

Shawn Edward Litster

323 Scaife Hall
5000 Forbes Avenue
Pittsburgh, PA, 15213, USA

litster@andrew.cmu.edu
Tel: 412.268.3050
Fax: 412.268.3348
www.cmu.edu/me/tpes/

Education

Stanford University, Stanford, CA, USA

Ph.D., Mechanical Engineering, July 2008

Advisor: Juan G. Santiago

Thesis: "Active water management for proton exchange membrane fuel cells using integrated wicks and electroosmotic pumps"

Graduate Coursework: Fluid mechanics, Applied mathematics, Computational fluid dynamics, Heat transfer, Microfluidics, Thermodynamics.

University of Victoria, Victoria, BC, Canada

M.A.Sc., Mechanical Engineering, June 2005

Advisor: Ned Djilali

Thesis: "Mathematical Modelling of Fuel Cells for Portable Devices"

Lieutenant Governor's Silver Medal for Most Outstanding Masters Thesis, all faculties

Graduate Coursework: Fluid mechanics, Computational methods, Microfluidics, Fuel cells, Thermodynamics

B.Eng. – With Distinction, Mechanical Engineering, June 2004

Co-op program

Camosun College, Victoria, BC, Canada

Diploma, Mechanical Engineering Technology, Machine Design Option, June 2000

Academic Positions

Carnegie Mellon University, Pittsburgh, PA

Dept. of Mechanical Engineering

Assistant Professor, 2008 to present

Director of the *Laboratory for Transport Phenomena in Energy Systems*

Research topics

- Transport phenomena in energy systems, with a focus technologies featuring electrochemistry and electrokinetics
- Polymer electrolyte fuel cells, Li-ion batteries, aqueous sodium batteries, ultracapacitors
- Microfabricated sensors for in-situ, micro-scale measurements in porous electrodes
- Microstructured electrode scaffold diagnostics for porous electrodes
- Nano-scale and micro-scale X-ray imaging of porous electrodes
- Computational modeling of porous electrodes and electrochemical cells
- Porous electrode fabrication
- Non-linear analysis and control for two-phase flow in fuel cell micro-channels
- Interfacial ion transport mechanisms in porous electrodes
- Non-linear electrokinetic flows
- Catalytic coal gasification for solid oxide fuel cell power plants
- Energy system modeling and exergy analysis
- Miniature fuel cells for portable electronics

Stanford Microfluidics Laboratory, Stanford University

Graduate Research Assistant, 2005 to 2008

Project: Advanced Water Management for PEM Fuel Cells, Confidential Industry Sponsor

- Designed and fabricated a 25 cm² polymer electrolyte membrane (PEM) fuel cell with a novel active water management system featuring an electroosmotic (EO) pump and a porous carbon wick.
- Experimentally studied dry gas operation of a PEM fuel cell with a hydrophilic porous flow field plate. Computationally analyzed heat pipe effect in the flow field.
- Developed a method of integrating capillary wicking structures with EO pumps and performed EO pump diagnostics.
- Developed models of water transport through porous PEMFC flow field and EO pumps.
- Performed experimental studies of traditional PEM fuel cell flow field designs.
- Developed a custom fuel cell test station and created LabVIEW programs for electrochemical testing.
- Supervised the design and fabrication of a segmented anode for spatial current mapping.

Project: Electrochemical Reanimation of the Orbicularis Oculi Muscle, US Dept. of Defence

- Designed, fabricated, and experimentally demonstrated two-liquid EO pumps for drug delivery using collapsible membranes for drug independent performance.
- Experimentally studied EO pumping with nano-porous substrates and evaluated the effects of concentration polarization.
- Designed and demonstrated *in vivo* a compact and flexible drug delivery patch for implantation.
- Administered laser ablation rapid-prototyping equipment.

Institute for Integrated Energy Systems (IESVic), University of Victoria

Research Assistant, 2002 to 2005

- Created a comprehensive model of a micro-structured, air-breathing fuel cell with computational fluid dynamics (CFD).
- Experimentally investigated microscale two-phase flow in PEM fuel cell electrodes.
- Developed a numerical pore-scale CFD model of two-phase flow in PEM fuel cell electrodes using the volume-of-fluid (VOF) method.
- Derived a pseudo-analytical two-dimensional model of a microstructured fuel cell.
- Performed an extensive review of transport phenomena in low temperature fuel cell electrodes and relevant mathematical models that was published as a book chapter.

UVic CFD Lab, University of Victoria

Research Assistant, 2002

Developed a CFD model of fluid flow and mass transport within a curved hollow-fibre reverse-osmosis membrane for desalination.

