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ZACHARY R. BINGEN, BSME, EIT
MARY E. STOFLET, AS, PARTNER
JAMES W. TORPY, BS, PARTNER
JILL L. IGL, AS

Christopher John Damm, Ph.D.

Milwaukee School of Engineering
1025 N. Broadway Avenue
Milwaukee, Wisconsin 53202
414-277-7543
414-277-2222 (fax)
damm@msoe.edu

Profile

Dr. Damm has been a full-time faculty member in the Mechanical Engineering department at the Milwaukee School of Engineering since the fall of 2004. He teaches courses in engineering design, thermodynamics, heat transfer, fluid mechanics, and internal combustion engines. Dr. Damm also has more than 9 years of experience working as a principal engineer at Skogen Engineering Group. He has worked closely with scientists and engineers from Lawrence Berkeley National Laboratory, Carnegie Mellon University, the Desert Research Institute, the University of Wisconsin, and the University of California, Berkeley. Dr. Damm has authored over 70 technical articles and reports. He holds leadership positions in several professional organizations including the *Society of Automotive Engineers* and the *Wisconsin Energy Research Consortium*.

Education

2001	Ph.D.	**University of California, Berkeley**	*Major field*: Mechanical Engineering *Minor fields*: Spectroscopy, Air Quality
1995	M.S.	**Brown University**	*Major field*: Physics
1993	M.S.	**University of Minnesota**	*Major field*: Mechanical Engineering
1991	B.M.E.	**University of Minnesota**	*Major field*: Mechanical Engineering *Minor field*: Economics

Current Positions

Consultant, **Skogen Engineering Group,** Madison, Wisconsin (since 2004)

- Areas of expertise include: safety in engineering design, thermal fluid design, energy systems, combustion and products of incomplete combustion, environmental pollution, air contaminant control, sensor and detector design, fuel systems, sound measurement and analysis, heating, ventilation, and air conditioning (HVAC), engineering statics and dynamics (stability analysis, mechanics of motion, etc.), engineering design methodology and analysis, product safety analysis.

Professor, Department of Mechanical Engineering, **Milwaukee School of Engineering** (since 2004)

- Chair of the ME department's Energy Committee, responsible for curriculum development, laboratory development, and learning outcomes assessment in the thermal science area.
- Developed the Renewable Energy Systems Laboratory and the Advanced Energy Technologies Laboratory (funded from external sources).
- Courses taught include: Thermodynamics I, Thermodynamics II*, Thermodynamics Applications*, Heat Transfer*, Fluid Mechanics, Advanced Energy Technologies**, Renewable Energy Utilization**, Internal Combustion Engines*, and Senior Design I, II, and III.
  (*course coordinator, **course creator and coordinator)
- Principle Investigator on several funded research projects that involve undergraduates.
- Faculty Advisor of the *SAE International (formerly the Society of Automotive Engineers)* student chapter at the Milwaukee School of Engineering (Awarded Honeywell Outstanding Collegiate Branch Award in 2011and 2012 by SAE International).
- Faculty Advisor to student design groups including the Supermileage Vehicle Team.

Affiliate Research Professor, Clean Technologies and Renewable Energy Research Center**, Desert Research Institute,** Reno, Nevada (since 2013)

- Areas of expertise include: solar thermal system design/characterization/optimization, renewable energy systems integration and control, solar cooling.

Fellowships &Honors

Award 2011 Milwaukee School of Engineering Karl O. Werwath Engineering Research

Sierra Nevada College Faculty Distinguished Achievement Award 2004
Society of Automotive Engineers Doctoral Scholar 2000-2001
University of California Earl C. Anthony Regents Fellow 1996-1997
Future Faculty Development Fellow, US Department of Education 1993-1994
Tau Beta Pi, The National Engineering Honor Society
Pi Tau Sigma, The National Mechanical Engineering Honor Society

