

Curriculum Vitae

Mark V. Fedkin

Ph.D., Associate Teaching Professor,
John and Willie Leone Family Department of Energy and Mineral Engineering
The Pennsylvania State University
421A Earth and Engineering Sciences Bld., University Park, PA 16802
814-876-0461 | mvf3@psu.edu

Summary of expertise

- Energy technologies: solar energy, hydrogen energy, electrochemical energy storage, fuel cells, electrolysis, technology assessment.
- Environmental science and earth systems: natural system thermodynamics, hydrothermal systems, environmental and surface chemistry.
- Sustainability systems education: system analysis, broader impacts of renewable energy projects, holistic energy education and project development.

Education

Ph.D. in Geo-Environmental Engineering, 2003. The Pennsylvania State University.

M.S. in Geo-Environmental Engineering, 2001. The Pennsylvania State University

B.S. in Geology, 1993, Moscow State University, Russia.

Professional experience

- *Associate Teaching Professor*, John A. Dutton e-Education Institute, College of Earth and Mineral Sciences (2018-present)
 - Lead Faculty, Professional Masters in Renewable Energy and Sustainability Systems (MPS RESS) program, Penn State University. Responsibilities include strategic planning, developing curriculum, teaching courses, hiring instructors for the program, recruiting students, serving as the main point of contact for the program, student admission and academic advising (over 100 students).
 - Coordinator, Solar Energy Graduate Certificate, Penn State University. Responsibilities include teaching, curriculum development, student recruiting, and maintaining student records, and performing program assessment and revisions.
 - Lead Faculty, Online BS and BA Energy and Sustainability Policy (ESP) program, Penn State University. Responsibilities include strategic planning, program revisions, oversight of operation and communications on behalf of the program.
- *Assistant Teaching Professor*, John A. Dutton Institute for Teaching and Learning Excellence, College of Earth and Mineral Sciences, Penn State University.

- *Assistant Research Professor*, Department of Mechanical and Nuclear Engineering, Penn State University, University Park, PA 16802. (2017 – 2018).
 - Performed research on aqueous electrolyte systems using ReaxFF molecular dynamic simulations, performed data analysis, and published papers based on the results.
- *Research Associate*, Department of Mechanical and Nuclear Engineering (ReaxFF Molecular Dynamics Group), Penn State University, University Park, PA 16802. (2013 – 2017).
 - Performed research on externally funded projects related to silica-water interfacial chemistry, ran molecular dynamic simulations, performed data treatment, and prepared papers and presentations based on the results.
- *Research Associate, Assistant Director for the Electrochemical Technologies Program*, EMS Energy Institute, Penn State University, University Park, PA 16802, (2003 – 2013)
 - Coordinated research and advised graduate students on a number of externally funded projects; designed experimental systems for high temperature electrochemical testing; performed electrochemical measurements of material properties in high temperature high pressure environments (including supercritical conditions); analyzed data and developed theoretical models of electrical double layer at solid/water interface; prepared research proposals, manuscripts, and presentations; prepared reports to the funding agencies; collaborated with external research groups countrywide within established research consortia.
- *Visiting Scientist*, Department of Earth and Atmospheric Sciences, Purdue University, West Lafayette, 47907 IN, January-May 1998.
 - Performed research on solid solutions in sulfide minerals; designed experiments and analyzed samples using microprobe and evacuated ampoule techniques.
- *Junior Scientist*, Institute of Experimental Mineralogy, Russian Academy of Sciences, Chernogolovka, 142432 Russia. Laboratory of High-Temperature Electrochemistry, 1995-1999.
 - Performed experimental studies on thermodynamics of oxide and sulfide mineral equilibria; designed high temperature electrochemical cells and probes.
- *Research Engineer*, Geochemistry Department, Moscow State University, Moscow, 119899 Russia. Laboratory of Experimental Geochemistry, 1993-1995.

