

Mark H. Anderson, Ph.D.

U. S. Citizen

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EDUCATION

University of Wisconsin - Madison

Ph.D. Mechanical Engineering (1998)

- Thesis Title: Steam Condensation on cold walls of advanced PWR containments
- Minor: Nuclear Engineering and Engineering Physics

M.S. Mechanical Engineering (1996)

- Steam condensation in atmospheric conditions on the surface of reactor containments

University of Wisconsin - River Falls

B.S. Physics (1993)

- Senior Project - Design, Build, and Study the efficiency of Stirling cycle engines
- Minor: Mathematics

EMPLOYMENT HISTORY

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|---|----------------|
| • Director – Thermal Hydraulics Laboratory, UW – Madison | 2008 - Present |
| • President – Madison Scientific, LLC | 2006 - Present |
| • Senior Scientist – Department of Engineering physics | 2007 – Present |
| • Associate Scientist – Department of Engineering Physics | 2001-2007 |
| • Assistant Scientist - Fusion Technology Institute | 1999 - 2001 |
| • Research Associate - Fusion Technology Institute | 1998 -1999 |
| • Research Assistant – Mechanical Engineering, UW - Madison | 1993 – 1998 |
| • Project Assistant – College of Engineering, UW – Madison | 1996 - 1998 |

Scientist, University of Wisconsin - Engineering Physics (2001-Present)

Lead scientist in the Wisconsin Institute of Nuclear system, Senior Scientist in the Fusion Technology Institute, Director of the University of Wisconsin-Madison Thermal Hydraulics Laboratory, and Director of the Tantalus X-ray/liquid metal laboratory in McFarland, WI.

- Developed research directions, investigated and prepared grant proposals, executed funded scientific work for governmental agencies, national laboratories, industries and small businesses.
- Organized project operations, managed staff scientists, research associates, technicians, graduate students and undergraduate students
- Designed and constructed new experimental facilities and maintained significant progress to insure desired results are met upon contract completion.
- Wrote peer review articles and detailed reports

**Total amount of competitive research funding awarded as PI or Co-PI
from 2002-2010: \$16,984,873.41**

Director, Thermal Hydraulics Laboratory (2008-Present)

Initiated and managed service contracts, managed personnel, and controlled gift funds

- Shell Oil - Heat transfer, materials characterization and reaction kinetics
- Garlock seal company – Testing valve and gasket seals
- Genie oil company – Design and consulting on oil-shale extraction
- Woodward – Thermal Energy storage systems
- Cummins Diesel- Conduct high temperature injector testing
- Idaho University - Construction of RCCS facilities
- Texas A&M University - Construction of components for S-CO₂ loop
- Abengoa Solar Joint testing of solar trough system
- Abengoa Solar – Density measurements of liquid salts
- Atomic Energy of Canada Limited - Design of SCW test facility

Total amount of service work received from 2008- 2010: \$ 1,446,000.00

President, Madison Scientific, LLC (2006- Present)

Consulting and design work for industries

- Abengoa Solar – Design and construction of testing facilities
- Texas A&M University (Qatar) - Design and consulting on design for S-CO₂ loop
- Woodward Governor - Consulting on Thermal energy storage system
- CMI-Novacast - Design and consulting on sodium pump system and loop design
- Cummins - Develop control system for engine test cell
- Shell Oil - Consult on oil recovery technology
- Watlow - Wind tunnel testing of thermocouple cooling system for F110 jet
- TXU-Electric - Wind tunnel test for lighting rod protection system
- Fredrick T. Elder and Associates - Corrosion testing and Labview code development
- SONEX Ltd./Aeroconversion Inc. - Performance measurements of VW engine for light aircraft
- ORBITEC- Fluid flow measurements, flow imaging of hybrid rocket engines, Hartmann tube ignition system
- Nuclear Filter Technology - X-ray damage studies
- Rath Manufacturing - Heat transfer analysis and development of manufacturing technique

Assistant Scientist, Fusion Technology Institute UW - Madison (1999-2001)

- Oversee several projects and manage graduate students, undergraduate students, technical staff and summer research students on a variety of different programs.
- Conception of new research directions and continuation of existing research programs.
- Design and construction of new experimental facilities
- Implemented and worked on several of the research topics discussed above.

Research Associate, Fusion Technology Institute UW – Madison (1998-1999)

- Study the hydrodynamic effects of inertial confinement fusion Rayleigh-Taylor and Richtmyer-Meshkov instabilities.
- Design and construction of 10 meter tall vertical, 20 MPA shock tube.
- Design systems to study Richtmyer – Meshkov instabilities, including shadowgraphy, schlieren, Rayleigh scattering, PLIF, PIV within a shock tube.
- Study the impact force, acceleration, and pressure distribution of shock wave diffraction around blunt bodies.

Research Assistant, Dept. of Nuclear Engineering & Engineering Physics (1993-1998)

- Designed, constructed and studied two experimental facilities dealing with condensation heat transfer within nuclear reactor containments.
- Developed and made use of several measurement techniques, including heat flux probes, dew point meter, PIV flow measurement, and mass spectrometer.
- Consulted on several other experiments including, shock tubes, molten corium concrete expt., vapor explosions

Project Assistant, Dept. of Engineering Professional Development UW-Madison (1996-1998)

- Worked with eleven Professors to organize a freshman introduction to Engineering course - 230 students.
- Dealt with Industry Representatives on the freshman projects.
- Supervised 16 senior student assistants, helped in the design and building of the projects, and assisted in the organization and presentation of lectures and labs.
- Taught one of the 16 sections.