Teaching and Supervisory Experience

24-722: Energy Systems Modeling, Carnegie Mellon University, Spring 2010, 2011, 2012

24-324: Energy & Thermal System Analysis, Carnegie Mellon University, Fall 2009, 2011

24-331: Viscous Flow, Carnegie Mellon University, Spring 2009, Fall 2011

Guest Lecturer, 24-739: Fuel Cells, Carnegie Mellon University, Fall 2008, Fall 2009
Teaching Assistant, ME 70: Introductory Fluid Engineering, Stanford University, 2007
Guest Lecturer, ME 70: Introductory Fluid Engineering, Stanford University, 2006

Ph.D. Students

1. Katherine Hess, "Potential sensing in porous electrodes," Spring 2009 - Spring 2013 (expected).
2. Nicholas Siefert, "Fuel cell system analysis," Spring 2009 - Spring 2013 (expected).
3. William Epting, "In situ chemical sensing in porous electrodes," Fall 2009 - Fall 2013 (expected).
4. Iryna Zenyuk, "Interface effects in PEFC electrodes," Fall 2009 - Fall 2013 (expected).
5. Michael Burkholder, "Non-linear diagnostics for fuel cells," Fall 2011-Fall 2015 (expected).
6. Seongjin An, "Microscale diagnostics for electrodes," Spring 2012-Spring 2016 (expected)

Master's Students

1. Fevzi Kivanc, "Electroosmosis of the 2nd kind," Fall 2008 - Spring 2010.
2. Sang Ho Yoon, "Modeling parallel channels in PEM fuel cells," Fall 2008.
3. Paul Jones, "Thermal and water management for miniature fuel cells," Spring 2009.
4. Ssu-Chieh Yu, "PEM fuel cell electrode fabrication", Fall 2009 - Fall 2010.
5. Xiaoxin Su, "Modeling miniature fuel cells," Fall 2009-Spring 2011.
6. Chi-Hsin Ho, "Two-phase flow in fuel cell micro-channels," Fall 2009-Spring 2010.
7. Cheng-Han Chen, "Modeling of miniature fuel cells," Spring 2010 -Summer 2011.
8. Joo Yeob Lee, "Modeling of ion transport in electrodes," Fall 2010-Spring 2012 (expected).
9. Siddharth Komini Babu, "Nanostructured electrodes," Fall 2011-Summer 2013 (expected)
10. Jingyi Yan, "Nanostructured fuel cell electrodes," Fall 2011-Summer 2013 (expected)

Undergraduate Students

1. Jarrett Valeri (Dept. Honors), "Voltage Measurement in PEFCs," Fall 2008 - Spring 2009.
2. Paul Jones, "Proton Exchange Membrane Fuel Cells," Spring 2009.
3. Michael Burkholder (CIT Honors), "Two-phase flow in fuel cells," Fall 2009-Spring 2010.
4. Colin O'Shea, "Modeling two-phase flow in fuel cell micro-channels," Spring 2010-Fall 2011
5. Tema Yaravitz (Dept. Honors), "Fuel cell catalyst layer fabrication", Fall 2010-Spring 2011.
6. John Boyle (CIT Honors), "Microscale fuel cell diagnostics", Fall 2010-Spring 2011.

Professional Experience

Angstrom Power Incorporated, North Vancouver, BC, Canada

Research Engineer, 2003

- Extensive review of low temperature fuel cell electrode design practices and fabrication processes in literature and patents.
- Analysis of microstructured fuel cell design with CFD software.
- Analysis and optimization of electric current paths in microstructured fuel cells.

Abitibi Consolidated Incorporated, Newsprint Division, Mackenzie, BC, Canada

Project Engineering Co-op Student, 2001

Project management and mechanical design.