Teaching experience (Penn State University)

- Residential Courses taught (Undergraduate):
 - EGEE 102 Energy Conservation and Environmental Protection*, 2017-2018
 - EGEE 304 Heat and Mass Transfer*, Spring 2017
 - EARTH 002 Earth System and Global Change*, Spring 2016-2017
 - EGEE 420 Hydrogen and Fuel Cells*, Spring 2012;
- Online Courses authored and taught (Graduate)
 - EME 807 Technologies for Sustainability Systems*, 2015 - present

EME 811 Solar Thermal Technologies for Utilities and Industry, 2015-2017

EME 812 Utility Solar Power and Concentration, 2015 - present

EME 810 Solar Resource Assessment and Economics, 2018 - present

- Co-Instructor (with Serguei Lvov)
EGEE 441 Electrochemical Energy Conversion, Fall, 2008-2010;
EGEE 597A Electrochemical Methods, Spring 2007;
EGEE 597A Electrochemical Engineering Principles, Spring 2004.
- Guest Lectures
SOILS 71 Environmental Sustainability, Fall 2020-2021 (Life Cycle Assessment)
- Lab development and instruction:
Design and organization of educational electrochemical labs (EME Department); instruction and training of graduate and undergraduate students; lab tours and demonstrations.

Service and Synergistic Activities

- International Solar Energy Society – Member
- Solar Innovation Working Group – Penn State Sustainability Institute
- EME Executive Council, 2020-present
- EME Graduate Executive Committee, 2022
- EME Committee on Online Programs and Microcredentials, 2021
- EMS College - Fixed Term Faculty Advisory Committee, 2018-2021
- RESS Symposium – Paper Judging Committee, 2016
- Peer Reviewer – Journals: *Environmental Science and Technology, Fuel Processing Technology, Langmuir, Central European Journal of Physics*
- Technical Translator – *Mineral Observer; Interperiodica (Petrology, Geology of Ore Deposits).*
- Book reviews: *Kendall Hunt Publishing, AIP Publishing, 2020-2021*
- Chemcut Corporation – consulting in technical communications and personnel training
- EMS Energy Institute Fixed Term Faculty Peer-Review Committee, 2008-2012
- EMS Energy Institute Safety Committee, 2008-2012
- Faculty Judge: Undergraduate Exhibition (PSU), Pennsylvania Junior Academy of Science (PJAS).

Graduate Dissertation Research Advising

- Haining Zhao, “Phase Equilibria in CO₂-Brine System for CO₂ Storage”, PhD Thesis, The Pennsylvania State University, 2014.
- Richard Schatz, “Cu-Cl electrolysis for Cu-Cl thermochemical cycle”, MS Thesis, The Pennsylvania State University, 2013.
- Justin Beck, “Electrochemical measurements of corrosion in supercritical CO₂ environments”, PhD Thesis, The Pennsylvania State University, 2012.
- Mark Labarbera, “Development of Solid Oxide Fuel Cells Utilizing Alternative Fuels”, PhD Thesis, The Pennsylvania State University, 2012.
- Victor Rodriguez-Santiago, “Electrophoresis of nanoparticles in high temperature aqueous solutions”, PhD Thesis, The Pennsylvania State University, 2009.

Grants and Awards

- G. Montgomery and Marion Hall Mitchell Award for Innovative Teaching, 2023
- Freiburg-Penn State Virtual Classroom Education Award: Solar Energy Integration and Economics – 2020-2021 (co-PI, Penn State)
- National Science Foundation (NSF): “Development of Nanoelectrophoresis Cell for Studying the Surface Properties of Minerals in Hydrothermal Environments” –2008-2012. (co-PI)
- U.S. Department of Energy (DOE): “Solid Oxide Fuel Cells Operating on Alternative and Renewable Fuels” – 2008-2013 (co-PI)
- Argonne National Lab (ANL)-DOE: “Development of CuCl/HCl Electrolyzer”
- National Energy Technology Lab (NETL): “Modeling of CO₂-Water-Rock Interactions for Carbon Sequestration Processes” -2011-2012(co-PI)
- National Energy Technology Lab (NETL): “Corrosion Experiments for Determining the Effects of CO₂ Transport in Pipelines” – 2010-2011 (co-PI)
- National Energy Technology Lab (NETL): “Clean and Efficient Electrical Power Generation from U.S. Coal in Solid Oxide Fuel Cells” – 2010-2011(co-PI)
- U.S. Department of Energy (DOE), Nuclear Energy Research Initiative (NERI) Consortium: “Advanced Electrochemical Technologies for Hydrogen Production by Alternative Thermochemical Cycles” – 2007-2009 (key contributor)
- Argonne National Laboratory: “Comparative Evaluation of an Alternate Thermochemical Cycle for Producing Hydrogen” – 2006
- Electric Power Research Institute (EPRI): “Simulated Boiler Corrosion Studies Using Electrochemical Techniques” – 2005-2008
- Electric Power Research Institute (EPRI): “Development of a Conductivity / Corrosion Probe for Using in Boiler Water at Temperatures up to 360 °C: - 2007-2008
- Research Achievement Award, EMS Energy Institute 2007.
- Muan/Wilson Fellow Award. College of Earth and Mineral Sciences, Penn State University, 2003.
- Materials Research Institute Fellow, Penn State University, 1999-2000.