Professional Associations and Activities

Member of Research Committee for the *Mid-West Energy Research Consortium* (M-WERC) (since 2010, the Committee distributes approximately $600,000 for energy research every year)
Member of Engineering Workforce Development Committee for the *Mid-West Energy Research Consortium* (M-WERC) (since 2011)
Member of the Steering Committee for *Milwaukee Shines* (a US DoE funded program), City of Milwaukee (since 2009)
Member of the *Solar Hot Water Business Council*, City of Milwaukee (since 2011)
Member of Executive Board of the *American Society for Engineering Education Energy Conversion and*
Conservation Division (2011-2013)
Member of the Executive Board of the Society of Automotive Engineers (Milwaukee Section, 2004-2008)
Member of Planning Committee for the *2010 Green Energy Summit*

Member of Program Committee for the *2009 Renewable Energy Summit*
Member, *SAE International*
Member, *American Society for Engineering Education* (ASEE)
Member, *American Society of Mechanical Engineers* (ASME)
Reviewer for several technical conferences and publications including: *ASME Annual International Mechanical Engineering Congress and Exposition, ASME Energy Sustainability and Fuel Cell Conference, Optics and Lasers in Engineering, Applied Spectroscopy, CLEAN AIR - International Journal on Energy for a Clean Environment, Annual American Society of Engineering Education Conference and Exposition*

Professional/Research Experience

Summer of 2013 — *Visiting Research Professor*, Clean Technologies and Renewable Energy Center, **Desert Research Institute**

Summers of 2005, 2006, 2007, 2008, and 2009 — *Visiting Professor*, Center for Building Performance and Diagnostics, **Carnegie Mellon University**

- Designed and implemented an energy system supply system (combined heat and power) for the "Intelligent Workplace" on the Carnegie Mellon campus as part of the Department of Energy's Advanced Building Efficiency Testbed Initiative
- Performed exhaust gas monitoring and analysis of a biodiesel fueled building energy supply system
- Performed thermodynamic modeling of a biodiesel fueled combined heat and power system

Summers of 2003 and 2004 — *Visiting Scientist*, Division of Atmospheric Sciences, **Desert Research Institute**

- Characterized emissions from vehicle exhaust, road dust, and woodburning in the Lake Tahoe basin (funded by the California Air Resources Board)
- Monitored particulate matter emissions from on-road motor vehicles in the Lake Tahoe basin (funded by the National Cooperative Highway Research Program, US DOT)
- Quantified the effect of motor vehicle emissions on Lake Tahoe clarity (funded by the California Air Resources Board)
- Assessed methodologies for motor vehicle emission factor determination

Summer '02 — *Visiting Scientist*, Environmental Energy Technologies Division, **Lawrence Berkeley National Laboratory**

- Designed a laser diagnostic technique for measuring lead and other toxic metals in contaminated soils
- Studied the effect of advanced fuel formulations on pollutant emissions from motor vehicles

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9/97 – 6/01 *Graduate Researcher*, Combustion Chemistry and Laser Diagnostics Laboratory, **Lawrence Berkeley National Laboratory**

- Conducted laser photofragmentation-fluorescence studies for detection of carbonaceous particles in reacting flow systems
- Designed a novel, *in situ*, real-time emissions monitor for diesel particulate matter
- Studied the effect of fuel additives on particulate emissions from diesel engines
- Developed an optical method for the detection of ammonia, ammonium nitrate, and ammonium sulfate
- Detected toxic metals using laser techniques
- Worked on a design team in the development of a polarized light scattering instrument to characterize diesel particulate matter

9/96 – 9/97 *Graduate Researcher,* Department of Civil and Environmental Engineering, **U.C. Berkeley**

- Used geophysical methods to enhance hydrogeological characterization of environmentally contaminated sites

6/94 – 12/94 *Graduate Researcher,* Department of Physics, **Brown University**

- Designed a quality assurance device for general radiography at Rhode Island Hospital

9/91 – 7/93 *Graduate Research Assistant,* Department of Mechanical Engineering, **University of Minnesota**

- Designed and constructed a combustion chamber for optical measurements of diesel sprays

6/90 – 5/92 *Energy Engineer,* **Center for Energy and Environment,** Minneapolis, MN