Honors and Awards

National Science Foundation CAREER Award, 2011.
Best poster award (with I. Zenyuk), Symposium of the International Association for Hydrogen Energy, Penn State University, April 17, 2010.
2nd place, poster competition (with N. Siefert and C.-H. Ho), Bennett Conference, Carnegie Mellon University, April 16, 2010.
Best student paper award (2nd author) - Advanced Energy Systems Division, 2007 ASME IMECE, Seattle, Wa, November 11-15, 2007.
Best student/post-doctoral oral presentation award, PEM fuel cell system sessions, 210th Meeting of The Electrochemical Society, Cancun, Mexico, 2006
Lieutenant Governor's Silver Medal for Top Masters Thesis, All faculties, University of Victoria, 2005/2006
Canada Graduate Scholarship for Doctorate, Natural Science and Engineering Research Council (NSERC), Declined award due to tenure at a university outside of Canada, 2005
Postgraduate Scholarship for Doctorate with Foreign Tenure, NSERC, 2005/2006
Canada Graduate Scholarship for Masters, NSERC, 2004/2005
Canadian Space Agency NSERC Supplement, Canadian Space Agency, 2004/2005
President's Research Scholarship, University of Victoria, 2004/2005
Dean's List (Top 10% graduating GPA in engineering), 2004
President's Scholarship (PT), University of Victoria, 2003
Cunliffe Engineering Scholarship, University of Victoria, 2002
Undergraduate Student Research Award (USRA), NSERC, 2002
Spaghetti Bridge Competition, Camosun College, 1st place in max strength test and innovative design categories. Awarded a semester of tuition paid, 1999

Academic Service

Seminar series coordinator, Dept. of Mechanical Engineering, 2010-2011
Undergraduate Education Committee, Dept. of Mechanical Engineering, 2008-2010.
Ph.D. research qualification exam committee, Dept. of Mechanical Engineering, 2009-2010
Student coordinator, *Thermal and Fluid Sciences Affiliates and Sponsors Conference*, Stanford University, 2007
Student Committee Member, Mechanical Engineering Multiphysics Faculty Search, Stanford University, 2006
Co-organizer, IESVic/ NRC Institute for Fuel Cell Innovation Joint Workshop on Fuel Cells, 2004

Publications (supervised researchers in **bold**)

Book chapters

1. S. Litster, "Micropumps" In B. Bhushan (Ed.), *Encyclopedia of Nanotechnology*, Springer, New York, NY, *In press*.
2. S. Litster and N. Djilali, "Performance Analysis of Microstructured Fuel Cells for Portable Applications," In S.Kakac, L. Vasiliev, A. Pramuanjaroenkij (Eds.), *Micro-Mini Fuel Cells-Fundamentals and Applications*, Springer Verlag, New York, NY, 2008.

3. S. Litster and N. Djilali, "Two-Phase Transport in Porous Gas Diffusion Electrodes," In M. Faghri and B. Sunden (Eds.), *Transport Phenomena in Fuel Cells*, volume 17 of Developments in Heat Transfer, WIT Press, Southhampton, UK, Chapter 5, pp. 175-214, 2005.

Journal articles

Published or In press

1. **K.C. Hess, W.K. Epting**, S. Litster, "Spatially-resolved, in situ potential measurements through porous electrodes as applied to fuel cells," *Analytical Chemistry*, in press, (2011).
2. **W.K. Epting**, J. Gelb, S. Litster "Resolving the Three-dimensional Micro-structure of Polymer Electrolyte Fuel Cell Electrodes using Nano-scale X-ray Computed Tomography," *Advanced Functional Materials*, in-press, (2011)
3. **F. Kivanc** and S. Litster, "Pumping with electroosmosis of the 2nd kind in mesoporous skeletons," *Sensors Actuators: B. Chemical*, **151**, pp. 394-401, (2011).
4. **N. Siefert** and S. Litster, "The scaling of PEM fuel cell voltage instabilities with cathode channel plurality," *Journal of Power Sources*, **196**, pp. 1948-1954, (2011).
5. S. Litster, M. Suss, and J.G. Santiago, "A two-liquid electroosmotic pump using low applied voltage and power," *Sensors Actuators: A. Physical*, **163**, pp. 311-314, (2010).
6. T. Fabian, R. O'Hayre, S. Litster, F.B. Prinz, J. G. Santiago, "Active Water Management at the Cathode of a Planar Air-breathing PEM Fuel Cell Using an Electroosmotic Pump," *J. Power Sources*, **195**, pp. 3640-3644, (2010).
7. T. Fabian, R. O'Hayre, S. Litster, F.B. Prinz, J. G. Santiago, "Passive Water Management at the Cathode of a Planar Air-breathing PEM Fuel Cell," *J. Power Sources*, **195**, pp. 3201-3206, (2010).
8. S. Litster, C.R. Buie, and J.G. Santiago, "Engineering model for coupling wicks and electroosmotic pumps with proton exchange membrane fuel cells for active water management," *Electrochim. Acta*, **174**, pp. 6223-6233, (2009).
9. S. Litster and J.G. Santiago, "Dry gas operation of proton exchange membrane fuel cells with parallel channels: Non-porous versus porous plates," *J. Power Sources*, **188**, pp. 82-88, (2009).
10. S. Litster and N. Djilali, "Theoretical Performance Analysis of Micro-Structured Air-Breathing Fuel Cells," *Electrochem. Solid State Lett.*, **11**, pp. B1-B5, (2008).
11. C. R. Buie, D. Kim, S. Litster and J.G. Santiago, "An Electroosmotic Fuel Pump for Direct Methanol Fuel Cells," *Electrochem. Solid State Lett.*, **10**, pp. B196-B200, (2007).

