

Curriculum Vitae

TONGHUN LEE

Assistant Professor
Department of Mechanical Engineering
Department of Chemical Engineering & Material Science, adjunct
Michigan State University
2555 Engineering Building
East Lansing, MI 48824
Phone: (517)432-3187, Cell: (517)290-8005, Fax : (517)353-1750
Email: tonghun@msu.edu, Web: <http://www.egr.msu.edu/~tonghun>

RESEARCH INTEREST

Laser Diagnostics: High-speed multi-spectral imaging of chemical species in harsh combustion environments
Alternative Energy: Next-generation biofuel, hydrogen based power generation
Advanced Propulsion Systems: Plasma enhanced combustion, Hypersonic Airbreathing Propulsion Systems

EDUCATION

Ph.D. Mechanical Engineering, Stanford University (Stanford, USA) 03/2002–06/2006
Thesis: *Strategies for Nitric Oxide Laser-Induced Fluorescence in High-Pressure-Combustion Systems*
Advisor: Dr. Ronald K. Hanson

M.S. Mechanical Engineering, Stanford University (Stanford, USA) 09/2000–03/2002
Advisor: Dr. Ronald K. Hanson

B.S. Mechanical Engineering, Yonsei University (Seoul, Korea) 03/1993–03/2000

Brebeuf College High School (Toronto, Canada) 03/1989–04/1992
Chungdam Junior High School (Seoul, Korea) 04/1984–12/1988
St. Paul's Elementary School (London, UK) 09/1980–03/1984

HONORS and AWARDS

Withrow Teaching Excellence Award, John D. and Dortha J. Withrow Endowment 3/2009

Air Force Summer Faculty Fellow, Air Force Research Laboratory 2/2009

AFOSR Young Investigator Program Award, Air Force Office of Scientific Research 10/2008

IRGP New Faculty Award 2006, Michigan State University 11/2006

Bernard Lewis Fellowship, 31st International Combustion Symposium, Combustion Institute 08/2006
High Quality Research by a Young Scientist in Combustion

RESEARCH EXPERIENCE

Aerospace Propulsion Division, Propulsion Directorate (Wright Patterson Air Force Base) 05/2009–07/2009
Air Force Summer Faculty Fellow
Laser diagnostics for plasma assisted combustion system

Physical Chemistry Institute (PCI), Univ. of Heidelberg (Heidelberg, Germany) 04/2003–06/2003
Visiting researcher: Research group of Dr. Christof Schulz and Prof. Yurgen Wolfrum.
Laser diagnostics for NO_x detection (sponsored by Volkswagen Corp.)

High Temperature Gasdynamics Laboratory, HTGL (Stanford, USA) 09/2000–06/2006
Ph.D. and M.S. degree. Advisor: Professor Ronald K. Hanson (<http://hanson.stanford.edu>)
Laser diagnostics development for practical high-pressure combustion systems

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WORK EXPERIENCE

Assistant Professor , Department of Mechanical Engineering, Michigan State Univ.	08/2006–present
Research Assistant (Ph.D. Candidate) , Stanford University <i>High Temperature Gasdynamics Laboratory, HTGL</i>	09/2000–06/2006
Military Service (Seoul, Korea) <i>Military Intelligence: Defense and Security Command</i>	07/1995–09/1997

FUNDING

Total PI Portion to date: \$1.53M

Department of Energy ARPA-E , Department of Energy (PI Portion: \$210K) “Wave Disc Generator - for Low Emissions, Light Weight Hybrid Vehicles and PV” (Total Project : \$2.5M)	10/2009
Air Force Summer Faculty Fellowship , Air Force Research Laboratory (\$11K) “Laser Diagnostics Study of Plasma Enhanced Flames in a Microwave Cavity”	2/2009
AFOSR Young Investigator Program , Air Force Office of Scientific Research (\$304K) “Laser Diagnostics Study of Plasma Assisted Combustion for Scramjet Applications”	10/2008
International Collaboration , Sogang University, Korea (\$235K) “Development of Fuel/Oxidizer Supply Modules for Ultralight Portable Fuel Cells”	10/2008
Powertrain Research , Donation from Toyota Motor Engineering & Manufacturing, USA (\$6K)	08/2008
Efficiency Clean Combustion and Fuels Co-Developed , Department of Energy (PI portion: \$720K) “Novel Biofuel Combustion” DE-PS26-07NT4103 (Total Project : \$4.8M)	08/2007
IRGP New faculty , Michigan State University (\$40K) “Laser Diagnostics of Thermal Oxidation and Plasma-Induced Partial Oxidation of Ethanol”	11/2006