List of Publications

1. Dasgupta, N., Shin, Y.K., Fedkin, M.V., van Duin, A., ReaxFF Molecular Dynamics Simulations of Aqueous Electrolytes at Supercritical Temperature, *J. Chem. Phys.*, 152, 204502 (2020).
2. Dasgupta, N., Shin, Y.K., Fedkin, M.V., van Duin, A., ReaxFF Molecular Dynamics Simulations of Electrolyte Water Systems at Ambient Temperature, *Computational Materials Science*, 172, 109349 (2020).
3. Fedkin, M.V., Shin, Y.K., Dasgupta, N., Yeon, J., Zhang, W., van Duin, D., Kubicki, J., van Duin, A., Mori, K., Fujiwara, A., Machida, M., Nakamura, H., and Okamura, M., Development of the ReaxFF Methodology of Electrolyte-Water Systems., *Journal of Physical Chemistry A* 123(10) (2019).

4. Osadchii, V.O., Fedkin, M.V., and Osadchii, E.G., Determination of the equilibrium fO_2 in bulk samples of H, L, and LL ordinary chondrites by solid-state electrochemistry, *Meteoritics & Planetary Science*, doi:10.1111/maps.12919 (2017).
5. Osadchii, V.O., Fedkin, M.V., Osadchii, E.G., Electrochemical determination of the thermodynamic parameters of sphalerite, ZnS, *J. Alloys Compounds*, 636, 368-374 (2015).
6. Khurana, S., LaBarbera, M., Fedkin, M.V., Lvov, S.N., Abernathy, H., and Gerdes, K., Performance evaluation of a liquid tin anode solid oxide fuel cell operating under hydrogen, argon and coal, *J. Power Sources* 274 (2015).
7. Khurana, S., Hall, D.M., Schatz, R.S., Fedkin, M.V., and Lvov, S.N., State-of-health of a CuCl electrolyzer during 168-h test., *Int. J. Hydrogen Energy*, 40(1), 62-69 (2015).
8. Khurana, S., LaBarbera, M., Fedkin, M.V., Lvov, S.N., Abernathy, H., Gerdes, K., Performance Evaluation of a Liquid Tin Anode Solid Oxide Fuel Cell Operating under Hydrogen, Argon, and Coal., *J. Power Sources*, 274, 1049-1054 (2015).
9. Zhao, H., Fedkin, M.V., Dilmore, R., and Lvov, S.N., Carbon dioxide solubility in aqueous solutions of sodium chloride at geological conditions: Experimental results at 50, 100, 150 °C and 150 bar and modeling up to 300 °C and 2000 bar, *Geochim. Cosmochim. Acta*, 149, 165-189 (2014).
10. Schatz, R., Kim, S., Khurana, S., Fedkin, M.V., and Lvov, S.N., High Efficiency CuCl Electrolyzer for Cu-Cl Thermochemical Cycle, *ECS Transactions*, 50, 153-164 (2013).
11. Beck, J., Fedkin, M.V., and Lvov, S.N., Electrochemical Corrosion Measurements in Supercritical Carbon Dioxide - Water Systems with and without Membrane Coating, *ECS Transactions*, 50, 315-334 (2013).
12. Beck, J., Fedkin, M.V., Lvov, S.N., and Ziomek-Moroz, M., Membrane-coated Electrochemical Probe for Corrosion Measurements of High Strength Carbon Steel in Supercritical CO₂, *NACE Corrosion* (2013).
13. J. Beck, M. Fedkin, S. Lvov, M. Ziomek-Moroz, G.R. Holcomb, J. Tylczak, D. Alman, In situ electrochemical corrosion measurements of carbon steel in supercritical CO₂ using a membrane-coated electrochemical probe,” *ECS Transactions* 45, 39-50 (2013).
14. Rodriguez-Santiago, V., Fedkin, M.V., and Lvov, S.N., Protonation Enthalpies of Metal Oxides from High Temperature Electrophoresis, *J. Colloid. Interface Sci.*, 371, 136-143 (2012).
15. LaBarbera, M., Khurana, S., Fedkin, M., Lvov, S., Abernathy, H., and Gerdes, K., Electrochemical Characterization of Liquid Metal Anode Solid Oxide Fuel Cell, *ECS Trans.*, 41(12), 103-113 (2012).
16. Ziomek-Moroz, M., Holcomb, G.R., Tylczak, J., Beck, J., Fedkin, M.V., and Lvov, S.N., Surface and Electrochemical Behavior of HSLA in Supercritical CO₂-H₂O Environment, *ECS Trans.*, 41, Issue 24, 61-70 (2012).
17. Kim, S., Schatz, R.S., Khurana, S., Fedkin, M.V., Wang, C., and Lvov, S.N., Advanced CuCl Electrolyzer for Hydrogen Production via the Cu-Cl Thermochemical Cycle, *ECS Trans.*, 35 (32), 257-265 (2011).
18. Balashov, V.N., Schatz, R., Chalkova, E., Akinfiev, N.N., Fedkin, M.V., and Lvov, S.N., CuCl Electrolysis for Hydrogen Production in the Cu-Cl Thermochemical Cycle, *J. Electrochem. Soc.*, 158(3), B266-B275 (2011).

