

# Matthew Frederick Campbell, Ph.D., P.E.

## *Curriculum Vitae*

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## EDUCATION/CERTIFICATION

2014. **Ph.D.** Mechanical Engineering. Stanford University.

*Advisor:* Professor Ronald K. Hanson, Woodard Professor of Mechanical Engineering

*Thesis Title:* **Studies of biodiesel surrogates using novel shock tube techniques**

2014. **P.E.** Professional Engineering Licensure #M37097 (Mechanical Engineering) in California.

2010. **M.S.** Mechanical Engineering, Stanford University.

2008. **B.S.E.** Mechanical Engineering and Materials Science. Duke University.

*Magna Cum Laude* with Distinction.

2008. **Certificate** Markets and Management. Duke University.

## PROFESSIONAL APPOINTMENTS/EMPLOYMENT

2017-Present. Engineer and Educator. Sigay Kauyagan, Inc.

*Location:* Mindanao State University, General Santos City, Republic of the Philippines.

2014-2016. Postdoctoral Appointee. Combustion Research Facility. Sandia National Laboratories.

## PUBLICATIONS

### Refereed Journal Articles

1. 2018. **Matthew F. Campbell**, Shengkai Wang, David F. Davidson, and Ronald K. Hanson. *Shock tube study of normal heptane first-stage ignition near 3.5 atm*. Combustion and Flame 198:0 (2018) 376-392.

2. 2017. **M. F. Campbell**, P. E. Schrader, A. L. Catalano, K. O. Johansson, G. A. Bohlin, N. K. Richards-Henderson, C. J. Kliewer, and H. A. Michelsen. *A small porous-plug burner for studies of combustion chemistry and soot formation*. Review of Scientific Instruments 88:12 (2017) 125106.
3. 2017. **Matthew F. Campbell**, Kyle G. Owen, David F. Davidson, and Ronald K. Hanson. *Dependence of calculated post-shock thermodynamic variables on vibrational equilibrium and input uncertainty*. AIAA Journal of Thermophysics and Heat Transfer 31:3 (2017) 586-608.
4. 2017. K. Olof Johansson, Tyler Dillstrom, Paolo Elvati, **Matthew F. Campbell**, Paul E. Schrader, Denisia M. Popolan-Vaida, Nicole K. Richards-Henderson, Kevin R. Wilson, Angela Violi, Hope A. Michelsen. *Radical-radical reactions, pyrene nucleation, and incipient soot formation in combustion*. Proceedings of the Combustion Institute 36:1 (2017) 799-806.
5. 2017. K. O. Johansson, F. El Gabaly, P. E. Schrader, **M. F. Campbell**, and H. A. Michelsen. *Evolution of maturity levels of the particle surface and bulk during soot growth and oxidation in a flame*. Aerosol Science and Technology 51:12 (2017) 1333-1344.
6. 2017. K. Olof Johansson, Judit Zádor, Paolo Elvati, **Matthew F. Campbell**, Paul E. Schrader, Nicole K. Richards-Henderson, Kevin R. Wilson, Angela Violi, and Hope A. Michelsen. *Critical assessment of photoionization efficiency measurements for characterization of soot-precursor species*. The Journal of Physical Chemistry A 121:23 (2017) 4475-4485.
7. 2017. K. Olof Johansson, **Matthew F. Campbell**, Paolo Elvati, Paul E. Schrader, Judit Zádor, Nicole K. Richards-Henderson, Kevin R. Wilson, Angela Violi, and Hope A. Michelsen. *Photoionization efficiencies of five polycyclic aromatic hydrocarbons*. The Journal of Physical Chemistry A 121:23 (2017) 4447-4454.
8. 2016. **M. F. Campbell**, G. A. Bohlin, P. E. Schrader, R. P. Bambha, C. J. Kliewer, K. O. Johansson, and H. A. Michelsen. *Design and characterization of a linear Hencken-type burner*. Review of Scientific Instruments 87:11 (2016) 115114.
9. 2016. **M. F. Campbell**, D. R. Haylett, D. F. Davidson, and R. K. Hanson. *AEROFROSH: A shock condition calculator for multi-component-fuel aerosol-laden flows*. Shock Waves 26:4 (2016) 429-447.
10. 2016. **Matthew F. Campbell**, David F. Davidson, and Ronald K. Hanson. *Scaling relation for high-temperature biodiesel surrogate ignition delay times*. Fuel 164:0 (2016) 151-159.
11. 2016. K. Olof Johansson, Tyler Dillstrom, Matteo Monti, Farid El Gabaly, **Matthew F. Campbell**, Paul E. Schrader, Denisia M. Popolan-Vaida, Nicole K. Richards-Henderson, Kevin R. Wilson, Angela Violi, and Hope A. Michelsen. *Formation and emission of large furans and oxygenated hydrocarbons from flames*. Proceedings of the National Academy of Sciences of the United States of America 113:30 (2016) 8374-8379.
12. 2016. V. A. Troutman, C. L. Strand, **M. F. Campbell**, A. M. Tulgestke, V. A. Miller, D. F. Davidson, and R. K. Hanson. *High-speed OH\* chemiluminescence imaging of ignition through a shock tube end-wall*. Applied Physics B: Lasers and Optics 122:3 (2016) 1-7.
13. 2015. **M. F. Campbell**, T. Parise, A. M. Tulgestke, R. M. Spearrin, D. F. Davidson, and R. K. Hanson. *Strategies for obtaining long constant-pressure test times in shock tubes*. Shock Waves 25:6 (2015) 651-665.