TEACHING EXPERIENCE

Course Instructor , ME422 Combustion (MSU)	08/2008–
Course Instructor , ME201 Thermodynamics (MSU)	02/2007–
Design Team Advisor , ME481 Mechanical Engineering Design (MSU)	08/2006–12/2006
Lab TA , ME367 Spectroscopy Lab (Stanford University)	01/2001–04/2001

RESEARCH GROUP

(Postdoctoral Scholar)

Elisa Toulson

Ph.D. Degree: University of Melbourne (Mechanical Engineering)
M.S. Degree: University of Melbourne (Energy Studies)
B.S. Degree: University of California, San Diego (Chemical Engineering)
Research: Chemical Kinetics and Combustion of Generation II Biofuels

(Graduate Students)

Casey Allen (Ph.D. Candidate)

B.S. Degree: University of Iowa (Chemical Engineering)
Research: Chemical Kinetics and Combustion of Biofuels using Rapid Compression Machine

Xing Rao (Ph.D. Candidate)

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B.S. Degree: Tsinghua University, China (Precision Instruments and Mechanology)

M.S. Degree: Tsinghua University, China (Nuclear and New Energy Technology)

Research: Energetically Boosted Fuels and Plasma Assisted Combustion

Stephen Hammack (Ph.D. Candidate)

B.S. Degree: Michigan State University (Mechanical Engineering)

Research: Plasma Enhanced Combustion for Scramjets

Zach Williamson (M.S. Candidate)

B.S. Degree: US Naval Academy (Mechanical Engineering)

Research: Laser Diagnostics of Miniature Fuel Cells

(Undergraduate Interns)

Daniel Joseph Tepe (Freshman, Honors College)

Jeffery Narkis (Freshman, Honors College)

EDUCATIONAL OUTREACH

Research Experience for Teachers (RET-Site), NSF 2009–2011

Alternative Energy Workshop, Michigan State University Each Semester (2007,2008,2009)

Detroit Area Pre-College Engineering Program (DAPCEP), Michigan State University 2007–2009

Michigan-Louis Stokes Alliance for Minority Participation (MI-LSAMP), NSF 2007–2009

Women in Engineering Seminar, Michigan State University 2007–2009

Career Day Participation, Local High Schools 2006–2009

PROFESSIONAL SOCIETIES AND ASSOCIATIONS PARTICIPATION

Member of the Combustion Institute

Member of the American Institute of Aeronautics and Astronautics (AIAA)

Member of the American Society for Engineering Education (ASEE)

Member of the American Society of Mechanical Engineers (ASME)

Member of the Society of Automotive Engineers (SAE)

PUBLICATIONS: Full Articles in Refereed Journals

1. L. Ma, W. Cai, L. Kranendonk, T. Lee, *Mie Scattering by Coated Spheres with Application to the Characterization of Composite Nanoparticles*, Computer Physics Communications, submitted (2009)
2. E. Toulson, C. Allen, D. Miller, T. Lee, *Modeling the Auto-Ignition of Oxygenated Fuels using a Multi-Step Model*, Energy and Fuels, submitted (2009)
3. X. Rao, I. Matveev, T. Lee, *Nitric Oxide Formation in a Premixed Flame with High Level Plasma Energy Coupling*, IEEE Transactions, Special Issue on Plasma Assisted Combustion, accepted and in print (2009).
4. K. Hemawan, I. Wichman, T. Lee, T. Grotjohn, J. Asmussen, *Compact microwave re-entrant cavity applicator for plasma-assisted combustion*, Review of Scientific Instrument 80, 053507 (1-9) (2009)
5. C. Allen, G. Mittal, C.J. Sung, T. Lee, *Ignition Characterization of Energetically Boosted Jetfuels*, Journal of Propulsion and Power, ready for submission (2009).
6. J. Yoo, T. Lee, J.B. Jeffries, R.K. Hanson, *Detection of Trace Nitric Oxide Concentrations Using 1-D Laser-Induced Fluorescence imaging*, Applied Physics B. 91, 661-667 (2008).
7. T. Lee, W. G. Bessler, J. Yoo, C. Schulz, J.B. Jeffries, R.K. Hanson, *Fluorescence Quantum Yield of Carbon Dioxide for Quantitative UV Laser-Induced Fluorescence in high-pressure flames*, Applied Physics B. online (2008).
8. T. Lee, J.B. Jeffries, R.K. Hanson, *Experimental Evaluation of Strategies for Quantitative Laser-Induced-*