Engineering Outreach Program -Dept. of Nuclear Engineering (1996-1997)

- Organize and implemented an outreach program at UW-Waukesha, UW- Janesville
- Instructed the mechanical dissection laboratory
- Assisted in the development of an outreach kit for nuclear science and technology for the College of Engineering

EDUCATIONAL/TEACHING EXPERIENCE

Introduction to Thermodynamics, University of Wisconsin Madison- Spring 2011
Co- Research Advisor to 16 PhD students, 8 MS and currently advising 16 MS/PhD students
Guest lectures in NE 231 (Introduction to nuclear engineering)
Development of international course on Supercritical fluid heat transfer through the IAEA
Numerous invited talks at domestic and international universities

TECHNICAL SKILLS

Computational	FORTRAN, Basic, FLUENT, HTML, PV-WAVE, ANSYS, STAN-JAN, TEX-STAN, LABVIEW, AUTOCAD, MATLAB, EES, etc.
Electronics	Experience in design and development of data acquisition systems, delay timing circuits, lasers, oscilloscopes, X-ray systems, vacuum systems
Optical diagnostics	Experience with LDV, PIV, Schlieren, Shadowgraphy, high speed laser diode measurements, Raman scattering, Raleigh scattering, PLIF
Radiographic diagnostics	Experience in design of X-ray and Neutron imaging diagnostics
Mechanical systems	High and low pressure containment systems, Vacuum systems
Machining	Experienced in operation of CNC and manual mills, lathes, drill presses. Experience in TIG, MIG and stick welding of advanced materials

PROFESIONAL ORGANIZATIONS

American Nuclear Society

Board of Governors of Fusion Energy Division (2007)

Society of Physics Students	Secretary Treasurer of Fusion Energy Division (2009-Present)
American Society for Engineering Education	President (1993)
American Physical Society	Secretary (1997)
American Institute of Aeronautics and Astronautics	member since (1997)
Experimental Aircraft Association	member since (1999)
	Student Chapter Advisor
	member since (2000)

SELECTED ACTIVE PROFESSIONAL COLLABORATIONS OUTSIDE UW

Sandia National Laboratory	Z-pinch reactor study, S-CO ₂ , Solar Energy
Argonne National Laboratory	Sodium reactors, S-CO ₂ fluids
Los Alamos National Laboratory	Richmyer-Meshkov instabilities,
Lawrence Livermore National Laboratory	Inertial fusion Energy, LIFE
Idaho National Laboratory	LiSn experiments, LN ₂ condensation, liquid salts
General Atomics	DOE/APEX EVOLVE design and lithium boiling
American Superconductor	Eddy current in super-conducting bus bars
ORBITEC	Advance aerospace propulsion systems
MIT	S-CO ₂ , Sodium fast reactor, Liquid salt
U. of Notre Dame	SCW Radiolysis
Forest Products Laboratory	Woody biomass gasification
Idaho University	Sodium fast reactor, RCCS, S-CO ₂
ORNL, PNNL, INL, U-Berkeley	Liquid salt technology
Texas A&M	S-CO ₂ , Shock Physics
KAPL	S-CO ₂
Abengoa, Solar	Solar Energy systems
Woodward Governor	Thermal Energy storage Grid stability
Shell Oil	Liquid salt reaction kinetics

HONORS and AWARDS

Engineering Academic Award	(1994) and (1995)
Honor Societies	Sigma Pi Sigma (physics honor society)
	Phi Kappa Phi (campus wide)
	Alpha Nu Sigma (Nuclear Eng. Honor society)
Engineering Education Scholars Program	Participated (1998)
National Academy of Engineering	Participant in Frontiers of Engineering
American Nuclear Society	Young investigator Engineering Achievement award (2005)
NASA	Selected for interview for Astronaut Core (1999)

SYNERGISTIC ACTIVITIES

US Representative for the International Atomic Energy Agency on Supercritical Water Reactor technology
Short Course development and lectures for IAEA
OECD/NEA - Liquid metal Reactor technology representative
University of Wisconsin - Nuclear reactor safety advisory board
Secretary/treasurer for the American Nuclear Society - Fusion Energy Division
National Academy of Engineering - Frontiers of Engineering
Paper reviews for Nuclear Technology, Nuclear Science and Engineering, International Journal of heat and Mass Transfer, Journal of heat transfer
Technical Reviewer - NEUP, NSF, Canadian Nuclear Energy program
Technical program committee - FHR meeting in ORNL, NUTHOS, ISSCWR5, TOFE, NURETH

PATENTS

20080307703 - Mark Anderson and Mark Dietenberger "METHOD AND APPARATUS TO PRODUCE SYNTHESIS GAS VIA FLASH PYROLYSIS AND GASIFICATION IN A MOLTEN LIQUID",

61/508765 – SYSTEM AND METHOD FOR THERMAL ENERGY STORAGE- July 18,2011

61/512757 – SYSTEM AND METHOD FOR CHARGING AND DISCHARGING A THERMAL ENERGY STORAGE MODULE, July 28, 2011

Books

I.L. Piro and R.B Duffy, Heat transfer and Hydraulic Resistance, ASME Press, 2009