- Conducted energy conservation research

Peer-Reviewed Publications and Conference Proceedings

(*denotes an undergraduate coauthor)

1. M. Anderson, D. Shiltz*, and C. Damm, **"Development of a Fluids Laboratory Experience in Dimensional Analysis and Similitude Applied to Vortex Shedding from a Cylinder in Cross-flow,"** *2013 ASME International Mechanical Engineering Congress and Exposition*, San Diego, CA, November 15-21, 2013.
2. C. Damm, A. Hjortland*, S. Drozek*, R. Enot*, K. Rode*, B. Jackson*, and B. Steffes*, **"Design, Installation, and Performance Characterization of a Laboratory Scale Solar Thermal System for Experiments in Solar Energy Utilization,"** *2012 ASME International Mechanical Engineering Congress and Exposition*, Houston, TX, November 9-15, 2012.
3. C.Damm, B. Steffes*, J. Flotterud*, J. Pfaff*, M. Duffy*, and M. Kaiser*, "**A Micro-Combined Heat and Power Laboratory for Experiments in Applied Thermodynamics,"** *2011 ASME International Mechanical Engineering Congress and Exposition*, Denver, CO, November 11-17, 2011.
4. F. Betz, C. Damm, D. Archer, and B. Goodwin*, **"Biodiesel-fueled Engine Generator with Heat Recovery,"** *Proceedings of the American Society of Mechanical Engineer's 2nd International Conference on Energy Sustainability,* Jacksonville, FL, August 10-14, 2008.

5. B. Egan*, S. Dechant*, and C. Damm, **"Building as a Power Plant: Modeling and Selection of a Combined Heat and Power System for an Advanced Commercial Building,"** *114th ASEE Annual Conference and Exposition,* Honolulu, Hawaii, June 24-27 (2007).
6. A.W. Gertler, H.D. Kuhns, M. Abu-Allaban, C.J. Damm, J. Gillies, V. Etyemezian, R. Clayton, and D. Proffitt, **"A Case Study of the Impact of Winter Road Sand/Salt and Street Sweeping on Road Dust Re-Entrainment,"** *Atmospheric Environment* v. 40, pp. 5976-5985 (2006).
7. J. Choi, C. Damm, N. O'Donovan, R. Sawyer, C. Koshland and D. Lucas, **"Detection of Lead in Soil with Excimer Laser Fragmentation Fluorescence Spectroscopy"** *Applied Spectroscopy*, v. 59, n. 2, pp. 258-261 (2005).
8. C.J. Damm, H.D. Kuhns and A.W. Gertler, **"An Assessment of Motor Vehicle Particulate Matter Emissions Measurements,"** *13th International Scientific Symposium on Transport and Air Pollution*, Boulder, Colorado, September 13-15 (2004).
9. H. Kuhns, C. Damm, J. Gillies, M. Abu-Allaban, R. Clayton, D. Proffitt, and A. Gertler, **"The Impact of Winter Road Sand/Salt and Street Sweeping on Road Dust Re-Entrainment,"** *13th International Scientific Symposium on Transport and Air Pollution*, Boulder, Colorado, September 13-15 (2004).
10. C.J. Damm, A. S. (Ed) Cheng, R. W. Dibble, D. Lucas, R.F. Sawyer, and C.P. Koshland, **"The Effect of Low Sulfur Diesel, Oxygenate-in-Diesel Blends, and Fischer-Tropsch Diesel on Particulate Matter Emissions from a Compression-Ignition Engine,"** presented at the *8th International Congress on Toxic Combustion Byproducts*, Umea, Sweden, June 17-19 (2003).
11. C. J. Damm, D. Lucas, R. F. Sawyer, and C. P. Koshland, **"Characterization Of Diesel Particulate Matter With Excimer Laser Fragmentation Fluorescence Spectroscopy,"** *Proceedings of the Combustion Institute* 29, 2767-2774 (2002), presented at the *29th International Symposium on Combustion,* Sapporo, Japan, July 21-26, 2002.
12. C.J. Damm, D. Lucas, R.F. Sawyer, and C.P. Koshland, **"Real-time Measurement of Combustion Generated Particles with Photofragmentation-Fluorescence,"** *Applied Spectroscopy*, v. 55, n. 11, pp. 1478-1482 (2001).
13. C.J. Damm, D. Lucas, R.F. Sawyer, and C.P. Koshland, **"Excimer Laser Fragmentation Fluorescence Spectroscopy as a Method for Monitoring Ammonium Nitrate and Ammonium Sulfate Particles,"** *Chemosphere,* v. 42, n. 5, pp. 655-661 (2001).
14. S.G. Buckley, C.J. Damm, W.M. Vitovec, L.A. Sgro, R.F. Sawyer, C.P. Koshland, and D. Lucas, **"Ammonia Detection and Monitoring with Fragmentation-Fluorescence,"** *Applied Optics*, v. 37, n. 36, pp. 8382 -8391 (1998).