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- Fluorescence Imaging of Nitric Oxide in High-Pressure Flames (1–60bar)*, Proc. Comb. Inst. 31, 757-764 (2007).
9. T. Lee, W. G. Bessler, H. Kronemayer, C. Schulz, J. B. Jeffries, R. K. Hanson, *Quantitative temperature measurements in high-pressure flames with multi-line NO-LIF thermometry*, Applied Optics 44-31, 6718-6728 (2005).
 10. J.B. Jeffries, C. Schulz, D.W. Mattison, M.A. Oehlschlaeger, W.G. Bessler, T. Lee, D.F. Davidson, and R.K. Hanson, *UV Absorption of CO₂ for Temperature Diagnostics of Hydrocarbon Combustion Applications*, Proc. Comb. Inst. 30, 1591-1599 (2005).
 11. Wolfgang G. Bessler, Max Hofmann, Frank Zimmermann, Gerrit Suck, Jan Jakobs, Sascha Nicklitzsch, Tonghun Lee, Jürgen Wolfrum, and Christof Schulz. *Quantitative in-cylinder NO-LIF imaging in a realistic gasoline engine with spray-guided direct injection*, Proc. Comb. Inst. 30, 2667-2674 (2005).
 12. T. Lee, W.G. Bessler, C. Schulz, M. Patel, J. B. Jeffries, R. K. Hanson, *UV Planar Laser Induced Fluorescence Imaging of Hot Carbon Dioxide in a High-Pressure Flame*, Appl. Phys. B 79, 427-430 (2004).
 13. W.G. Bessler, C. Schulz, T. Lee, J.B. Jeffries, R.K. Hanson, *Carbon dioxide UV laser-induced fluorescence in high-pressure flames*, Chem. Phys. Lett. 375, 344-349 (2003).
 14. W.G. Bessler, C. Schulz, T. Lee, J.B. Jeffries, R.K. Hanson, *Strategies for laser-induced fluorescence detection of nitric oxide in high-pressure flames: III. Comparison of A-X Strategies*, Appl. Opt. 42-24, 4922-4936(2003).
 15. W.G. Bessler, C. Schulz, T. Lee, J.B. Jeffries, R.K. Hanson, *Strategies for laser-induced fluorescence detection of nitric oxide in high-pressure flames: II. A-X (0,1) excitation*, Appl. Opt. 42-12, 2031-2042 (2003).
 16. W.G. Bessler, C. Schulz, T. Lee, J.B. Jeffries, R.K. Hanson, *Strategies for laser-induced fluorescence detection of nitric oxide in high-pressure flames: I. A-X (0,0) excitation*, Appl. Opt. 41-18, 3547-3557 (2002).
 17. W.G. Bessler, C. Schulz, T. Lee, D.-I. Shin, M. Hofmann, J. B. Jeffries, J. Wolfrum, R. K. Hanson, *Quantitative NO-LIF imaging in high-pressure flames*, Appl. Phys. B 75, 97-102 (2002), 0946-2171.

PUBLICATIONS: Non-Refereed Conference Proceedings

1. C. Allen, T. Lee, *Energetic-Nanoparticle-Enhanced JP-8 Combustion in an Aerosol Rapid Compression Machine*, 6th U.S. National Combustion Meeting, Ann Arbor MI, May. (2009).
2. C. Allen, T. Lee, *Energetic-Nanoparticle-Enhanced Combustion of Liquid Fuels in a Rapid Compression Machine*, paper AIAA-2009-0227 at 47th Aerospace Sciences Meeting, Orlando FL, Jan. (2009).
3. X. Rao, I. Matveev, T. Lee, *Nitric Oxide Formation during Ignition and Combustion of a Transient Arc Plasmatron*, paper AIAA-2009-0228 at 47th Aerospace Sciences Meeting, Orlando FL, Jan. (2009).
4. J. Yoo, T. Lee, J.B. Jeffries, R.K. Hanson, *Detection of trace NO concentration using 1-D NO-LIF imaging*, The 2007 Joint Meeting of the US sections of the combustion institute, University of California San Diego, CA. (2007).
5. T. Lee, W.G. Bessler, H. Kronemayer, C.Schulz, J.B. Jeffries, R.K. Hanson, *Quantitative temperature measurements in high-pressure flames with multi-line nitric oxide (NO)-LIF thermometry*, The 2005 Joint Meeting of the US sections of the combustion institute, Drexel University, PA. (2005).
6. W. G. Bessler, H. Kronemayer, C. Schulz , T. Lee, J. B. Jeffries, and R. K. Hanson, *Quantitative multi-line NO-LIF temperature imaging in flames over a wide pressure range*, in Laser Applications to Chemical and environmental analysis, OSA Technical Digest Series (Optical Society of America, Washington, DC, 2004).
7. G. Suck, J. Jakobs, S. Nicklitzsch, T. Lee, W. G. Bessler, M. Hofmann, F. Zimmermann, C. Schulz, *NO laser-induced fluorescence imaging in the combustion chamber of a spray-guided direct-injection gasoline engine*, SAE 04SFL-102 (2004).
8. T. Lee, J.B. Jeffries, R.K. Hanson, W.G. Bessler, C. Schulz, *Carbon dioxide UV laser-induced fluorescence imaging in high-pressure flames*, paper AIAA-2004-0386 at 42nd Aerospace Sciences Meeting, Reno (AIAA) , NV, Jan. (2004).
9. W.G. Bessler, T. Lee, C. Schulz, J.B. Jeffries, R.K. Hanson, *Strategies for quantitative NO-concentration and temperature measurements by NO LIF in high pressure flames*, 3rd Joint Meeting of the US sections of the combustion institute, Chicago, (2003).
10. W.G. Bessler, T. Lee, C. Schulz, J.B. Jeffries, R.K. Hanson, *UV laser-induced fluorescence of carbon dioxide in high-pressure flames*, 3rd Joint Meeting of the US sections of the combustion institute, Chicago, (2003).
11. T. Lee, J.B. Jeffries, R.K. Hanson, W.G. Bessler, C. Schulz, *Quantitative NO-LIF Temperature Imaging in High-Pressure Flames*, paper AIAA-2003-0583 41st Aerospace Sciences Meeting, Reno, NV, Jan. (2003).
12. T. Lee, D.-I. Shin, J.B. Jeffries, R.K. Hanson, W.G. Bessler, C. Schulz, *Laser-Induced Fluorescence*