STUDENTS SUPPORTED BY GRANTS AND CO-ADVISED (Participated on Thesis committees)

<u>Student</u>	<u>Department</u>	<u>Present affiliation</u>	<u>CO-advised with</u>
Sherif Mohamed	ME	General Electric	Mike Corradini
Helge Klockow	ME	General Electric	Mike Corradini
Xin Liu	NE	Argonne National Laboratory	Mike Corradini
Phongsan Meekumsombat	ME	Cadarache	Riccardo Bonazza
Rachna Jain	NE	Exxon	Mike Corradini
Craig Rom	EMA	Spectrumbrands	Riccardo Bonazza
Kyoung Seo	NE	Postech Korea	Mike Corradini
Virginia Vigil	NE	Sandia National Laboratory	Riccardo Bonazza
Eric Edwards	NE	KAPL	Paul Wilson
Brad Motl	NE	Law School	Riccardo Bonazza
Devesh Ranjan	ME	Texas A&M	Riccardo Bonazza
Tim Setter	NE	Dominion power	Paul Wilson
Jeremy Licht	NE	AECL	Mike Corradini
Guillaume Mignot	NE	Paul Scherier Institute	Mike Corradini
John Niederhaus	NE	Sandia National Laboratory	Riccardo Bonazza
James Ambrosek	NE	PhD., in progress, UW	Todd Allen
Ryan Peterson	ME	unknown	Riccardo Bonazza
Kent Wardle	NE	Argonne National Laboratory	Todd Allen
Alan Kruienza	NE	Sandia National Laboratory	Todd Allen
Luke Olson	NE	Savanna River National Lab	Todd Allen
Michael Dragon	ME	Ilaste student	Mike Corradini
Jeremy White	NE	PhD., in progress, UW	Riccardo Bonazza
McLean Machut	NE	Dominion power	Todd Allen
Keith Bourne	ME	Forest Products Laboratory	Mike Corradini
Dan Ludwig	NE	Dominion power	Mike Corradini
Chris Weber	NE	Graduate student UW	Riccardo Bonazza
Nick Haehn	NE	Graduate student UW	Riccardo Bonazza
Nickolas Kuwahara	NE	Graduate student UW	Todd Allen
Mike Hvasta	NE	Graduate student UW	Mike Corradini
Mike Avery	NE	Graduate student UW	Mike Corradini
Darius Lisowski	NE	Graduate student UW	Mike Corradini
Brian Kelleher	NE	Graduate student UW	Todd Allen
Steve Sellers	NE	Graduate student UW	Todd Allen
Stephanie Zwolinski	NE	Graduate student UW	Mike Corradini
Derek Schmidt	NE	Graduate student UW	Mike Corradini
Hongzhi Li	NE	Graduate student UW	Mike Corradini
Matt Carlson	NE	Graduate student UW	Mike Corradini
Eric Van Able	NE	Graduate student UW	Mike Corradini
Mark Rodarte	ME	Graduate student UW	Greg Nelis
Billy Nollet	NE	Graduate student UW	Todd Allen
Gary Strange	NE	Graduate student UW	Mike Corradini

PUBLICATIONS

Contributions to Books:

I.L. Piro and R.B. Duffy, Heat transfer and Hydraulic Resistance, ASME Press, 2009

High energy density physics (instabilities and shock induced mixing):

1. “*Experimental investigation of primary and secondary features in high-mach-number shock-bubble interaction*” Ranjan, Devesh (Engineering Physics Department, University of Wisconsin-Madison); Niederhaus, John; Motl, Bradley; Anderson, Mark; Oakley, Jason; Bonazza, Riccardo Source: **Physical Review Letters**, v 98, n 2, 2007, p 024502