12. D.G. Strickland, S. Litster, J.G. Santiago, "Current distribution in polymer electrolyte membrane fuel cell with active water management," *J. Power Sources*, **174**, pp. 272-281, (2007).
13. S. Litster, C.R. Buie, T. Fabian, J.K. Eaton and J.G. Santiago, "Active Water Management for PEM Fuel Cells," *J. Electrochem. Soc.*, **154**, pp. B1049-B1058, (2007).
14. R. O'Hayre, T. Fabian, S. Litster, F.B. Prinz, and J.G. Santiago, "Engineering Model of a Passive Planar Air Breathing Fuel Cell Cathode," *J. Power Sources*, **167**, pp. 118-129, (2007).
15. S. Litster and N. Djilali, "Mathematical Modelling of Ambient Air-Breathing Fuel Cells for Portable Devices", *Electrochim. Acta*, **52**, pp. 3849-3862, (2007).
16. S. Litster , J. Pharoah, G. McLean , N. Djilali, "Computational Analysis of Heat and Mass Transfer in a Micro-Structured PEMFC Cathode", *J. Power Sources*, **156**, pp. 334-344, (2006).
17. S. Litster , D. Sinton , N. Djilali, "Ex situ Visualization of Liquid Water Transport in PEM Fuel Cell Gas Diffusion Layers", *J. Power Sources*, **154**, pp.95-105, (2006).
18. S. Litster, J.G. Pharoah, and N. Djilali, "Convective Mass Transfer in Helical Pipes: Effect of Curvature and Torsion", *Heat Mass Transfer*, **42**, pp. 387-397, (2006).
19. S. Litster and G. McLean, "PEM fuel cell electrodes", *J. Power Sources*, **130**, pp. 61-76, (2004).

Conference Papers

1. S. Litster, **K.C. Hess**, **W.K. Epting**, and J. Gelb, "Catalyst layer analysis: Nanoscale X-ray CT, spatially-resolved in-situ microscale diagnostics, and modeling," Transactions of the Electrochemical Society, Boston, MA, Oct. 10, 2011.
2. **I. Zenyuk**, **J.-Y. Lee**, and S. Litster, "Modeling ion transport in fuel cell electrodes including water|electrolyte interfaces and electric double layers," Transactions of the Electrochemical Society, Boston, MA, Oct. 12, 2011.
3. **N. Siefert**, T. McQuain, J.R. Ferrell, S. Litster, D. Shekhawat, D. Berry, "Molten Catalytic Coal Gasification for Methane Rich Syngas," Pittsburgh Coal Conference, Pittsburgh, PA, Sept. 12-15, 2011.
4. **N. Siefert**, D. Bhatnagar, S. Litster, "Exergy & Economic Analysis of Advanced IGCC & IGFC Power Plants with >90% Capture of CO₂," Pittsburgh Coal Conference, Pittsburgh, PA, Sept. 12-15, 2011.
5. **N. Siefert**, **C. O'Shea**, and S. Litster, "The Role of Channel Plurality in Two-phase Flow Instabilities in PEM Cathode Channels," ASME 9th Fuel Cell Science, Engineering and Technology Conference, Washington, DC, August 7-10, 2011.