Recent Invited Talks

1. *SAE A6-Aerospace Actuation, Control and Fluid Power Systems Annual Meeting*, **"Engineering Leadership Development in the SAE Chapter at MSOE,"** Milwaukee, WI, May 7, 2013.
2. *RiverEdge Science for Everyone Lecture Series*, **"Solar Energy Utilization,"** Cedarburg, WI, March 15, 2011.
3. *Quarterly Meeting of the Executive Committee of the Wisconsin Energy Research Consortium,* **"Energy Engineering in MSOE's Mechanical Engineering Department,"** Milwaukee, WI, January 2011.

4. *2009 Renewable Energy Summit,* **"A Carbon Dioxide Emissions Assessment of Biofuels for the Transportation Sector,"** Milwaukee, WI, March 25, 2009.
5. *US Department of Energy-National Energy Technology Lab Symposium, Energy in Today's Global Economy*, **"Energy Research Activities and Lab Development at the Milwaukee School of Engineering,"** Milwaukee, Wisconsin, October 9, 2008.
6. *RiverEdge Speaks Out Lecture Series*, **"Are Biofuels a Good Energy Choice?"** Mequon, WI, August 19, 2008.
7. *2008 Renewable Energy Summit,* **"Developing and Teaching a New Advanced Energy Technologies Course at the Milwaukee School of Engineering,"** Milwaukee, WI, March 13, 2008.
8. *2008 Renewable Energy Summit,* **"Green Engineering at the Milwaukee School of Engineering,"** Milwaukee, WI, March 14, 2008.
9. *Wisconsin Association of Energy Engineers Monthly Meeting,* **"Green Engineering at the Milwaukee School of Engineering,"** Milwaukee, WI, January 23, 2008.
10. *Hybridfest 2007,* **"Well-to-Wheel Emissions from Motor Vehicles with Alternative Propulsion Systems,"** Madison, WI, July 22, 2007.
11. *16th Annual Keep Greater Milwaukee Beautiful Environmental Business Seminar—Global Warming: Strategies for Wisconsin,* **"Plug-in Hybrids Using Renewable Energy—A Primer,"** Milwaukee, WI, May 11, 2007.
12. *6th Annual Green Colleges Workshop,* **"MSOE's (Solar Electric) PV System,"** Milwaukee, WI, April 20, 2007.
13. *4th Annual Green Vehicle Workshop*, **"Carbon Dioxide Emissions from Passenger Motor Vehicles with Alternative Powertrain Systems,"** Milwaukee, WI, March 30, 2007.
14. Keynote Address at the Society of Automotive Engineer's *Emissions: The Engineering Challenge* Technical Lecture Series, **"Well-to-Wheel Emissions from Motor Vehicles: A Discussion of the Performance of Alternative Propulsion Systems,"** Discovery World Digital Theater, Milwaukee, WI, January 24, 2007.