2. "Experimental study of shock-accelerated liquid layers", Meekunnasombat, P. (Fusion Technol. Inst., Wisconsin Univ., Madison, WI, USA); Oakley, J.G.; Anderson, M.H.; Bonazza, R. Source: **Shock Waves**, v 15, n 6, Oct. 2006, p 383-97
3. "Experimental Study for ICF-Related Richtmyer-Meshkov Instabilities", Motl, B. (Fusion Technol. Inst., Wisconsin Univ., Madison, WI, USA) Neiderhaus, J., Anderson, M., Ranjan, D., Oakley, J., Bonazza, R., source: **Fusion Science and Technology**, 2007
4. "Experimental investigation of a strongly shocked gas bubble", Ranjan, Devesh (Engineering Physics Department, University of Wisconsin-Madison); Anderson, Mark; Oakley, Jason; Bonazza, Riccardo Source: **Physical Review Letters**, v 94, n 18, May 13, 2005, p 1-4
5. "Inertial-fusion-related hydrodynamic instabilities in a spherical gas bubble accelerated by a planar shock wave", Niederhaus, J. (Dept. of Eng. Phys., Wisconsin Univ., Madison, WI, USA); Ranjan, D.; Anderson, M.; Oakley, J.; Bonazza, R.; Greenough, J. Source: **Fusion Science and Technology**, v 47, n 4, May 2005, p 1160-4
6. "Protection of IFE first wall surfaces from impulsive loading by multiple liquid layers", Meekunnasombat, P. (Fusion Technol. Inst., Wisconsin Univ., Madison, WI, USA); Oakley, J.G.; Anderson, M.H.; Bonazza, R. Source: **Fusion Science and Technology**, v 47, n 4, May 2005, p 1170-4
7. "Experimental study of the Richtmyer-Meshkov instability induced by a Mach 3 shock wave",Puranik, P.B. (Dept. of Eng. Phys., Wisconsin Univ., Madison, WI, USA); Oakley, J.G.; Anderson, M.H.; Bonazza, R. Source: **Shock Waves**, v 13, n 6, June 2004, p 413-29
8. "A thermodynamically consistent and fully conservative treatment of contact discontinuities for compressible multicomponent flows", Wang, S.-P. (Dept. of Eng. Phys., Wisconsin-Madison Univ., Madison, WI, USA); Anderson, M.H.; Oakley, J.G.; Corradini, M.L.; Bonazza, R. Source: **Journal of Computational Physics**, v 195, n 2, 10 April 2004, p 528-59
9. "Experimental investigation of a shock-accelerated liquid layer with imaging and pressure measurement",Meekunnasombat, P. (Fusion Technol. Inst., Wisconsin Univ., Madison, WI, USA); Oakley, J.G.; Anderson, M.H.; Bonazza, R. Source: **Fusion Science and Technology**, v 44, n 2, Sept. 2003, p 351-5
10. "Numerical study of shock-cylinder banks interactions",Wang, S.P. (Dept. of Eng. Phys., Univ. of Wisconsin, Madison, WI, USA); Anderson, M.H.; Oakley, J.G.; Bonazza, R. Source: **Fusion Science and Technology**, v 44, n 1, July 2003, p 127-31
11. "Numerical study of shock-cylinder banks interactions", Wang, S.P. (Fusion Technology Institute, Department of Engineering Physics, University of Wisconsin-Madison); Anderson, M.H.; Oakley, J.G.; Bonazza, R. Source: **Fusion Science and Technology**, v 44, n 1, July, 2003, p 127-131
12. "Shock loading of IFE reactor cooling tubes", Anderson, M.H. (Wisconsin Univ., Madison, WI, USA); Oakley, J.G.; Coil, M.A.; Bonazza, R.; Peterson, R.R. Source: **Fusion Technology**, v 39, n 2, pt.2, March 2001, p 828-333
13. "Shock tube investigation of hydrodynamic issues related to inertial confinement fusion", Anderson, M.H. (Fusion Technol. Inst., Wisconsin Univ., Madison, WI, USA); Puranik, B.P.; Oakley, J.G.; Brooks, P.W.; Bonazza, R. Source: **Shock Waves**, v 10, n 5, Nov. 2000, p 377-87
14. "A computational parameter study for the three-dimensional shock-bubble interaction", Niederhaus, J.H.J., Greenough, J. A., Oakley, J.G., Ranjan, D, Anderson, M.H., Bonazza, R. **J. Fluid Mech. (2008), vol. 594, pp 85-124** cover issues
15. "Shock-bubble interactions: features of divergent shock-refraction geometry observed in experiments and simulations," " Ranjan, Devesh (Engineering Physics Department, University of Wisconsin-Madison); Niederhaus, John; Anderson, Mark; Oakley, Jason; Bonazza, Riccardo, **Physics of Fluids (2008)** [Manuscript PF#07-0739]

Shock physics conference papers:

16. "Shock mitigation studies of solid foams for Z-pinch chamber protection", Anderson, M. (Wisconsin Univ., WI, USA); Oakley, J.; Vigil, V.; Rodriguez, S.; Bonazza, R. Source: 21st IEEE/NPSS Symposium on Fusion Engineering. SOFE 05 (IEEE Cat. No.05CH37764), 2007, p 4 pp.
17. "Modeling of two-phase, multi-species flows with shock-interface interactions", Wang, S.P. (Wisconsin Univ., Madison, WI, USA); Oakley, J.; Anderson, M.; Bonazza, R. Source: Transactions of the American Nuclear Society, v 87, 2002, p 191-2
18. "Membrane Effects on the Richtmyer-Meshkov Instability", Anderson, M. H., Puranik, B. P., Oakley, J. G., Bonazza, R., , 7th International workshop on the physics of compressible turbulent mixing, St. Petersburg, Russia 6/99
19. "Experimental Investigation of the R-M Instability for Strong Incident Shocks", Anderson, M. H., Puranik, B. P., Oakley, J. G., Bonazza, R., 7th International workshop on the physics of compressible turbulent mixing, St. Petersburg, Russia 6/99
20. "Planar Imaging of Density Interfaces Accelerated by Strong Shocks", Anderson, M. H., Puranik, B. P., Oakley, J. G., Bonazza, R., , The 22nd International Symposium on Shock Waves, London, England, 6/99
21. "Experimental and Numerical Investigation of Shock-Cylinder Interactions", Anderson, M. H., Puranik, B. P., Oakley, J. G., Bonazza, R., The 22nd International Symposium on Shock Waves, London, England, 6/99