14. 2015. **Matthew F. Campbell**, Shengkai Wang, Christopher S. Goldenstein, R. Mitchell Spearrin, Andrew M. Tulgestke, Luke T. Zaczek, David F. Davidson, and Ronald K. Hanson. *Constrained reaction volume shock tube study of n-heptane oxidation: Ignition delay times and time-histories of multiple species and temperature*. Proceedings of the Combustion Institute 35:1 (2015) 231-239.
15. 2014. **Matthew F. Campbell**, Andrew M. Tulgestke, David F. Davidson, and Ronald K. Hanson. *A second-generation constrained reaction volume shock tube*. Review of Scientific Instruments 85:5 (2014) 055108.
16. 2014. **Matthew F. Campbell**, Keilan G. Freeman, David F. Davidson, and Ronald K. Hanson. *FTIR measurements of mid-IR absorption spectra of gaseous fatty acid methyl esters at T=25-500 °C*. Journal of Quantitative Spectroscopy & Radiative Transfer 145:0 (2014) 57-73.
17. 2014. **Matthew F. Campbell**, David F. Davidson, and Ronald K. Hanson. *Ignition delay times of very-low-vapor-pressure biodiesel surrogates behind reflected shock waves*. Fuel 126:0 (2014) 271-281.
18. 2013. **Matthew F. Campbell**, David F. Davidson, Ronald K. Hanson, and Charles K. Westbrook. *Ignition delay times of methyl oleate and methyl linoleate behind reflected shock waves*. Proceedings of the Combustion Institute 34:1 (2013) 419-425.

### Manuscripts in Preparation

1. 2018. **Matthew Campbell**, Joshua Hammons, Ich Tran, Olof Johansson, Paul Schrader, Ray Bambha, Eric Schaible, Chenhui Zhu, Alexander Hexemer, Tony van Buuren, and Hope Michelsen. *Small angle X-ray scattering investigation of soot formation in an ethylene/air diffusion flame*.

### Other Publications

1. 2013. Ronald K. Hanson, **Matthew F. Campbell**, Genny A. Pang, and Subith S. Vasu. *Non-equilibrium processes in high-temperature gases*. Revision of course reader.

### FELLOWSHIPS

1. 2010-2013. National Defense Science and Engineering Graduate (NDSEG) Fellowship. Stanford University.
2. 2009. (April – June). Dean's Office Fellowship. Stanford University.