Conference Papers and Presentations

(*denotes an undergraduate coauthor)

1. B. Steffes*, C. Chapman*, B. Jackson*, D. Neumann*, N. Weber*, and C. Damm, **"Design and Modeling of Combined Heat and Power Systems for Sustainable Urban Agriculture and Aquaculture,"** *2012 Green Energy Summit*, Milwaukee, WI, March 7-10, 2012.
2. A. Hjortland*, S. Drozek*, R. Enot*, K. Rode*, and C. Damm, **"Solar Energy Experiments and Modeling for Engineers,"** *2011 Green Energy Summit*, Milwaukee, WI, March 9-11, 2011.
3. A. Zelhofer*, M. Peterson*, N. Hanson*, M. Ajax*, T. Henke*, and C. Damm, **"Supermileage: Student Project Vehicle at MSOE,"** *2011 Green Energy Summit*, Milwaukee, WI, March 9-11, 2011.
4. D. Neumann*, C. Damm, and A. Nasiri, **"Power Smoothing for Wind Turbine Gearbox Stress Reduction,"** *2010 Green Energy Summit*, Milwaukee, WI, March 26-28, 2010.
5. A. Carlson*, R. Lampe*, W. Carnell and C. Damm, **"Hydraulic Regenerative Braking,"** *2009 Renewable Energy Summit*, Milwaukee, WI, March 25-27, 2009.
6. S. Krause*, A. Zelhofer*, and C. Damm, **"Importance of Applied Green Education—The Supermileage Vehicle Challenge,"** *2009 Renewable Energy Summit*, Milwaukee, WI, March 25-27, 2009.

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7. D. Archer, F. Betz, C. Damm, and J. Wiss, **"A Biodiesel-fueled CHP System for a Building Energy Supply,"** *4th Annual Advanced Stationary Reciprocating Engines Conference*, Downey, CA, September 18-19, 2007.

8. A. McMillen, G. Wrate, C. Damm, and C. Diggelman, **"Optimizing the Performance of a Photovoltaic Array by Evaluating Site-Specific Parameters,"** *Center for Alternative Energy and Technology 2007 Alternative Energy Symposium*, Chicago, IL, August 9-10, 2007.

9. Gertler, A., H. Kuhns, J. Gillies, C. Damm, M. Abu-Allaban, R. Clayton, and D. Proffitt, **"Road Dust Re-entrainment: The Impact of Winter Road Sand/Salt and Street Sweeping on Emissions"**, *Environmental Nuisances: Noise, Odour and Fugitive Dust Conference*, Mississauga, Ontario, Canada, May 9-11, 2005.

10. Etyemezian, V., A. Gertler, J. Gillies, H. Kuhns, C. Damm, C. Denney*, and J. Skotnik*, **"Methods To Assess Road Dust Resuspension and Results of Recent Studies"**, *15th CRC On-Road Vehicle Emissions Workshop*, San Diego, CA, April 4-6, 2005.

11. C.J. Damm, A. S. (Ed) Cheng, R. W. Dibble, D. Lucas, R.F. Sawyer, and C.P. Koshland, **"Particulate Matter Emissions Monitoring from a Compression-Ignition Engine Fueled with Low Sulfur Diesel, Oxygenate-in-Diesel Blends, and Fischer-Tropsch Diesel,"** *Third Joint Meeting of the U.S. Sections of The Combustion Institute*, Chicago, IL, March 16-19, 2003.

12. C.J. Damm, D. Lucas, R.F. Sawyer, and C.P. Koshland, **"Characterization of Diesel Particulate Matter with Photofragmentation Fluorescence,"** Paper 01F-11, *Combustion Institute Western States Fall Meeting*, Salt Lake City, Utah, October 15-16, 2001.

13. C.J. Damm, A. S. (Ed) Cheng, R. W. Dibble, D. Lucas, R.F. Sawyer, and C.P. Koshland, **"Photofragmentation-fluorescence Measurement of Particulate Emissions from a Diesel Engine Fueled by Oxygenate-in-Diesel and Fischer-Tropsch Diesel Blends,"** *7th International Congress on Toxic Combustion Byproducts*, Research Triangle Park, North Carolina, June 4-6, 2001.

14. C.J. Damm, D. Lucas, R.F. Sawyer, and C.P. Koshland, **"Monitoring Particulate Matter with Photofragmentation-fluorescence,"** *SAE Spring 2001 Fuels and Lubricants Meeting,* Orlando, Florida, May 7-9, 2001.