22. "Shock Loading of a Cylinder Bank with Imaging and Pressure Measurements", Oakley, J.G., Anderson, M.H., Wang, S.P., Bonazza 23rd International Symposium on Shock Waves, Fort Worth Texas, July 2001
23. "Richtmyer – Meshkov Instability of an Interface Prepared by the Removal of a Sine-wave Plate", Anderson, M.H., Oakley, J.G., Puranik, B., Bonazza 23rd International Symposium on Shock Waves, Fort Worth Texas, July 2001
24. "An investigation of Shock-Induced Interfacial Instabilities for Strong Incident Shocks", Oakley, J. G., Puranik, B., Anderson, M. H., Bonazza, R., International Conference of Theoretical and Applied Mechanics 2000, CX5, Chicago, IL, Aug 28, 2000
25. "Richtmyer-Meshkov Experiments with Rayleigh-Taylor Generated Initial Conditions", Anderson, M. H., Oakley, J. G., Puranik, B., Bonazza, R., American Physical Society Fluids, Washington D.C, Nov 2000.
26. "Study of IFE Reactor Cooling Tubes Response to Shock Loading", Anderson, M. H., Oakley, J. G., Coil, M., Bonazza, R., 14th ANS Topical meeting on the Technology of Fusion Energy, Park City, Utah 15-19 Oct, 2000 TOFE March 2001
27. "The Rayleigh-Taylor Instability at a Magneto-rheological Fluid/Water Interface", Jeremy White, Jason Oakley, Mark Anderson, Riccardo Bonazza, APS division of fluid dynamics, Seattle WA, 2004
28. "Experimental study of a strongly shocked gas bubble", D. Ranjan, J. Niederhaus, J. Oakley, M. Anderson, R. Bonazza, , APS division of fluid dynamics, Seattle WA, 2004
29. "Numerical simulation of strongly shocked gas bubble", J. Niederhaus, D. Ranjan J. Oakley, M. Anderson, R. Bonazza, Jeff Greenough, , APS division of Plasma Physics, Savanna GA, 2004
30. "The Rayleigh-Taylor Instability at a Water/Magnet-orheological Fluid Interface", Jeremy White, Chaine Selig, Jason Oakley, Mark Anderson, Riccardo Bonazza, IWPCTM, Cambridge, UK July 2004
31. "Experimental and computational investigations of shock-accelerated gas bubbles", B. Motl, J. Niederhaus, D. Ranjan M. Anderson, J. Greenough, J. Oakley, R. Bonazza, , IWPCTM, Cambridge, UK July 2004
32. "Summary of shocked foam layer experiments for Z-pinch reactor protection schemes", Anderson, M., Meekunasombat, P., Oakley, J., Bonazza, R., ISSW25, Bangalor India, July 2005
33. "Experimental Study of A Shock Accelerated Water Layer with Imaging and Velocity Measurement", P. Meekunnasombat, J. G. Oakley, M. H. Anderson and R. Bonazza, Proceedings of the 24th International Symposium on Shock Waves, Paper 2692, Springer-Verlag, 2004.
34. "Radiography for a Shock-accelerated Liquid Layer", P. Meekunnasombat, J. G. Oakley, M. H. Anderson and R. Bonazza, 25th International Symposium on Shock Waves, July 17-22, 2005, Bangalore, India.
35. "Experimental Study of A Shock Accelerated Water Layer with Imaging and Velocity Measurement", P. Meekunnasombat, J. G. Oakley, M. H. Anderson and R. Bonazza, , 24th International Symposium on Shock Waves, July 11-16, 2004, Beijing, China.
36. "Experimental Investigation of A Shock-accelerated Liquid Layer with Imaging and Pressure Measurements", P. Meekunnasombat, J.G. Oakley, M.H. Anderson and R. Bonazza, , 15th Topical Meeting on the Technology of Fusion Energy, November 17-21, 2002, Washington, D.C., USA
2006 tofe, ans 2006 aps 2006, iwpcmtm 2006, Issw 2007 2007, tmab 2007

Liquid metal water interaction/heat transfer

37. "Liquid-metal/water direct contact heat exchange: flow visualization, flow stability, and heat transfer using real-time X-ray imaging", Abdulla, S.H. (Gen. Electr. Res. Lab., Schenectady, NY, USA); Xin Liu; Anderson, M.H.; Bonazza, R.; Corradini, M.L.; Dae Cho; Page, R. Source: **Nuclear Science and Engineering**, v 150, n 2, June 2005, p 182-220
38. "Melt quenching and coolability by water injection from below: Co-injection of water and non-condensable gas", Cho, D.H. (Nucl. Eng. Div., Argonne Nat. Lab., IL, USA); Page, R.J.; Abdulla, S.H.; Anderson, M.H.; Klockow, H.B.; Corradini, M.L. Source: **Nuclear Engineering and Design**, v 236, n 19-21, Oct. 2006, p 2296-2303
39. "Energetic analysis of experimental behavior of molten Sn_xLi_y when impacted by a vertical column of water", Meekunnasombat, P. (Fusion Technol. Inst., Wisconsin Univ., Madison, WI, USA); Anderson, M.H.; Corradini, M.L. Source: **Fusion Science and Technology**, v 44, n 4, Dec. 2003, p 803-10
40. "Experimental behavior of molten Sn_xLi_y when impacted by a vertical column of water", Anderson, M.H. (Wisconsin Univ., Madison, WI, USA); Meekunnasombat, P.; Corradini, M.L. Source: **Fusion Technology**, v 39, n 2, pt.2, March 2001, p 965-9

Conference papers:

