Joshua R. Gray, Ph.D.

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Experienced, professional engineer with a diverse background ranging from educational , instruction and mentoring roles to extensive experience in research and development environments. Educational roles range from experience as a teaching assistant in graduate school chemical engineering laboratories, serving as a mentor and thesis committee member as an adjunct professor while working in the national laboratory system, and serving as a laboratory manager and instructor in the chemistry department at a state-supported liberal arts university. R&D experience primarily involves the application of electrochemical engineering to localized corrosion and sustainable energy applications. I have worked in such areas as materials compatibility and corrosion susceptibility of high temperature heat transfer fluids for solar energy, hydrogen storage and fuel cell applications, the development of alternative separations processes for used nuclear fuel, and battery component research and characterization.

Areas of Specialization

- Laboratory management including equipment installation and safety analysis
- Laboratory and classroom educational instruction with emphasis on application of theoretical concepts
- Experimental design and data analysis
- R&D project management from proposal development to execution and reporting
- Electrochemical engineering with emphasis on corrosion, energy storage and conversion
- Computational development and analysis using FEA and FD approaches
- Rapid adaptation to new areas of technical content and approach

Experience

Francis Marion University Florence, SC 2017-Present
One of 13 state-supported universities in South Carolina providing a broad and inclusive liberal arts educational experience across a range of disciplines.

Department of Chemistry Laboratory Manager

- Taught undergraduate general chemistry laboratories - including lecture instruction, leading sections in the laboratory environment, and evaluating students in both practical and written formats
- Updated the chemical inventory and laboratory organization system used in the department of chemistry laboratories by moving the chemical and supply inventory to online database and streamlining laboratory preparation.
- Created online tools through Blackboard and google groups to improve organization of teaching and laboratory assistants in the chemistry department and created cross-matrix organizational structure
- Organized and maintained the laboratories and related stockrooms and instrument facilities in the department of chemistry.
- Supervised undergraduate student laboratory assistants employed to prepare and facilitate the laboratories led by the faculty of the department
- Monitored the department budget and tracked expenditures for personnel, equipment and supplies
- Maintained department computer resources including two computer laboratories primarily used by students in the department as well as faculty research efforts

Midlands Recovery Center Columbia, SC 2018-Present
Non-profit recovery community organization developed to bridge the gap between crisis and stable recovery for substance abuse clients in the Columbia and greater South Carolina areas.

Director of Resource Development

- Assisted in creation and funding of 501c3 non-profit organization from planning stages through successful organizational standup.
- Co-lead on funded grant proposal submission exploring funding opportunities for technologies to support recovery outreach for substance abuse clients
- Serves to develop opportunities and broker service interaction with local and state-wide substance use recovery services and legal system representatives, recovery house organizations, and health care and hospital system resources

South Carolina Share Columbia, SC 2016-Present
Non-profit organization serving the substance abuse and mental illness communities in South Carolina.

Information Technology Consultant

- Developed solution for remote-capable whiteboard-enabled classroom to support meeting and teaching needs for SCShare's non-profit communities and serviced general telecommunication and computer applications.

Boeing Research and Technology Laboratory (BR&T) Charleston, SC 2015-2016
The Boeing Company's Research facility supporting production needs for commercial airline and defense applications, as well as next-generation product development.

Technical Lead**,** Analytical Chemistry Laboratory

- Research and Laboratory lead responsible for overseeing laboratory preparation including equipment installation and documentation. Consultant for project development in the areas of corrosion and hydrogen uptake measurement.

Savannah River National Laboratory (SRNL), Aiken, SC 2007 - 2015
U.S. Department of Energy facility providing research, technology and solutions to address the nation's most complex energy, nuclear materials processing and environmental challenges.

Principal Engineer, Materials Science and Technology 2013 - 2015

- Joint Principal Investigator, U.S. Department of Energy (DoE) SunShot ($3.9M / 3 year) project; understanding corrosion in molten halide salt systems for solar power applications; partnered with Universities of Alabama and South Carolina
- Principal Investigator, SRNL $300K project; exploit fluoride volatility of nuclear components for analytical capabilities for in-line and field detection applications
- Technical Lead, SNRL project; corrosion analysis of nuclear storage applications

Senior Engineer, Materials Science and Technology 2009 - 2013

- Principal Investigator, DoE Office of Nuclear Energy study; gas-phase separation techniques for treatment of used nuclear fuels
- Principal Investigator, $500K / 2 year project in collaboration with Celgard LLC; developing advanced quality control techniques of polymeric battery components; patent disclosure filed
- Co-Principal Investigator, DoE Solar Energy Programs ($1M / 3 year) project; development of nanoparticle-enhanced ionic liquids for heat transfer in solar energy applications

Post-Doctoral Researcher, Energy Security 2007 - 2009

- Technical Lead, DoE projects; study development / analysis of materials for hydrogen storage applications
- Significant project areas;
  -safety and environmental reactivity of metal hydride materials
  -kinetic characterization of hydrogen sorption / desorption

-electrochemical production of metal hydrides
- Co-recipient; International Energy Agency Hydrogen Implementing Agreement Prize, 2010; Fundamental Research, Safety Testing / Analysis, Hydrogen Storage Materials / Systems

Palmetto Fuel Cell Technologies LLC, Columbia, SC 2007 - 2008
Start-up company focused on the development of next-generation fuel cell technologies

Research Engineer, Fuel Cell and Hydrogen Storage Technologies
- Technical Project Lead; leverage university / specialty chemical intellectual property developed in areas of fuel cell and hydrogen storage technologies

University of South Carolina, Columbia, SC 2004 - 2007

Post-Doctoral Researcher, Chemical Engineering
- Technical Project Lead; develop hydrogen storage technologies based on hydrolysis of chemical hydride materials; focus on demonstration of novel reactor concepts. Patent disclosures filed on the concepts developed.