6. **N. Siefert** and S. Litster, "Exergy and Economic Analysis of Catalytic Coal Gasifiers Coupled with Solid Oxide Fuel Cells," ASME 9th Fuel Cell Science, Engineering and Technology Conference, Washington, DC, August 7-10, 2011.
7. **W.K. Epting, K.C. Hess,** and S. Litster, "In-Situ Measurement of Oxygen Partial Pressure in a Cathode Catalyst Layer," Transactions of the Electrochemical Society, Las Vegas, NV, Oct. 10-15, 2010.
8. **K.C. Hess, W.K. Epting, S.-C. Yu,** and S. Litster, "*In Situ* Through-Plane Measurements of Ionic Potential in a PEMFC Catalyst Layer," Transactions of the Electrochemical Society, Las Vegas, NV, Oct. 10-15, 2010.
9. **K.C. Hess, W.K. Epting,** and S. Litster, "Micron-scale Diagnostic for Through-plane Transport Phenomena in Porous Electrodes," 14th International Heat Transfer Conference, Washington D.C., August 8-13, 2010.
10. **K.C. Hess, W.K. Epting,** and S. Litster, "*In Situ* Measurements of Through-Plane Distributions in Porous Electrodes," ASME 8th International Conference on Fuel Cell Science, Engineering and Technology, Brooklyn, NY, June 14-16, 2010.
11. **N. Siefert, C.-H. Ho,** and S. Litster, "Nonlinear Analysis of Two-Phase Instabilities in PEMFC Parallel-Channel Cathodes," ASME 8th International Conference on Fuel Cell Science, Engineering and Technology, Brooklyn, NY, June 14-16, 2010.
12. **I. Zenyuk** and S. Litster, "The effect of electric double layers on ionic conductivity in the agglomerates of PEM fuel cell anodes," ASME 8th International Conference on Fuel Cell Science, Engineering and Technology, Brooklyn, NY, June 14-16, 2010.
13. D. Strickland, D. Fenning, S. Litster, J.G. Santiago, "In Situ Polymerized Wicks for Passive Water Management in PEM Fuel Cell Systems," Proceedings of the ASME Energy Sustainability Conference, San Francisco, CA, July 18-23, 2009.
14. **F. Kivanc,** S. Litster, "Pumping with Electroosmosis of the 2nd Kind in Mesoporous Skeletons," Proceedings of the 20th International Symposium on Transport Phenomena, Victoria, BC, July 7-10, 2009.
15. S. Litster, B. Ha, D. Kim, and J.G. Santiago, "A Two-Liquid Electroosmotic Pump for Portable Drug Delivery," Proceedings of the ASME IMECE, Seattle, WA, Nov. 11-15, 2007.
16. Buie, C.R., Litster, S., and J.G. Santiago, "Physics of Pumping Methanol/Water Solutions for Fuel Cell Applications," Proceedings of the ASME IMECE, Seattle, WA, November 11-15, 2007. (Best student paper award)

17. S. Litster, A. Bazylak, D. Sinton, and N. Djilali, "Water Transport in Gas Diffusion Layers of PEMFCs," ECS Transactions, vol. 3, pp. 409-414, 2006. *210th Meeting of the Electrochemical Society*, Cancun, Mexico, 2006.
18. S. Litster and N. Djilali, "Performance Analysis of Air-Breathing Fuel Cells," ECS Transactions, vol. 3, pp. 1217, 2006. *210th Meeting of the Electrochemical Society*, Cancun, Mexico, 2006. (Best student/post-doc paper award)
19. R. O'Hayre, T. Fabian, S. Litster, F. B. Prinz, and J. G. Santiago, "Combined Heat and Mass Transfer Model of a Passive Air Breathing Fuel Cell Cathode," ECS Transactions, vol. 3, pp. 1125, 2006. *210th Meeting of the Electrochemical Society*, Cancun, Mexico, 2006.
20. T. Fabian, R. O'Hayre, S. Litster, F. B. Prinz, and J. G. Santiago, "Water Management at the Cathode of a Planar Air-Breathing Fuel Cell with an Electroosmotic Pump," ECS Transactions, vol. 3, pp. 949, 2006. *210th Meeting of the Electrochemical Society*, Cancun, Mexico, 2006.
21. C.R. Buie, S. Litster, D. Kim, and J. G. Santiago, "Free Convection Direct Methanol Fuel Cells Powered by Electroosmotic Pumps," ECS Transactions, vol. 3, pp. 949, 2006. *210th Meeting of the Electrochemical Society*, Cancun, Mexico, 2006.
22. R. O'Hayre, T. Fabian, S. Litster, F.B. Prinz, and J.G. Santiago, "Passive Air Breathing Fuel Cells For Portable Applications: What are the Limits to Cathode Performance?" Proc. of the Fall meeting of the Materials Research Society, Portable Power Symposium Boston, MA, USA, November 27-December 1, 2006.
23. S. Litster, N. Djilali, J. Pharoah, G. McLean, "Computational Analysis of a Micro-Structured PEMFC Cathode Featuring Nano-Porous Gas Diffusion Media," World Hydrogen Technologies Convention 2005, Singapore, Oct 3-5, 2005.
24. S. Litster and N. Djilali, "An Analytical Model of the Membrane Electrode Assembly in a PEMFC," Proceedings of ASME's 3rd International Conference on Fuel Cell Science, Engineering and Technology, May 23-25, 2005.
25. J.G. Pharoah, S. Litster and N. Djilali, "Mass Transfer Enhancement in Membrane Separation – Rotating vs. Helical Modules," Proc. of CFD 2003, Vancouver, May 28-30, 2003.
26. S. Litster, J.G. Pharoah and N. Djilali, "Flow And Mass Transfer In Helical Pipes," Progress in Transport Phenomena, (Eds. S. Dost, H. Struchtrup and I. Dincer), pp. 133-138, Elsevier, 2002. Proc. of 13th Int. Symp. Transport Phenomena, Victoria, BC, July 14-18, 2002.

