Sili Deng

Assistant Professor
Mechanical Engineering
Massachusetts Institute of Technology

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EDUCATION

Ph.D., *Princeton University* 09/2010-09/2016

Department: Mechanical and Aerospace Engineering
Dissertation: Chemistry-Transport Coupling in Flame Dynamics and Emissions
Co-advisers: Professor C. K. Law and Professor M. E. Mueller

M.A., *Princeton University* 09/2010-05/2012

Department: Mechanical and Aerospace Engineering

B.S., *Tsinghua University* 08/2006-07/2010

Department: Thermal Engineering (Graduation with Honor)

RESEARCH EXPERIENCE

Assistant Professor, *Massachusetts Institute of Technology* 01/2019-Present

Visiting Scientist, *Massachusetts Institute of Technology* 06/2017-12/2018

Postdoctoral Scholar, *Stanford University* 09/2016-12/2018

Energetic materials: Synthesized energetic materials and characterized their thermal and chemical properties.

Research Assistant, *Princeton University* 09/2010-09/2016

Flame dynamics: Investigated flame stabilization and dynamics at practical engine conditions with Direct Numerical Simulation.

Soot dynamics: Studied soot evolution and emissions in turbulent flows with high-fidelity Large Eddy Simulation.

Soot chemistry: Assessed and created a database for the soot emission propensities of fossil fuels and biofuels.

Cool flame chemistry: Initiated a project to first experimentally observe nonpremixed cool flame and studied low-temperature chemistry.

Research Assistant, *Tsinghua University* 08/2008-07/2010

SCR catalysts: Collaborated with engineers from industry to improve Selective Catalytic Reduction (SCR) catalysts regeneration efficiency to 90%.

Flame synthesis: Designed a stagnation swirl burner and the axillary system for flame synthesis of photovoltaic nanomaterials.

TEACHING EXPERIENCE

Assistant Professor, *Massachusetts Institute of Technology* 01/2019-Present

2.005: Thermal Fluids Engineering I (Spring 2020)

2.006: Thermal Fluids Engineering II (Spring 2019, Fall 2019)

McGraw Graduate Teaching Fellow, *Princeton University* 05/2014-09/2016

Professional trainer: Designed and led Teaching Assistant Orientation every semester for 60+ graduates.

Panelist: Organized and moderated pedagogy panel discussion and mentored 40+ graduates and postdocs.

Teaching Assistant, *Princeton University* 02/2013-09/2016

MAE 221: Thermodynamics (Undergraduate)

MAE 426: Rocket and Air-Breathing Propulsion Technology (Undergraduate)

MAE/ELE 427: Energy Conversion and the Environment: Transportation Applications (Undergraduate)

MAE 531: Combustion (Graduate)

SELECTED AWARDS

d'Arbeloff Career Development Chair, *Massachusetts Institute of Technology* 2019

Bernard Lewis Fellowship, *Combustion Institute* 2016

Gordon Wu Prize for Excellence, *Princeton University* 2014

Excellence in Teaching Award, *Princeton University* 2014

Princeton Energy and Climate Scholarship, *Princeton University* 2013

Princeton University Graduate Fellowship, *Princeton University* 2010

Best Bachelor Thesis Award, *Tsinghua University* 2010

Tsinghua University Fellowships, *Tsinghua University* 2006-2010

PUBLICATIONS

1. H. Zhao, D. Lu, S.W. Koh, P. Gao, **S. Deng**, Y. Zhou, B. You, H. Li, "Scalable hybrid electrolysis for simultaneous hydrogen and organic acid generation", ***Nature Sustainability*** (submitted).

2. Y. Jiang*, **S. Deng***, S. Hong*, S. Tiwari, H. Chen, K. Nomura, R.K. Kalia, A. Nakano, P. Vashishta, M.R. Zachariah, and X.L. Zheng, "Synergistically chemical and thermal coupling between graphene oxide and graphene fluoride for enhancing aluminum combustion", ***ACS Applied Materials & Interfaces*** 12 (2020) 7451-7458. *Equal contribution.

3. S. Huang, **S. Deng**, Y. Jiang, X.L. Zheng, "Experimental effective metal oxides to enhance boron combustion", ***Combustion and Flame*** 205 (2019) 278-285.

4. S. Huang, M. Pan, **S. Deng**, Y. Jiang, J. Zhao, B. Levy-Wendt, S.K.Y. Tang, X.L. Zheng, "Modified micro-emulsion synthesis of highly dispersed Al/PVDF composites with enhanced combustion properties", ***Advanced Engineering Materials*** (2019) 1801330.