## CONFERENCE ACTIVITY/PARTICIPATION

### Presentations

*Presenter underlined*

1. 2016. K. Olof Johansson, Paul Schrader, **Matthew Campbell**, and Hope Michelsen. *Relating the LII signal to soot maturity via the absorption cross section dispersion exponent*. 7<sup>th</sup> International Workshop on Laser-Induced Incandescence. 19 - 22 June 2016. Lake Tahoe, CA, USA.
2. 2015. Valerie Troutman, Victor Miller, Christopher Strand, Andrew Tulgestke, **Matthew Campbell**, David Davidson, and Ronald Hanson. *High-speed OH\* chemiluminescence imaging of ignition through a shock tube end-wall*. Paper No. M28.00003 68<sup>th</sup> Annual Meeting of the APS Division of Fluid Dynamics. 22 - 24 November 2015. Boston, MA, USA.
3. 2015. David Davidson, Andrew Tulgestke, Christopher Strand, **Matthew Campbell**, Shengkai Wang, and Ronald Hanson. (2015). *Rapid chemiluminescent imaging behind reflected shock waves*. Paper No. 180. 2017:313-316. 30<sup>th</sup> International Symposium on Shock Waves. 19 - 24 July 2015. Tel Aviv, Israel.
4. 2014. **Matthew Campbell**, Shengkai Wang, Christopher Goldenstein, Mitchell Spearrin, Andrew Tulgestke, Luke Zaczek, David Davidson, and Ronald Hanson. (2014). *Constrained reaction volume shock tube study of n-heptane oxidation: Ignition delay times and time-histories of multiple species and temperature*. Paper No. 2376. 35<sup>th</sup> International Symposium on Combustion. 3 - 8 August 2014. San Francisco, CA, USA.
5. 2013. **Matthew F. Campbell**, David F. Davidson, and Ronald K. Hanson. (2013). *Ignition delay times of very-low-vapor-pressure biodiesel surrogates behind reflected shock waves*. Paper No. 070RK-0008. 8<sup>th</sup> U.S. National Combustion Meeting. 19 - 22 May 2013. University of Utah, Utah, USA.
6. 2012. **Matthew F. Campbell**, David F. Davidson, Ronald K. Hanson, and Charles K. Westbrook. (2012). *Ignition delay times of methyl oleate and methyl linoleate behind reflected shock waves*. Paper No. D301. 34<sup>th</sup> International Symposium on Combustion. 30 July - 3 August 2012. Warsaw University of Technology, Poland.
7. 2011. **M. F. Campbell**, D. F. Davidson, and R. K. Hanson. (2011). *A second-generation aerosol shock tube and its use in studying ignition delay times of large biodiesel surrogates*. Paper No. 2463. 2012:517-522. 28<sup>th</sup> International Symposium on Shock Waves (ISSW). 17 - 22 July 2011. University of Manchester, UK.
8. 2011. **Matthew Campbell**, David Davidson, and Ronald Hanson. (2011). *Biodiesel ignition delay times*. *Thermal and Fluid Sciences Affiliates and Sponsors Conference (TFSA)*. 2 - 4 February 2011. Stanford University, CA, USA.
9. 2009. Anna-Katrina Shedletsky, **Matthew Campbell**, and David Havskjold. (2009). *Embracing ambiguity: A perspective on student foresight engineering*. Paper No. DS 58-10. 2009:237-244. 17<sup>th</sup> International Conference on Engineering Design, ICED'09. 24 - 27 August 2009. Stanford University, CA, USA.

## Posters

*Presenter underlined*

1. 2016. Olof Johansson, Tyler Dillstrom, **Matthew Campbell**, Matteo Monti, Farid El Gabaly, Paolo Elvati, Denisia Popolan-Vaida, Nicole Richards-Henderson, Paul Schrader, Kevin Wilson, Angela Violi, and Hope Michelsen. *Formation and emission of large furans and oxygenated hydrocarbon species from flames*. 3<sup>rd</sup> International Sooting Flame Workshop. 30 - 31 July 2016. Seoul, South Korea.
2. 2016. **Matthew Campbell**, Paul Schrader, Olof Johansson, Ich Tran, Chenhui Zhu, Eric Schaible, Polite Stewart, Jr., Alexander Hexemer, Tony van Buuren, Ray Bambha, and Hope Michelsen. *Towards understanding the relationship between LII, soot particle maturity, and minimum particle size detection limit*. 7<sup>th</sup> International Workshop on Laser-Induced Incandescence. 19 - 22 June 2016. Lake Tahoe, CA, USA.
3. 2015. **Matthew Campbell**, Ich Tran, Matteo Monti, Olof Johansson, Ray Bambha, Paul Schrader, Tony Van Buuren, Farid El Gabaly, Dimosthenis Sokaras, Dennis Nordlund, Tsu-Chien Weng, and Hope Michelsen. *X-ray-based diagnostics for studying soot formation, evolution, and oxidation*. 18<sup>th</sup> Gordon Research Conference and Seminar on Laser Diagnostics in Combustion. 9 - 14 August 2015. Waterville Valley, NH, USA.
4. 2009. David Havskjold, **Matthew Campbell**, and Anna-Katrina Shedletsky. *Dynamic space*. 32<sup>nd</sup> Annual Stanford University Opportunity Job Fair. 23 January 2009. Stanford University, CA, USA.

## TEACHING EXPERIENCE

### Sigay Kauyagan, Inc. at Mindanao State University

1. 2018 (June – August). Tutorial instructor, *College bound program for cultural communities, science section*.
2. 2017-2018. Instructor for five-session mini-courses that I designed and taught: *Study skills; Introduction to Octave and Matlab; Scientific writing; Mental math skills; and Basics of baking*.