Published Abstracts

1. **W.K. Epting**, J. Gelb, S. Litster, "Nano-scale X-ray Computed Tomography of Polymer Electrolyte Fuel Cell Electrodes," Fall meeting of the Materials Research Society (MRS), Boston, MA, December 2, 2011.

2. **W.K. Epting, K.C. Hess**, T. Yaravitz, J. Boyle, and S. Litster, “Validation of an Agglomerate Model using In-Situ Oxygen and Potential Distribution Measurements in the Catalyst Layer,” ASME 9th Fuel Cell Science, Engineering and Technology Conference, Washington, DC, August 7-10, 2011.
3. **K. Hess**, J.F. Whitacre, and S. Litster, “In-situ measurements of potential, current, and charging rate across an ultracapacitor electrode,” 219th Meeting of the Electrochemical Society, Montreal, Canada, May 3, 2011.
4. S. Litster and **P. Jones**, “The role of catalyst layer microstructure in the transient behavior of miniature, air-breathing fuel cells,” 2nd ASME Micro/Nanoscale Heat & Mass Transfer International Conference, Shanghai, China, Dec. 19, 2009.

Seminars and Presentations

Invited Seminars and Presentations

1. Dept. of Mechanical Engineering Seminar Series, Pennsylvania State University, State College, PA, October 25, 2011 (Invited).
2. “Catalyst layer analysis: Nanoscale X-ray CT, spatially-resolved in-situ microscale diagnostics, and modeling,” 220th Meeting of Electrochemical Society, Boston, MA, Oct. 10, 2011 (Invited, 40 min talk).
3. “Transport in porous electrodes: Three-dimensional nano-scale imaging and micro-scale in-situ measurements,” Transport Modeling Working Group Meeting, US Dept. of Energy, Fuel Cell Program, Lawrence Berkeley National Laboratory, Berkeley, CA, August 18-19, 2011 (Invited speaker and participant).
4. “Transport in porous electrodes: Three-dimensional nano-scale imaging and micro-scale in-situ measurements,” Santa Clara University, Santa Clara, CA, August 17, 2011 (Invited).
5. “Transport in porous electrodes: Three-dimensional nano-scale imaging and micro-scale in-situ measurements,” General Motors, Fuel Cell Research Facility, Honeyoeye Falls, NY , August 12, 2011 (Invited).
6. “Transport in porous electrodes: Three-dimensional nano-scale imaging and micro-scale in-situ measurements,” Rochester Institute of Technology, Rochester, NY, August 11, 2011 (Invited).
7. “Transport in porous electrodes: Three-dimensional nano-scale imaging and micro-scale in-situ measurements,” Chemical and Biological Engineering Department Seminar Series, Illinois Institute of Technology, Chicago, IL , February 23, 2011 (Invited).
8. “In-situ Micrometer Scale Measurements for Porous Electrodes,” Fuel Cell Research Centre – National Research Council Canada (FCRC-NRC) Fifth Annual Colloquium on Fuel Cell and Hydrogen Technologies, Kingston, ON, Canada, December 14, 2010 (Invited).