5. Y. Jiang*, **S. Deng***, S. Hong*, J. Zhao, S. Huang, C.-C. Wu, J.L. Gottfried, K. Nomura, Y. Li, S. Tiwari, R.K. Kalia, P. Vashishta, A. Nakano, X.L. Zheng, "Energetic performance of optically activated aluminum/graphene oxide composites", ***ACS Nano*** 12 (2018) 11366-11345. *Equal contribution.

6. J. Pan, L. Chen, H. Wei, D. Feng, **S. Deng**, G. Shu, "On autoignition mode under variable thermodynamic state of internal combustion engines", ***International Journal of Engine Research*** (in press).

7. **S. Deng***, Y. Jiang*, S. Huang, X. Shi, J. Zhao, X.L. Zheng, "Tuning the morphological, ignition and combustion properties of micron-Al/CuO thermites through different synthesis approaches", ***Combustion and Flame*** 195 (2018) 303-310. *Equal contribution.

8. S. Huang*, **S. Deng***, Y. Jiang, J. Zhao, X.L. Zheng, "Electroless deposition and ignition properties of Si/Fe_2O_3 core/shell nanothermites", ***ACS Omega*** 2 (2017) 3596-3600. *Equal contribution.

9. S. Huang, V.S. Parimi, **S. Deng**, S. Lingamneni, X.L. Zheng, "Facile thermal and optical ignition of silicon nanoparticles and micron particles", ***Nano Letters*** 17 (2017) 5925-5930.

10. **S. Deng**, D. Han, C.K. Law, "Ignition and extinction of strained nonpremixed cool flames at elevated pressures", ***Combustion and Flame*** 176 (2017) 143-150.

11. **S. Deng**, M.E. Mueller, Q.N. Chan, N.H. Qamar, B.B. Dally, Z.T. Alwahabi, G.J. Nathan, "Hydrodynamic and chemical effects of hydrogen addition on soot evolution in turbulent nonpremixed bluff body ethylene flames", ***Proceedings of the Combustion Institute*** 36 (2017) 807-814.

12. D. Han, **S. Deng**, W. Liang, P. Zhao, F. Wu, Z. Huang, C.K. Law, "Laminar flame propagation and nonpremixed stagnation ignition of toluene and xylenes", ***Proceedings of the Combustion Institute*** 36 (2017) 479-489.

13. **S. Deng**, P. Zhao, M.E. Mueller, C.K. Law, "Flame dynamics in oscillating flows under autoignitive conditions", ***Combustion and Flame*** 168 (2016) 75-82.

14. **S. Deng**, P. Zhao, M.E. Mueller, C.K. Law, "Stabilization of laminar nonpremixed DME/air coflow flames at elevated temperatures and pressures", ***Combustion and Flame*** 162 (2015) 4471-4478.

15. **S. Deng**, P. Zhao, M.E. Mueller, C.K. Law, "Autoignition-affected stabilization of laminar nonpremixed DME/air coflow flames", ***Combustion and Flame*** 162 (2015) 3437-3445.

16. P. Zhao, W. Liang, **S. Deng**, C.K. Law, "Initiation and propagation of laminar premixed cool flames", ***Fuel*** 166 (2015) 477-487.

17. **S. Deng**, J.A. Koch, M.E. Mueller, C.K. Law, "Sooting limits of nonpremixed n-heptane, n-butanol, and methyl butanoate flames: Experimental determination and mechanistic analysis", ***Fuel*** 136 (2014) 122-129.

18. **S. Deng**, P. Zhao, D. Zhu, C.K. Law, "NTC-affected ignition and low-temperature flames in nonpremixed DME/air counterflow", ***Combustion and Flame*** 161 (2014) 1993-1997.

19. Y. Zhang, S. Li, **S. Deng**, Q. Yao, S.D. Tse, "Direct synthesis of nanostructured TiO_2 films with controlled morphologies by stagnation swirl flames", ***Journal of Aerosol Science*** 44 (2012) 71-82.

20. **S. Deng**, S. Li, S.D. Tse, J. Wang, Y. Tao, Q. Yao, "Experimental studies on TiO_2 nanoparticles in a swirl-stabilized stagnation flame", ***Journal of Engineering Thermophysics*** 32 (2011) 157-160.

21. J. Wang, Y. Tao, Y. Zhang, **S. Deng**, S. Li, Q. Yao, "Sintering behavior of TiO_2 particles in a premixed stagnation flame", ***Journal of Engineering Thermophysics*** 32 (2011) 875-878.

22. D. Yun, **S. Deng**, Q. Song, Q. Yao, "Potassium deactivation and regeneration method of V_2O_5-WO_3/TiO_2 SCR catalyst", ***Research of Environmental Sciences*** 6 (2009) 730-735.