### Stanford University

1. 2013 (January – March). Teaching assistant, *Non-equilibrium processes in high-temperature gases*.
2. 2011 (March). Laboratory instructor, *Optical diagnostics and spectroscopy laboratory*.

**Duke University**

1. 2007 (January – May). Teaching assistant and laboratory instructor, *Data analysis and statistical inference*.
2. 2005 (August – December). Teaching assistant and laboratory instructor, *Computer methods in engineering*.

**RESEARCH EXPERIENCE**

1. 2014-2016. Postdoctoral appointee. Combustion Research Facility, Sandia National Laboratories. *Mentor*: Dr. Hope A. Michelsen.
2. 2009-2014. Research assistant. High Temperature Gasdynamics Laboratory, Stanford University. *Advisor*: Professor Ronald K. Hanson.

**SERVICE TO PROFESSION****Evaluations**

1. 2017. Reviewer. National Defense Science and Engineering Graduate (NDSEG) Fellowship applications.
2. 2009-2016. Alumni undergraduate admissions interviewer. Duke University.

**Referee Service Performed**

1. Proceedings of the Combustion Institute
2. Combustion and Flame
3. Energy and Fuels
4. Journal of Renewable and Sustainable Energy
5. Journal of Chemical Engineering and Materials Science
6. Journal of Sustainable Bioenergy Systems
7. Journal of the Brazilian Society of Mechanical Sciences and Engineering

**DEPARTMENTAL/UNIVERSITY SERVICE**

1. 2014-2016. Recruiting team representative, Sandia National Laboratories.
2. 2012-2014. Graduate student representative, Mechanical Engineering Building Renovation Design Committee. Stanford University.
3. 2012-2014. Member, Building Assessment Team (BAT). Stanford University.
4. 2012-2014. Member, Building Evacuation Response Team (BERT). Stanford University.
5. 2009-2014. Undergraduate Admissions Alumni Interviewer. Duke University.

### **COMMUNITY INVOLVEMENT/OUTREACH**

1. 2012-2014. Science Experiment Station Leader for Vacation Bible School (VBS). Menlo Church in San Mateo, CA.
2. 2012-2013. Volunteer. Habitat for Humanity.
3. 2012 (August). Volunteer working with children at risk for human trafficking. Agape International Missions, Phnom Penh, Cambodia.

### **RELATED PROFESSIONAL SKILLS/CERTIFICATIONS**

1. 2014. Passed Principles and Practice of Engineering (PE) Exam in California.
2. 2008. Passed Fundamentals of Engineering (FE) Exam in North Carolina.

### **NON-ACADEMIC WORK**

1. 2017-Present. Engineer and Educator. Sigay Kauyagan, Inc. at Mindanao State University, General Santos City, Republic of the Philippines. *Director*: Dr. Craig Gustafson.
2. 2009 (June – September). Growth and Capital Engineering Intern. Medtronic Surgical Solutions.
3. 2008 (July – September). Battery Manufacturing and Process Engineering Intern. Boston Scientific.
4. 2007 (May – August). Hybrid Circuit Manufacturing and Process Engineering Intern. Boston Scientific.

### **TEACHING AREAS/COURSES PREPARED TO TEACH**

1. Combustion
2. Compressible flow
3. Computer methods in Engineering (Matlab/Octave)
4. Energy systems
5. Fluid mechanics
6. Heat and mass transfer
7. Mechanical and product design methodology
8. Physical gas dynamics
9. Reaction kinetics
10. Spectroscopy
11. Thermodynamics

**PROFESSIONAL MEMBERSHIPS/AFFILIATIONS**

1. 2015. Toastmasters International
2. 2014. American Chemical Society
3. 2012. Combustion Institute
4. 2008. Phi Beta Kappa Honor Society
5. 2007. Pi Tau Sigma Mechanical Engineering Honor Society
6. 2006. Tau Beta Pi Engineering Honor Society
7. 2004. American Society of Mechanical Engineers



**REFERENCES**

Hope A. Michelsen, Ph.D.

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Combustion Research Facility, Sandia National Laboratories  
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Department of Mechanical Engineering, Stanford University  
452 Escondido Mall, Bldg. 524, Stanford, CA 94305  
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Craig T. Bowman, Ph.D.

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David F. Davidson, Ph.D.

Senior Research Scientist  
Department of Mechanical Engineering, Stanford University  
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