41. "Direct contact heat exchange interfacial phenomena for liquid metal reactors: part II - void fraction", Abdulla, S. (Inst. of Nucl. Syst. & Eng. Phys., Wisconsin-Madison Univ., Madison, WI, USA); Liu, X.; Anderson, M.H.; Bonazza, R.; Corradini, M.L.; Cho, D.H.; Page, R.J.; Hurtault, D. Source: Tenth International Conference on Nuclear Engineering, 2002, p 7 pp.
42. "Local heat transfer coefficient in liquid metal/water bubbly flow" Abdulla, S. (Wisconsin Univ., Madison, WI, USA); Liu, X.; Anderson, M.H.; Bonazza, R.; Corradini, M.L.; Cho, D.H.; Page, R.J. Source: Transactions of the American Nuclear Society, v 87, 2002, p 280-1

43. "Direct contact heat exchange interfacial phenomena for liquid metal reactors: Part II-void fraction", Abdulla, S. (Wisconsin Inst. of Nuclear Systems, Engineering Physics, Univ. of Wisconsin-Madison 53706); Liu, X.; Anderson, M.H.; Bonazza, R.; Corradini, M.L.; Cho, D.H.; Page, R.J.; Hurtault, D. Source: International Conference on Nuclear Engineering, Proceedings, ICONE, v 3, 2002, p 607-612
44. "Ex-vessel cooling: Heat transfer and flow stability of multiphase injection", Klockow, Helge B. (University of Wisconsin - Madison); Anderson, Mark H.; Corradini, Michael L. Source: Transactions of the American Nuclear Society, v 91, Transactions of the American Nuclear Society - 2004 Winter Meeting, 2004, p 228-229
45. "Melt quenching by water injection from below; co-injection of water and noncondensable gas", Cho, Dae H. (Argonne National Laboratory, Nuclear Engineering Division); Abdulla, Sherif H.; Page, Richard J.; Anderson, Mark H.; Klockow, Helge B.; Corradini, Michael L. Source: Proceedings of the International Conference on Nuclear Engineering (ICONE12), v 3, 12th International Conference on Nuclear Engineering (ICONE12) - 2004 Volume 3: Safety and Security; Fuel Cycle and High Level Waste Management; Thermal Hydraulics, 2004, p 125-131
46. "A new look at ex-vessel debris coolability", Klockow, H. (Argonne Nat. Lab., IL, USA); Anderson, M.; Corradini, M.; Cho, D.; Bang, K. Source: Transactions of the American Nuclear Society, v 87, 2002, p 513-14
47. "Experimental behavior of molten SnxLiy when impacted by a vertical column of water", Anderson, M.H. (University of Wisconsin - Madison); Meekunnasombat, P.; Corradini, M.L. Source: Fusion Technology, v 39, n 2 II, March, 2001, Proceedings of the 14th Topical Meeting on The Technology of Fusion Energy, p 965-969
48. "Interfacial Transport Phenomena and Stability in Molten Metal-Water Systems", Kim, H., Anderson, M. H., Cho, D., Corradini, M. L., Proceedings of the 8th International Conference on Nuclear Engineering, April 2-6, 2000, Baltimore, MD USA
49. "Ex-Vessel Cooling: Heat transfer and flow stability of Multiphase Injection", Klockow, Helge, Anderson, Mark H., Corradini, M. L., 2004 ANS Winter meeting
50. "Melt Quenching by Water Injection From Below; Co-Injection of Water and Non-condensable Gas" Dae H. Cho, Richard Page, Sherif Mohamed, Mark Anderson, Helge Klockow, Michael Corradini Icone 12, April 25-29, 2004, Arlington, Virginia USA
51. "Local Heat Transfer Coefficient in Liquid Metal/Water Bubbly Flow", S. Abdulla, X. Liu, M. Anderson, R. Bonazza, M. Corradini, D. Cho, and R. Page, American Society of Nuclear Engineering, Winter Meeting, Washington D. C., November 2002.
52. "Interfacial Transport Phenomena and Stability in Liquid-Metal/Water", S. Abdulla, X. Liu, M. Anderson, R. Bonazza, M. Corradini, D. Cho, and R. Page, Proceedings of the 12th International Heat Transfer Conference, Grenoble, France, August 2002 (Best Paper award).
53. "Direct Contact Heat Exchange Interfacial Phenomena for Liquid Metal Reactors: Part I-Heat Transfer", D. Cho, R. Page, and D. Hurtault, S. Abdulla, X. Liu, M. Anderson, R. Bonazza, and M. Corradini, Proceedings of the 10th International Conference On Nuclear Engineering (ICONE10), Arlington, Virginia, US, April 2002.
54. "Direct Contact Heat Exchange Interfacial Phenomena for Liquid Metal Reactors: Part II-Void Fraction", S. Abdulla, X. Liu, M. Anderson, R. Bonazza, M. Corradini, D. Cho, R. Page, and D. Hurtault, ", Proceedings of the 10th International Conference On Nuclear Engineering (ICONE10), Arlington, Virginia, US, April 2002.
55. "Interfacial Transport Phenomena and Stability in Liquid-Metal/Water Systems: Scaling Considerations", S. Abdulla, X. Liu, M. Anderson, R. Bonazza, M. Corradini, and D. Cho, Proceedings of the 9th International Conference On Nuclear Engineering (ICONE9), Nice, France, April 2001.
56. "Interfacial Transport Phenomena and Stability in Molten Metal – Water Systems", M. L. Corradini, M. H. Anderson, R. Bonazza, S. H. Abdulla, and X. Liu, DOE final Report – NERI #99-0233, 1999.
57. "Interfacial Transport Phenomena and Stability in Molten Metal-Water Systems", Kim, H., Anderson, M. H., Cho, D., Corradini, M. L., Proceedings of the 8th International Conference on Nuclear Engineering, April 2-6, 2000, Baltimore, MD USA