CONFERENCE PRESENTATIONS

1. W. Ji, **S. Deng**, "KiNet: a deep neural network representation of chemical kinetics", ***Spring Technical Meeting of the Eastern States Section of the Combustion Institute***, Columbia, SC, March 8-11, 2020.

2. W. Ji, T. Yang, Z. Ren, **S. Deng**, "Kinetic similarity between extinction strain rate and laminar flame speed", ***Spring Technical Meeting of the Eastern States Section of the Combustion Institute***, Columbia, SC, March 8-11, 2020.

3. **S. Deng**, S. Huang, Y. Jiang, J. Zhao, X.L. Zheng, "Electroless deposition and ignition properties of Si/Fe_2O_3 core/shell nanothermites", ***2017 MRS Fall Meeting***, Boston, MA, November 26-December 1, 2017.

4. S. Huang, V.S. Parimi, **S. Deng**, S. Lingamneni, X.L. Zheng, "Facile thermal and optical ignition of silicon nanoparticles and micron particles", ***2017 MRS Fall Meeting***, Boston, MA, November 26-December 1, 2017.

5. **S. Deng**, P. Zhao, M.E. Mueller, C.K. Law, "Dynamics of autoignitive DME/air coflow flames in oscillating flows", ***69th Annual Meeting of the APS Division of Fluid Dynamics***, Portland, OR, November 20-22, 2016.

6. **S. Deng**, M.E. Mueller, Q.N. Chan, N.H. Qamar, B.B. Dally, Z.T. Alwahabi, G.J. Nathan, "Hydrodynamic and chemical effects of hydrogen addition on soot evolution in turbulent nonpremixed bluff body ethylene flames", ***36th International Symposium on Combustion***, COEX, Seoul, Korea, July 31-Augest 5, 2016.

7. D. Han, **S. Deng**, W. Liang, P. Zhao, F. Wu, Z. Huang, C.K. Law, "Laminar flame propagation and nonpremixed stagnation ignition of toluene and xylenes", ***36th International Symposium on Combustion***, COEX, Seoul, Korea, July 31-Augest 5, 2016.

8. **S. Deng**, M.E. Mueller, Q.N. Chan, N.H. Qamar, B.B. Dally, Z.T. Alwahabi, G.J. Nathan, "Soot evolution in turbulent nonpremixed ethylene/hydrogen bluff body flame", ***ESSCI Spring Meeting***, Princeton, NJ, USA, March 13-17, 2016.

9. **S. Deng**, P. Zhao, M.E. Mueller, C.K. Law, "Autoignited DME/air coflow flames in oscillating flows", ***ESSCI Spring Meeting***, Princeton, NJ, USA, March 13-17, 2016.

10. D. Han, **S. Deng**, W. Liang, P. Zhao, F. Wu, Z. Huang, C.K. Law, "Laminar premixed flame propagation and nonpremixed ignition of toluene and xylenes", ***ESSCI Spring Meeting, Princeton***, NJ, USA, March 13-17, 2016.

11. **S. Deng**, P. Zhao, M.E. Mueller, C.K. Law, "Laminar nonpremixed coflow flame stabilization under autoignitive conditions", ***Fourth International Education Forum on Environment and Energy Science***, Maui, HI, December 6-10, 2015.

12. **S. Deng**, M.E. Mueller, Q.N. Chan, N.H. Qamar, B.B. Dally, Z.T. Alwahabi, G.J. Nathan, "Hydrodynamic and chemical effects of hydrogen dilution on soot evolution in turbulent nonpremixed bluff body ethylene flames", ***68th Annual Meeting of the APS Division of Fluid Dynamics***, Boston, MA, November 22-24, 2015.

13. **S. Deng**, P. Zhao, M.E. Mueller, C.K. Law, "Stabilization of laminar nonpremixed DME/air coflow flames at elevated temperature and pressure", ***9th U.S. National Combustion Meeting***, Cincinnati, OH, USA, May 17-20, 2015.

14. P. Zhao, W. Liang, **S. Deng**, C.K. Law, "On premixed cool flames in the counterflow", ***9th U.S. National Combustion Meeting***, Cincinnati, OH, USA, May 17-20, 2015.

15. **S. Deng**, P. Zhao, M.E. Mueller, C.K. Law, "Detailed numerical simulations of the autoignition-affected stabilization of laminar nonpremixed DME/air coflow flames at elevated pressure", ***High Pressure and High Reynolds Number Combustion Workshop***, King Abdullah University of Science and Technology, Saudi Arabia, March 24-26, 2015.

