L. Hoffmann, M. M., Darab, J. G., **APS User Activity Report**, (1999), In press.
81. "An X-ray Absorption Fine Structure Study of Copper(I) Chloride Coordination Structure in Water up to 325°C" J. L. Fulton, M. M. Hoffmann, and J. G. Darab, **Chemical Physics Letters**, (2000) submitted.
82. "An Infrared and X-ray Absorption Study of the Equilibria and Structures of Chromate, Bichromate and Dichromate in Ambient Aqueous Solutions," M. M. Hoffmann, J. G. Darab, and J. L. Fulton, **J. Phys. Chem. A**, (2000), submitted.