Magneto-hydrodynamics:

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Z-pinch IFE reactor:

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COMPETITIVE RESEARCH FUNDING AS PI or Co-PI

- **Technical Development for S-CO₂ Advanced Energy Conversion (ARC-2: Advanced Energy Conversion)** PI: Mark Anderson, Source: NEUP, Total Award Amount: \$815,000.00, Period covered 11/01/2011-10/30/2014

- **High-Temperature Salt-Cooled Reactor for Power and Process Heat (IRP: Advanced Thermal Reactor Concepts)**, PI: Charles Forsberg, Todd Allen, Mark Anderson, Source: NEUP IRP, Total Award Amount: \$7,500,000.00, Period Covered 2011-2016
- **Reactor Cavity Cooling System (PRJ53JE)**, PI: Mike Corradini, Mark Anderson, Source: DOE Idaho, Total Award Amount \$1,199,988.00, Period Covered, 9/14/2011-9/30/2014
- **Critical Heat Flux Phenomena (PRJ53GL)**, PI: Mike Corradini, Mark Anderson, Source: DOE Idaho, Total Award Amount \$1,199,781.00, Period covered, 9/16/2011-9/30/2014
- **Heat Transfer Salts for Nuclear reactor systems (PRJ41DG)**, PI: Mark Anderson, Source: DOE Idaho, Total Award Amount 1,289,339, Period covered, 8/9/2010-8/9/2013
- **Corrosion in supercritical Carbon Dioxide (PRJ39TC)**, PI Kumar Sridharan, Mark Anderson, Source DOE Idaho, Total Award Amount \$651,447, Period covered 7/28/2010-7/28/2013
- **Supercritical CO2 Studies: Micro-Channel Heat Transfer for Reactor Heat Exchangers and Cycle Design (144QE50)**, PI: Anderson, UW Co-PIs: Corradini, Source: DOE Idaho, Total Award Amount: \$384,163, Period Covered: 5/1/07-10/31/10
- **Liquid Salts as Media for Process Heat Transfer from VHTR: Forced Convective Channel Thermal Hydraulics (144QFO2)**, PI: Sridharan, Anderson, Allen, Corradini, Source: DOE-Idaho, Total Award Amount: \$575,590, Period Covered: 6/1/07-5/31/11
- **Emissivity of Candidate Materials for VHTR Applications: Role of Oxidation and Surface Modification Treatments (144QG45)**, PI: Allen, Sridharan, Anderson, DOE Idaho, Total Award Amount: \$500,514, Period Covered: 6/1/07-12/31/10
- **Research on the Advanced VHTR Gas-Cooled Reactor Wisconsin Institute of Nuclear Systems (144QN81)** PI List: Allen, Anderson, Szlufarska, Morgan, Tan, Sridharan, Nuclear Regulatory Commission, Total Award Amount: \$890,058, Periods Covered: 9/15/07-9/30/10
- **Shock-Induced Reactive Turbulent Mixing at a Density Interface (PRJ17RA)**, PI List: Bonazza, Anderson, Rothamer, Oakley, Source: National Science Foundation, Total Award Amount: \$240,000, Period Covered: 9/15/08-9/30/10
- **Sodium Compatibility Testing (PRJ21SB)** PI List: Allen, Anderson, Source: UT-Battelle, LLC, Total Award Amount: \$430,000, Period Covered: 1/16/10-1/15/11
- **Thermal Properties of LiCl-KCl Molten Salt for Nuclear Waste Separation (PRJ27BA)**, PI List: Sridharan, Anderson, Allen Source: Battelle Energy Alliance, LLC, Total Award Amount: \$478,584, Period Covered: 10/2/09-9/30/12
- **CHF and Flow Instability in TRIGA Reactors (PRJ27XU)**, PI list: Anderson, Corradini, Argonne National Laboratory, Total Award Amount: \$472,238, Period Covered: 8/10/09-8/9/11
- **Liquid Salt Heat Exchanger Technology for VHTR-Based Applications (PRJ29LY)**, PI list: Anderson, Sridharan Source: Battelle Energy Alliance, LLC, Total Award Amount: \$495,958, Period Covered: 10/1/09-9/30/12
- **Improved LWR Cladding Performance by EPD Surface Modification Technique (PRJ29UX)**, PI List: Corradini, Anderson, Sridharan, Battelle Energy Alliance, LLC, Total Award Amount: \$303,794, Period Covered: 10/1/09-9/30/12
- **Materials, Turbomachinery, and Heat Exchangers for Supercritical CO2 Systems (PRJ29VI)**, PI List: Anderson, Nellis, Corradini, Battelle Energy Alliance, LLC, Total Award Amount: \$533,354, Period Covered: 10/1/09-9/30/12
- **Experimental Studies of Next Generation Nuclear Plant Reactor Cavity Cooling System with Water (PRJ29ZY)** PI List: Corradini, Anderson, Battelle Energy Alliance, LLC, Total Award Amount: \$543,716, Period Covered: 10/1/09-9/30/12