19. LaBarbera, M., Fedkin, M., and Lvov, S., Liquid Tin-Lead Anode Solid Oxide Fuel Cell Fueled by Coal, *ECS Trans.*, 35 (1) 2725-2734 (2011).
20. LaBarbera, M., Fedkin, M., Wang, X., Chao, X., Song, C., and Lvov, S., Solid Oxide Fuel Cell Fueled by Diesel Reformate and Anaerobic Digester Gas, *ECS Trans.*, 35(1), 2867-2872 (2011).
21. Beck, J., Lvov, S., Fedkin, M., Ziomek-Moroz, M., Holcomb, G., Tyleczak, J., and Alman, D., Electrochemical System to Study Corrosion of Metals in Supercritical CO₂ Fluids, *NACE Corrosion*, Paper No. 11380 (2011).
22. Wang, X., Chao, X., LaBarbera, M., Fedkin, M., Lvov, S., and Song, C., Steam reforming of Liquid Hydrocarbon Fuels with On-Line Solid Oxide Fuel Cell Test, Prep. Pap. – Am. Chem., Soc., Div. Fuel Chem., 56(1), 356 (2011).
23. Wang, C., Chalkova, E., Lee, J.K., Fedkin, M.V., Komarneni, S., and Lvov, S.N., Composite Membranes with Sulfonic and Phosphonic Functionalized Inorganics for Reduced Relative Humidity PEM Fuel Cells, *J. Electrochem. Soc.*, 158(6), B690-B697 (2011).
24. Vidojkovic, S., Rodriguez-Santiago, V., Fedkin, M.V., Wesolowski, D.J., and Lvov, S.N., Electrophoretic mobility of magnetite particles in high temperature water, *Chemical Engineering Science*, 66, 4029-4035 (2011).
25. Machesky, M.L., Wesolowski, D.J., Rosenqvist, J., Predota, M., Vlcek, L., Ridley, M., Kohli, V., Zhang, Z., Fenter, P., Cummings, P., Lvov, S., Fedkin, M.V., Rodriguez-Santiago, V., Kubicki, J., Bandura, A.V., Comparison of Cation Adsorption by Isostructural Rutile and Cassiterite, *Langmuir*, 27, 4585-4593 (2011).
26. Zhang, M., Kim, H.K., Chalkova, E., Fedkin, M.V., Lvov, S.N., and Mike Chung, T.C., New Polyethylene Based Anion Exchange Membranes (PE-AEMs) with High Ionic Conductivity, *Macromolecules*, 44, 5937-5946 (2011).
27. Wang, C., Chalkova, E., Lute, C.D., Fedkin, M.V., Komarneni, S., Mike Chung, T.C., and Lvov, S.N., Proton Conductive Inorganic Materials for Temperatures up to 120 °C and Relative Humidity down to 5%, *J. Electrochem. Soc.*, 157 (11), B1634-B1642 (2010).
28. Gong, Y., Chalkova, E., Akinfiev, N.N., Balashov, V., Fedkin, M., and Lvov, S.N., CuCl-HCl Electrolyzer for Hydrogen Production via Cu-Cl Thermochemical Cycle, *ECS Trans.*, 19(10), 21 (2009).
29. Chalkova, E., Wang, C., Komarneni, S., Lee, J., Fedkin, M., and Lvov, S., Composite proton conductive membranes for elevated temperature and reduced relative humidity PEMFC, *ECS Trans.*, 25(1) 1141 (2009).
30. LaBarbera, M., Fedkin, M., Lee, J., Zhou, Z., and Lvov, S., Degradation in Solid Oxide Fuel Cells Operating with Alternative Fuels, *ECS Trans.*, 25(2) 1125 (2009).
31. Balashov, V.N., Fedkin, M.V., Lvov, S.N., and Mathews, J.A., Electrochemical Corrosion Measurements in High Temperature Boiler Water, *NACE International, 17th International Corrosion Congress*, Paper No. 4869 (2009).
32. Rodriguez-Santiago, V., Fedkin, M.V., Vidojkovic, S., Wesolowski, D.J., and Lvov, S.N., Nanoelectrophoresis Studies of Magnetite and Silica in Hydrothermal Environments, *Geochim. Cosmochim. Acta*, Goldschmidt Conference Abstracts, A1111 (2009).
33. Zhang, Z., Chalkova, E., Fedkin, M., Wang, C., Lvov, S.N., Komarneni, S., and Chung, T.C., Synthesis and Characterization of Poly(vinylidene fluoride)-g-Sulfonated Polystyrene Graft