15. C.J. Damm, D. Lucas, R.F. Sawyer, and C.P. Koshland, **"Monitoring Diesel Particulate Matter with Photofragmentation-fluorescence,"** *2nd Joint Meeting of the U.S. Sections of the Combustion Institute,* Oakland, CA, March 25-28, 2001.

16. C.J. Damm, A. S. (Ed) Cheng, R. W. Dibble, D.Lucas, R.F. Sawyer, and C.P. Koshland, **"The Effect of Oxygenate-in-Diesel Blends and Fischer-Tropsch Diesel on Particulate Matter Emissions from a Compression-Ignition Engine,"** *2nd Joint Meeting of the U.S. Sections of the Combustion Institute,* Oakland, CA, March 25-28, 2001.

17. C.J. Damm, D. Lucas, R.F. Sawyer, and C.P. Koshland, **"Measurement of Combustion Generated Particles with Excimer Laser Fragmentation Fluorescence Spectroscopy,"** Paper 00S-6, *Combustion Institute Western States Spring Meeting*, Golden, CO, March 13-14, 2000.

18. C.J. Damm, D. Lucas, R.F. Sawyer, and C.P. Koshland, **"Excimer Laser Fragmentation Fluorescence Spectroscopy as a Method for Monitoring Ammonium Nitrate and Ammonium Sulfate Particle Concentrations,"** *6th International Congress on Toxic Combustion Byproducts*, Karlsruhe, Germany, June 27-30, 1999.

19. S.G. Buckley, C.J. Damm, W. Vitovec, L.A. Sgro, R.F. Sawyer, C.P. Koshland, and D. Lucas **"Ammonia Detection Using Photofragmentation-Fluorescence,"** Paper 98S-18, *Combustion Institute Western States Spring Meeting*, Berkeley, CA, March 23-24, 1998.

20. D.L. Bohac, T.S. Dunsworth, L.S. Shen and C.J. Damm*, **"The Energy Penalty of Sub-Slab Depressurization Radon Mitigation Systems,"** *1992 International Symposium on Radon and Radon Reduction Technology*, Minneapolis, MN, Sept. 22-25, 1992.

Selected Technical Reports

(*denotes an undergraduate coauthor)

In addition to the published reports listed below, Dr. Damm has authored **40 technical reports since 2004** for clients of his consulting practice in the following areas: thermal fluid design, energy systems, sound measurement and analysis, environmental pollution, air contaminant control for a safe workplace, combustion and products of incomplete combustion, air pollution dispersion modeling, fuel systems, natural gas explosions, product safety analysis, engineering statics and dynamics.

1. C. Damm, A. Hjortland*, S. Drozek*, K. Rode*, and R. Enot*, **"The Design and Testing of Laboratory Scale Solar Technology,"** report for *We Energies*, September 14, 2011.
2. C. Damm, T. Wanke, and K. Burgess, Fluid Power Institute Report #52103 **"Applied Mechanical Incorporated Rooftop and Unit Efficiency Testing,"** June 17, 2011.
3. A. Nasiri, C. Damm, and N. Demerdash, **"New Energy Storage Technologies and Power Convertor Topologies for Wind Turbines,"** report for 2010 *Southeastern Wisconsin Energy Technology Research Consortium*, August 15, 2010.
4. H. Kuhns, J. Chow, V. Etyemezian, D. Trimble, S. Kohl, M. McClaren, M. Abu-Allaban, J. Gillies, A. Gertler, C. Damm, C. Denney*, C. Gallery*, and J. Skotnik*, **"Lake Tahoe Particulate Matter Source Characterization Study,"** report for the California Air Resources Board (2004).
5. D.L. Bohac, L.S. Shen, T.S. Dunsworth, and C.J. Damm*, **"Radon Mitigation Cost Penalty Research Project,"** Report TR91-4-SF, Minnesota Building Research Center, University of Minnesota, Minneapolis, MN, 1991.