16. **S. Deng**, J.A. Koch, M.E. Mueller, C.K. Law, "Sooting limits of nonpremixed n-heptane, n-butanol, and methyl butanoate flames: Experimental determination and mechanistic analysis", ***35th International Symposium on Combustion***, San Francisco, CA, USA, August 3-8, 2014.

17. **S. Deng**, P. Zhao, D. Zhu, C.K. Law, "NTC-affected ignition of DME by heated counterflowing air", ***8th U.S. National Combustion Meeting, Park City***, UT, USA, May 19-22, 2013.

INVITED TALKS

1. **Xi'an Jiaotong University**, School of Energy and Power Engineering, "Enabling Energy Conversion and Materials Synthesis with Fundamental Combustion Research", June 13, 2019

2. **Stanford University**, Department of Mechanical Engineering, "Material engineering for silicon-based nanoenergetics", May 17, 2017.

3. **Virginia Polytechnic Institute and State University**, Department of Mechanical Engineering, "Towards high-efficiency low-emission combustion design: Multi-modal combustion and soot emissions", March 21, 2017.

4. **University of Wisconsin-Madison**, Department of Mechanical Engineering, "Towards high-efficiency low-emission combustion design: Cool flames and soot emissions", March 15, 2017.

5. **Case Western Reserve University**, Department of Mechanical and Aerospace Engineering, "Towards high-efficiency low-emission combustion design: Cool Flames and soot emissions", March 8, 2017.

6. **Georgia Institute of Technology**, Department of Aerospace Engineering, "Towards high-efficiency low-emission combustion design: Multi-modal combustion and soot emissions", Feburary 21, 2017.

7. **Massachusetts Institute of Technology**, Department of Mechanical Engineering, "Towards high-efficiency low-emission combustion design: Cool flames and soot emissions", Feburary 15, 2017.

8. **Tsinghua University**, Department of Thermal Engineering, "NTC-affected combustion under engine condition", January 22, 2016.

9. **Peking University**, Department of Mechanics and Engineering Science, "NTC-affected combustion under engine conditions", January 20, 2016.

ADVISING AND MENTORING EXPERIENCE

Postdoctoral Scholar: Weiqi Ji (2019-present).
Graudate Students: Suyong Kim (2019-present), Maanasa Bhat (2019-present).
Undergraduate Students: Bowen Ge (Visiting Undergraduate Student, 2019), Alex Aguilar (Undergraduate Thesis, 2019), Sophie Y. Longawa (UROP, 2020), Averitt A. Johns (UROP, 2020).

INSTITUTE SERVICE

Graduate Student Admission Committee: Department of Mechanical Engineering, MIT (2018-present).
General Faculty Search Committee: Department of Mechanical Engineering, MIT (2019-2020).
Gender Equity Committee: School of Engineering, MIT (2019-present).

ACADEMIC COMMUNITY SERVICE

Journal Reviewer: ACS Applied Energy Materials, ACS Omega, Aerosol Science & Technology, Annual Review of Heat Transfer, Applied Mathematical Modelling, Combustion and Flame, CrystEngComm, Energy & Fuels, Flow, Turbulence, and Combustion, Fuel, IEEE Transactions on Nanotechnology, International Journal of Hydrogen Energy, Journal of Taiwan Institute of Chemical Engineers, Proceedings of the Combustion Institute, Physical Chemistry Chemical Physics, Sensors and Actuators A: Physical, The Journal of Physical Chemistry
Conference Reviewer: Annual Meeting of Chinese Society of Engineering Thermophysics, SAE, Turbo Expo
NSF GRFP Reviewer: Mechanical Engineering, 2019
Committee Member: Bernard Lewis Fellowship of the Combustion Institute, 2020-present
Symposium Organizer: Advances in the Fundamental Understanding and Functionalization of Reactive Materials, 2019 MRS Fall Meetings
Conference Organizer and Program Track: 2019 Applied Energy Symposium: MIT A+B
Conference Organizer: Student Working Group Co-Chair, 2020 International Combustion Symposium New York City Bid **Conference Session Chair:** Advances and Upcoming Research Strategies in Reactive Materials, 2017 MRS Fall Meetings
Conference Session Chair: Novel Combustion Technologies, 2020 Spring Technical Meeting of the Eastern States Section
Conference Session Chair: Reaction Kinetics, 2020 Spring Technical Meeting of the Eastern States Section

PROFESSIONAL ASSOCIATIONS

The Combustion Institute
American Physical Society, Division of Fluid Dynamics
Materials Research Society
American Society of Mechanical Engineers