- **Heat Transfer Salts for Nuclear Reactor Systems - Chemistry Control, Corrosion Mitigation, and Modeling (PRJ41DG)** PIs List: PI(s): Mark Anderson, Co-PI(s): Dane Morgan, Kumar Sridharan, Per Peterson, Randall Scheele , Bruce McNamara, Patrick Calderoni, Source: Department of Energy (DOE), Office of Nuclear Energy, NEUP ,Total Award Amount: \$1,289,339.00 (7 PIs), Period Covered: 07/01/10 – 06/30/13
- **Corrosion of Materials in Supercritical Carbon Dioxide (PRJ39TC)**, PI List: Sridharan, Anderson, Allen, Source: Department of Energy (DOE), Office of Nuclear Energy, NEUP, Total Award Amount: \$651,447, Period covered: 07/01/10 –06/30/13
- **Investigation of the Rayleigh-Taylor and Richtmyer-Meshkov instabilities (144PA37)**, PI List: Bonazza, Anderson, Source: Department of Energy (DOE) , Total Award Amount: \$993,868.00
- **Syngas Via Pyrolysis and gasification in a liquid metal (144PS44)**, PI List: Anderson, Source: Forest Products Laboratory, Total Award Amount: \$62,186
- **Innov. & Enhancement for a consortium of big 10 Univ. Research & training reactors (144QQ80)** PI List: Anderson, Source: PENNSYLVANIA STATE UNIVERSITY, Total Award Amount: \$21,916.66
- **Supercritical Carbon Dioxide corrosion test (144QL81) \$77,635.00**, PI list: Allen, Anderson, Source: Knolls Atomic Power Laboratory, Total Award Amount: \$77,635
- **Fusion Reactor System Safety Studies: Investigations in vapor condensation and supercritical Phenomena**, PI list: Corradini, Anderson, Source: DOE, CHICAGO OPERATIONS OFFICE, Total amount; \$662,687.00
- **Optimization of Wind Turbine Blade Design and Operation (1180713)**, PI list: Bonazza, Anderson, Oakley Source: UIR - Industrial & Economic Development Research, Total amount \$50,000
- **Investigation of the Richtmyer-Meshkov Instability (144PJ18)**, PI list: Bonazza, Anderson, source: Los Alamos National Laboratory, Total Award amount: \$600,000.00
- **Low Case Temperature Reusable Vortex flow Liquid O2 Rocket Engine**, PI: Anderson, Bonazza, Source: UIR - Industrial & Economic Development Research, Date 2008-2009, Total Award amount: \$125,500.00
- **Evaluation of corrosion resistance of candidate alloys for application in supercritical water-cooled reactors (144ND34)**, PI list: Allen, Sridharan, Anderson , Source: Bechtell BWXT Idaho, LLC, date: 10/18/2004-10/31/2008, total award amount: \$505,660.00
- **Supercritical water Heat transfer Neri (144KJ39) DE-FG07-015F22328**, PI list: Anderson, Mark, Corradini, Mike, Cho Dae (ANL), Department of Energy, 8/1/01-7/31/04, Total Award amount: \$782,666.00
- **Liquid metal Ex-Vessel cooling (144LB42)** PI list: Anderson, Mark, Corradini, Mike, Cho, Dae (ANL), Department of Energy, 1/15/02-1/14/05, Total award amount: \$610,000.00
- **Investigation of the Rayleigh-Taylor and Richtmyer-Meshkov Instabilities (144LL63)**, PI list Bonazza, Anderson Source: Department of Energy, 11/15/02-3/31/06, Total award amount; \$1,738,453.00
- **Neutron and Beta/Gamma Radiolysis of Supercritical Water (144LM75)**, Agasie, Robert, Anderson, Mark, Wilson, Paul, Argonne National Laboratory, 11/18/02-9/30/05, Total award amount: \$331,593.00
- **Heat transfer phenomena in supercritical water nuclear reactors (144NB10)** , PI list: Anderson, Mark, Corradini, Mike, Hajzlar Pavel (MIT), Department of Energy, 8/15/04-8/14/07, Total Award amount: \$300,365.00
- **Molten Salt Heat Transfer Loop Materials (144NL45)**, PI list: Sridharan, Kumar, Anderson, Mark, Allen, Todd, Source: Department of Energy, Idaho Operations Office, 4/1/05-3/31/08, Total Award Amount: \$647,144.00
- **Shock-Loading of IFE Target Chamber Structures (144GHO3)**, PI List: Bonazza, Riccardo, Anderson, Mark, Oakley, Jason, Source: Department of Energy, 6/15/97-1/4/01, Total Award Amount: \$747,960.00

- **Neutron Radiography of Near Nozzle Diesel Spray (144MH02)**, PI List: Anderson, Mark, Source: Pennsylvania State University, 5/1/03-12/31/9999, Total Award Amount: \$24,679.49
- **Experimental Studies of Shock Accelerated Spherical Gas Inhomogenities (144QA11)**, PI list: Bonazza,Riccardo, Anderson, Mark, Source: University of Chicago, Dept. of Energy, 01-Oct-06 to 31-Mar-08, Total Award Amount: \$163,914.00
- **Candidate Materials Evaluation for Supercritical Water-Cooled Reactor (144NK24)** , PI List; Allen,Todd, Sridharan,Kumar, Anderson, Mark, DOE, IDAHO OPERATIONS OFFICE DE-FC07-05ID14664, 15-Mar-05 to 14-Sep-08, Total Award amount: \$749,891.92