- Copolymers for Proton Exchange Membrane, in *Fuel Cell Chemistry and Operation*, ACS Volume, Herring A., Hamrock, S., and Zawodzinski, T., Eds., (2009).
34. Balashov, V.N., Fedkin, M.V., and Lvov, S.N., Experimental system for electrochemical studies of aqueous corrosion at temperatures above 300 °C, *J. Electrochem. Soc.*, 156, C209-C213 (2009).
 35. Rodriguez-Santiago, V., Fedkin, M.V., Wesolowski, D.J., Rosenqvist, J., and Lvov, S.N., Electrophoretic study the SnO₂/aqueous solution interface up to 260 °C, *Langmuir*, 25 (14), 8101–8110 (2009).
 36. Rodriguez-Santiago, V.; Fedkin, M.V.; Rosenqvist, J. Machesky, M.L., Wesolowski, D.J., and Lvov, S.N., Surface properties of nanosize oxides by high temperature electrophoresis *Geochim. Cosmochim. Acta*, 72 (Issue: 12), A802-A802 (2008).
 37. Wang, C., Chalkova, E., Lute, C., Fedkin, M., Komarneni, S., Chung, T.C.M., and Lvov, S., Proton conductive inorganics for composite membranes in PEM fuel cells, *ECS Trans.*, 16(2) 1451 (2008).
 38. Rodriguez-Santiago, V., Fedkin, M.V., and Lvov, S.N., Electrophoresis system for high temperature mobility measurements of nanosize particles, *Rev. Sci. Instrum.* 79, 093302 (2008).
 39. Zhang, Z., Chalkova, E., Fedkin, M., Wang, C., Lvov, S., Komarneni, S., and Chung, T.C., Synthesis and Characterization of Poly(vinylidene fluoride)-g-sulfonated polystyrene Graft Copolymers for Proton Exchange Membrane, *Macromolecules* 41, 9130-9139 (2008).
 40. Machesky, M.L., Wesolowski, D.J., Ridley, M.K., Palmer, D.A., Rosenqvist, J., Lvov, S.N., Fedkin, M.V., Předota, M., and Vlcek, L., The Protonation Behavior of Metal Oxide Surfaces to Hydrothermal Conditions, *ECS Transactions*, 11 (27) 151-166 (2008).
 41. Rodriguez-Santiago, V., Fedkin, M.V., and Lvov, S.N., Study of the Electrochemical Step of Novel Active Metal Alloy Thermochemical Cycles for Hydrogen Production, *ECS Transactions*, 11 (27) 133-142 (2008).
 42. Fedkin, M.V., Chalkova, E., Wesolowski, D.J., Lvov, S.N., Understanding the Water Retention of Composite PEMs Based on Surface Chemistry of Inorganic Fillers, *ECS Transactions*, 11 (27) 189-198 (2008).
 43. Balashov, V.N., Fedkin, M.V., Lvov, S.N., Dooley, B., Experimental System for Studying Interfacial Electrochemistry at Temperature above 300 °C, *ECS Transactions*, 11 (27) 27-38 (2008).
 44. Chung, T.C., Zhang, Z., Chalkova, E., Wang, C., Fedkin, M.V., Komarneni, S., Sharma, S., and Lvov, S.N., Proton Conductive Composite Materials Using Functionalized and Crosslinkable VDF/CFTE Fluoropolymers and Proton Conductive Inorganics, *ECS Transactions*, 11 (1) 35-47 (2007).
 45. Chalkova, E., Fedkin, M.V., Komarneni, S., and Lvov, S.N., Nafion/Zirconium Phosphate Composite Membranes for PEMFC Operating at up to 120°C and down to 13% RH, *J. Electrochem. Soc.*, 154, B288 (2007).
 46. Balashov, V.N., Fedkin, M.V., Lvov, S.N., and Dooley B., Experimental System For Electrochemical Corrosion Studies In High Temperature Aqueous Solutions, CORROSION NACE International Corrosion Conference and Expo, 2007, Paper #07403 (2007)