9. "In-situ Micrometer Scale Measurements for Porous Electrodes," Fall 2010 Colloids, Polymers & Surfaces Seminar Series, Dept. of Chemical Engineering, Carnegie Mellon University, Pittsburgh, PA, November 19, 2010 (Invited).
10. "Thermal and water management for miniature, passive fuel cells for portable power," Panelist and speaker, Panel on Thermal Management of Fuel Cells and Electric/Hybrid Vehicles, 8th AIAA International Energy Conversion Engineering Conference, Nashville, TN, July 26, 2010 (Invited).
11. "Transport Phenomena in Fuel Cells," National Energy Technology Laboratory (NETL), US Dept. of Energy, Morgantown, WV, Sept. 16, 2009 (Invited).
12. S. Litster, C.R. Buie, T. Fabian, J.K. Eaton and J.G. Santiago, "Active Water Management in PEM Fuel Cells using Integrated Wicks and Electroosmotic Pumps," 3rd Annual FCRC-NRC Colloquium on Fuel Cell and Hydrogen Technologies, Toronto, ON, Dec. 4, 2008 (Invited).
13. Fall 2008 Seminar Series, Dept. of Mechanical Engineering, Carnegie Mellon University, Nov. 21, 2008 (Invited).
14. UVic/Ballard Water Management Tools Workshop, University of Victoria, Victoria, BC, Nov. 14, 2008 (Invited).
15. Dept. of Mechanical Engineering, University of Colorado, Boulder, CO, March 12, 2008 (Invited).
16. Dept. of Mechanical Engineering, EPFL, Lausanne, Switzerland, March 7, 2008 (Invited).
17. Dept. of Mechanical Engineering, Carnegie Mellon University, Pittsburgh, PA, Feb. 5, 2008 (Invited).
18. Alternative/Sustainable Energy Seminar Series, University of Toronto, Toronto, Canada, February 1, 2008 (Invited).
19. "Ex situ Visualization of Liquid Water Transport in PEM Fuel Cell Gas Diffusion Layers," Ballard Power Systems, Vancouver, Canada, April 15, 2005 (Invited).
20. "Microstructured Fuel Cells and Microscale Two-phase Transport," Swiss Federal Institute of Technology (ETH), Zurich, Switzerland, February 6, 2005 (Invited).

Conference Presentations

1. S. Litster, B. Ha, D. Kim, and J.G. Santiago, "A Two-Liquid Electroosmotic Pump for Portable Drug Delivery," ASME IMECE, Seattle, WA, Nov. 11-15, 2007.
2. S. Litster, C.R. Buie, T. Fabian, J.K. Eaton and J.G. Santiago, "Active Water Management in PEM Fuel Cells using Electroosmotic Pumps," *ASME's 5th International Conference on Fuel Cell Science, Engineering, and Technology*, New York, NY, June 18-20, 2007.

3. S. Litster, C.R. Buie, T. Fabian, J.D. Posner, F.B. Prinz, J.K. Eaton and J.G. Santiago, "Fuel Cell Water Management using Electroosmotic Pumps," *2007 Thermal and Fluid Sciences Affiliates and Sponsors Conference*, Stanford, CA, February 7-8, 2007.
4. S. Litster, C.R. Buie, T. Fabian, J.D. Posner, and J.G. Santiago, "Water Management in a 25 cm² PEM Fuel Cell with Electroosmotic Pumping," *AIChE Annual Meeting*, November 12-17, 2006; San Francisco, CA. 2006.
5. S. Litster, A. Bazylak, D. Sinton, and N. Djilali, "Water Transport in Gas Diffusion Layers of PEMFCs," *210th Meeting of The Electrochemical Society*, Cancun, Mexico, 2006.
6. S. Litster and N. Djilali, "Performance Analysis of Air-Breathing Fuel Cells," *210th Meeting of The Electrochemical Society*, Cancun, Mexico, 2006.
7. S. Litster, C.R. Buie, J.D. Posner, T. Fabian, S.-W. Cha, F.B. Prinz, J.K. Eaton and J.G. Santiago, "Water Removal in a 25 cm² PEM Fuel Cell using Electroosmotic Pumps," *Seoul National Univ. -Stanford Univ. Student Joint Workshop*, Stanford, CA, June 27, 2006.
8. S. Litster and N. Djilali, "An Analytical Model of the Membrane Electrode Assembly in a PEMFC," *ASME's 3rd International Conference on Fuel Cell Science, Engineering and Technology*, Ypsilanti, MI, May 23-25, 2005.
9. S. Litster, "An analytical model of the membrane electrode assembly in a PEM fuel cell," 2nd Annual Mechanical Engineering Graduate Research Colloquium, Victoria, BC, May 17, 2005.
10. S. Litster, J.G. Pharoah and N. Djilali, "Flow And Mass Transfer In Helical Pipes," *13th Int. Symp. Transport Phenomena*, Victoria, BC, July 14-18, 2002.