Education

University of Illinois at Urbana-Champaign
Ph.D - Chemical Engineering 2004
Master of Science - Chemical Engineering 2000
3M Graduate Student Fellow, 1997
Outstanding Teaching Assistant, 1997

University of South Carolina, Columbia, SC 1997
Bachelor of Science - Chemical Engineering
Cum Laude, Carolina Honors College
Selected "Outstanding Chemical Engineering Student", 1997
Foreign Exchange student with prof. M. Matlosz, ENSIC, Nancy, France

Certifications and Licenses

"L" clearance, U.S. Department of Energy
Radiological Worker, Trained by the U.S. Department of Energy

Professional Associations

The Electrochemical Society
American Institute of Chemical Engineers
American Nuclear Society
Carolina Nuclear Cluster

Other Activities

University of South Carolina
Department of Chemical Engineering, Visiting Scientist
Department of Chemical Engineering, External Advisory Board, Member
Department of Mechanical and Nuclear Engineering, Adjunct Professor
Reviewer
International Journal of Hydrogen Energy
Journal of Nuclear materials
The Electrochemical Society
Chaired Symposia

American Institute of Chemical Engineering
Materials Challenges for Battery and Fuel Cell Systems Applications, 2011
Sustainable Energy Technologies, 2010
American Ceramics Society, Battery Technology, 2009

Selected Publications

- Olson, L. ; Fuentes, R. ; Martinez-Rodriguez, M. ; Garcia-Diaz, B. ; Gray, J. "Reducing Agent Effects on Haynes-230 in Molten Halide Salts, Transactions of the American Nuclear Society, Vol. 110, Reno, Nevada, June 15–19, 2014, pp. 859-862.
- Olson, L.; Fuentes, R.; Martinez-Rodriguez, M.; Garcia-Diaz, B. ; Gray, J. "Impact of container Material in Corrosion Testing of Alloys in Molten Fluoride Salt." Paper No. ES-FuelCell2014-6821., ASME 8th International Confverence on Energy Sustainability, 2014.
- Inabinett, D.; Knight, T.; Adams, T.; and Gray, J. "Study of XeF_2 fluorination potential against Rh_2O_3, RuO_2, ZrO_2, and U_3O_8 for use in reactive gas recycle of used nuclear fuel." *Prog. Nuclear Energy*, **76**, pp. 106. (2014)
- Inabinett, D.; Knight, T.; Adams, T.; and Gray, J. "Study of XeF_2 fluorination potential against SrO, MoO_3, and Nb_2O_5 in TG/DTA for use in reactive gas recycle." *Prog. Nuclear Energy*, **68**, pp. 16. (2013)
- Sherman, Steven; Gray, Joshua R.; Brinkman, Kyle S.; and Huang, Kevin. "Combustion-Assisted CO_2 Capture Using MECC Membranes." *J. Membrane Sci*., doi:10.1016/ j.memsci.2012.02.024. (2012)
- Mohtadi, R.; Sivasubramanian, P.; Huang, S.; Stowe, A.; Gray, J.; Matsunaga, T.; and Zidan, R. "Alanate-borohydride material systems for hydrogen storage applications." *Int. J. Hydrogen Energy*, **37**, pp. 2388. (2012),
- Anton, D.; Price, C.J.; Gray, J. "Affects of Mechanical Milling and Metal Oxide Additives on Sorption Kinetics of 1:1 LiNH2/MgH2 Mixture". *Energies,* **4**, pp. 826 (2011)
- Price, C.; Gray, J.; Lascola, R. and Anton, D.L "The effects of halide modifiers on the sorption kinetics of the Li-Mg-N-H System." *Int. J. Hydrogen Energy*, **37,** pp. 2742. (2012)
- James, C.W.; Tamburello, D.A.; Brinkman, K.S.; Gray, J.R.; Hardy, B.J. and Anton, D.L. "Environmental exposure of $2LiBH_4+MgH_2$ using empirical and theoretical thermodynamics." Int. J. Hydrogen Energy, 36, pp. 2471. (2011)
- Zidan R, Garcia-Diaz BL, Fewox CS, Stowe AC, Gray JR, and Harter AG. "Aluminum hyride: a reversible material for hydrogen storage." Chem. Comm., 25, pp. 3717. (2009)
- Marrero-Alfonso, E.Y.; Gray, J.R.; Davis, T.A.; Matthews, M.A. "Minimizing water utilization in hydrolysis of sodium borohydride: The role of sodium metaborate hydrates." Int. J. Hydrogen Energy, 32, pp. 4723. (2007)
- J. R. Gray, C. Homescu, L. R. Petzold, and R. C. Alkire. "Algorithms and Computing Architectures for Solving Differential-Algebraic Equation Systems Typically Encountered in Models of Corrosion Pit Initiation." J. Electrochem. Soc., 152, pp. B277. (2005)
- Carter, J.; Khulbe, Pramod K.; Gray, Joshua; Van Zee J.W.; Angel, S. Michael. "Raman spectroscopic evidence supporting the existence of $Ni_4(OH)_4^{4+}$ in aqueous $Ni(NO_3)_2$ solutions. Analytica Chimica Acta, 514, pp. 241. (2004)