47. Fedkin, M.V., Chalkova, E., Komarneni, S., Wesolowski, D.J., and Lvov, S.N., Surface Electrochemistry of Composite Materials for High-Temperature PEM Fuel Cells, *Electrochem. Soc. Trans.*, 1(6), 215-225 (2006).
48. Chalkova, E., Rybka, G., Fedkin, M.V., Wesolowski, D.J., Roelofs, M., and Lvov, S.N., Nafion/TiO₂ Composite Membranes for PEM Fuel Cells Operating at Elevated Temperature and Reduced Relative Humidity, *Electrochem. Soc. Trans.*, 3(1), 73-82 (2006).
49. Machesky, M.L., Wesolowski, D.J., Palmer, D.A., Ridley, M.K., Bénézeth, P., Lvov, S.N., and Fedkin M.V., Ion adsorption into the hydrothermal regime: Experimental and modeling approaches . Chapter 12, in (J. Lutzenkirchen, ed.) *Surface Complexation Modeling 11*, Elsevier, Amsterdam, p. 324-358 (2006).
50. Lvov, S.N., Fedkin, M.V., Chalkova, E., Komarneni, S., and Wesolowski, D.J., Surface Chemistry of Inorganic Materials for Composite Membranes in PEM Fuel Cells Operating at Elevated Temperature and Reduced Relative Humidity, *Prepr. Pap. Am. Chem. Soc., Div. Fuel Chem.*, 51(2) (2006).
51. Chalkova, E., Fedkin, M.V., Wesolowski, D.J. and Lvov, S.N., Effect of TiO₂ Surface Properties on Performance of Nafion-Based Composite Membranes in High temperature and Low Relative Humidity PEM Fuel Cells, *J. Electrochem. Soc.* 152, A1742 (2005).
52. Chalkova, E., Pague, M.B., Fedkin, M.V., Wesolowski, D.J., and Lvov, S.N., Nafion/TiO₂ Proton Conductive Composite Membranes for Operating PEMFC at Elevated Temperature and Low Relative Humidity, *J. Electrochem. Soc.* 152, A1035 (2005).
53. Wesolowski, D. J. Anovitz, L., Benezeth, P. Chialvo, A.A., Palmer, D.A., Fenter, P., Cheng, L., Sturchio, N.C., Zhang, Z., Bedzyk, M.J., Kubicki, J.D., Fedkin, M.V., Lvov, S.N., Sykes, D., Cummings, P.T., Ridley, M.K., Machesky, M.L., Predota, M., and Bandura, A.V., Temperature-Effects and Structure at the Rutile-Water Interface, in *Water-Rock Interaction: Proceedings of the Eleventh International Symposium on Water-Rock Interaction* (ed. R. B. Wanty and R. R. I. Seal), pp. 775-779, A.A. Balkema Publishers (2004).