Poster Presentations

1. S. Litster and J.G. Santiago, "Dry gas operation of PEM fuel cells with parallel channels: non-porous plates versus hydrophilic porous plates," *Gordon Research Conference on Fuel Cells*, Smithfield, RI, July 21-25, 2008.
2. S. Litster, C.R. Buie, T. Fabian, J.K. Eaton, and J.G. Santiago, "Enhanced Water Management with Electroosmotic Pumps for PEM Fuel Cells," *Cleantech 2007*, Santa Clara, CA, May 23-24, 2007.
3. S. Litster, C.R. Buie, T. Fabian, J.K. Eaton, and J.G. Santiago, "Enhanced Water Management with Electroosmotic Pumps for PEM Fuel Cells," *Young Scientists Workshop on Transport Phenomena in Fuel Cells*, University of Victoria, Canada, May 4-5, 2007.
4. S. Litster and N. Djilali, "Membrane dry-out in air-breathing Micro-PEMFCs," *Gordon Research Conference on Fuel Cells*, Smithfield, RI, July 23-28, 2006.

Patents and Intellectual Property

1. T. Fabian, S. Litster, J.G. Santiago, C. Buie, J. Sasahara, T. Kubota, “Heat and Water Management Device and Method in Fuel Cells,” US Patent 784693, 2010.
2. G.F. McLean, J. Schrooten, S. Litster, “Covers for Electrochemical Cells and Related Methods,” US Patent Application 20090191435, 2009.

Funding

1. Two-phase flow instabilities in large arrays of microchannels in low temperature fuel cells, National Science Foundation, PI, September 2011 – August 2014, \$328,903.
2. Interfaces and Related Losses in PEM Fuel Cells: Theoretical and Experimental Studies, Co-PI (PI: E.C. Kumbur, Drexel University), National Science Foundation, May 2011-April 2014, \$358,340.
3. CAREER: Micro-structured scaffolds for through-plane porous electrode diagnostics and design, National Science Foundation CAREER Award, PI, January 2011 – December 2015, \$400,000.
4. Gift in support of fuel cell modeling, 2010-2011, PI, \$20,400.
5. Physicochemical Transport in Ultra-Thick Battery Electrodes for Large-scale Energy Storage, Pennsylvania Infrastructure Technology Alliance (PITA), PI (Co-PI: J. Whitacre), June 2010 – May 2011, \$49,977.
6. Understanding Two-phase Flow in Fuel Cell Micro-channels: Experimental Analysis and Model Development, Berkman Faculty Development Fund, PI, March 2009 – February 2010, \$4954.

Membership and Activities in Professional Societies

1. Treasurer, Pittsburgh Section of the Electrochemical Society
2. Member, American Society of Mechanical Engineers (ASME).
3. Member, The Electrochemical Society (ECS).

Conference organizing

1. Session chair, Fall meeting of the Electrochemical Society, Boston, MA, October 9-14, 2011
2. Session organizer, ASME Fuel Cell Science, Engineering and Technology Conference, Washington, DC, August 7-10, 2011.
3. Session chair, Fall meeting of the Electrochemical Society, Las Vegas, NV, October 10-15, 2010.
4. Organizer and Moderator (with P.P. Mukherjee), Panel on “Thermal and Water Management in Polymer Electrolyte Fuel Cells,” 14th International Heat Transfer Conference, Washington, DC, August 8-13, 2010.
5. Session organizer, ASME Fuel Cell Science, Engineering and Technology Conference, Brooklyn, NY, June 8-10, 2010.

6. Session organizer, ASME Micro/Nanoscale Heat and Mass Transfer International Conference, Shanghai, China, December 18-21, 2009.
7. Session organizer, ASME Energy Sustainability Conference, San Francisco, CA, July 19-23, 2009.
8. Session co-organizer, ASME Fuel Cell Science, Engineering and Technology Conference, Newport Beach, CA, June 8-10, 2009.

Reviewing

Review panelist, National Science Foundation, 2009, 2010, 2011.

Proposal Reviewer, Natural Science and Engineering Research Council of Canada, 2011.

Peer reviewer for:

Proceedings of the National Academy of Sciences (2011)

Energy & Environmental Science (2011)

Chemical Communications (2011)

Journal of Physical Chemistry (2010)

Journal of Chemical Physics (2010)

Journal of Membrane Science (2010)

Journal of The Electrochemical Society (2009-present);

Electrochemistry Communications (2009);

Journal of Power Sources (2008-present);

International Journal of Hydrogen Energy (2008-present);

International Journal of Heat and Fluid Flow (2009);

Journal of Renewable and Sustainable Energy (2009),

Nanoscale and Microscale Thermophysical Engineering (2008);

International Heat Transfer Conference (2010);

ASME Conference on Fuel Cell Science, Engineering, and Technology (2008-present);

ASME Micro/Nano Heat and Mass Transfer Conference (2009);

ASME Energy Sustainability Conference (2009);

ASME IMECE (2009);

ASME MicroNano Conference (2008)