54. Fedkin, M.V., Zhou, X.Y., Kubicki, J.D., Bandura, A.V., Lvov, S.N., Machesky, M.L., and Wesolowski, D.J., High Temperature Microelectrophoresis Studies of the Rutile/Aqueous Solution Interface, *Langmuir*, 19, 3797 (2003).
55. Zhou, X.Y., Wei, X.J., Fedkin, M.V., Strass, K.H., and Lvov, S.N., A Zetameter for Microelectrophoresis Studies of the Oxide/Water Interface at Temperatures up to 200°C, *Rev. Sci. Instrum.*, 74, 2501 (2003).
56. Osadchii, E.G., Fedkin, M.V., and Kotova, A.A., Study of the Pyrrhotite-Magnetite Equilibrium by EMF Method with Ag/Ag₂S Gas Buffer, *Petrology*, 10, 645 (2002).
57. Lvov, S.N., Zhou, X.Y., Fedkin, M.V., Zhou, Z., Kathuria, A., and Barnes, H.L., Advanced Electrochemical Studies of Hydrothermal Systems, *Geochim. Cosmochim. Acta*, 66, A467 (2002).
58. Fedkin, M.V., Zhou, X., Hofmann, M.A., Chalkova, E., Weston, J.A., Allcock, H.R., and Lvov, S.N., Evaluation of methanol crossover in proton- conducting polyphosphazene membranes, *Materials Lett.*, 52/3, 192 (2002).
59. Osadchii, E.G., Lunin, S.E., Fedkin, M.V., Zhdanov, N.N., and Kotova, A.A., Experimental Studies of Sulfide and Intermetallide Solid Solutions by the EMF- Cell Technique at High

Temperatures and Pressures // in *Experimental and Theoretical Modeling of Mineral Formation Processes*, Moscow: Nauka, p. 355 (1998).

60. Kotova, A.A., Fedkin, M.V., and Osadchii, E.G., Measurement of fO_2 in five ordinary chondrites and redox conditions in the parent bodies of meteorites, *Experiment in Geosciences*, 7(2), 11 (1998)
61. Fedkin, M.V., Osadchii, E.G., and Kotova, A.A., Measurements of FeS activities in the Zn-Fe-S-(O) system, *Experiment in Geosciences*, 7(2), 41 (1998).
62. Osadchii, E.G., Fedkin, M.V., and Lunin, S.E., Thermodynamic properties and a phase transition in the sphalerite solid solution (Fe,Zn)S, *Experiment in Geosciences*, 7(1), 48 (1998).
63. Fedkin, M.V., Kotova, A.A., and Osadchii, E.G., A study of thermodynamic properties of pyrrhotite by EMF measurements, *Experiment in Geosciences*, 5(2), 32 (1996).