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- Detection of NO in High-pressure Flames with A-X(0,0), (0,1), and (0,2) excitation*, paper AIAA-2002-0399 at 40th Aerospace Sciences Meeting, Reno, NV, Jan. (2002).
13. W.G. Bessler, C. Schulz, T. Lee, D.-I. Shin, M. Hofmann, J.B. Jeffries, J. Wolfrum, R.K. Hanson, *Quantitative NO-LIF imaging in high-pressure flames*, First International Conference on Optical and Laser Diagnostics (ICOLAD), City University, London. 16-20 Dec., (2002).
 14. W.G. Bessler, C. Schulz, D.-I. Shin, T. Lee, J.B. Jeffries, R.K. Hanson, *Strategies for NO Laser-Induced Fluorescence in Methane/Air Flames at Pressures between 1 and 60 bar*, in Laser Applications to Chemical and Environmental Analysis, OSA Technical Digest Series (Optical Society of America, Washington DC, Feb., (2002).
 15. W.G. Bessler, C. Schulz, T. Lee, J.B. Jeffries, R.K. Hanson, *Laser-induced-fluorescence detection of nitric oxide in high-pressure flames with A-X(0,1) excitation*, Western States Section of the Combustion Institute, Spring Meeting, Oakland, CA. (2001).

Invited Presentations and Posters

1. *Energetic-Nanoparticle-Enhanced Combustion of Liquid Fuels in a Rapid Compression Machine*, 47th Aerospace Sciences Meeting, Orlando FL, Jan. (2009)
2. *Nitric Oxide Formation during Ignition and Combustion of a Transient Arc Plasmatron*, 47th Aerospace Sciences Meeting, Orlando FL, Jan. (2009)
3. *Laser Diagnostics in High Pressure Propulsion Systems*, Department of Mechanical Engineering, Marquette University (11/2008)
4. *Laser Diagnostics of Novel Fuels in High Pressure Combustion Environments*, Department of Mechanical Engineering, Case Western Reserve Seminar Series (11/2007)
5. *Laser Diagnostics of Novel Fuels in High Pressure Combustion Environments*, Sloan Automotive Laboratory, Massachusetts Institute of Technology, (07/2007)
6. *Laser Diagnostics of Plasma Energy Coupling to High Pressure Combustion Environments*, Plasma Science and Fusion Center Seminar, Massachusetts Institute of Technology, (07/2007)
7. *Strategies for UV Nitric Oxide LIF Imaging in High-Pressure Combustion Systems*, Plasma Institute, Department of Mechanical Engineering, Drexel University (11/2006)
8. *Strategies for UV Nitric Oxide LIF Imaging in High-Pressure Combustion Systems*, High Pressure Combustion Laboratory Seminar, Department of Mechanical and Nuclear Engineering, The Pennsylvania State University (12/2006)
9. T. Lee, J.B. Jeffries, R.K. Hanson, *Experimental Evaluation of Strategies for Quantitative Laser-Induced-Fluorescence Imaging of Nitric Oxide in High-Pressure Flames (1–60bar)*, 31st International Symposium on Combustion, University of Heidelberg (08/2006).
10. *Strategies for UV Nitric Oxide LIF Imaging in High-Pressure Combustion Systems*, CRF Seminar, Sandia National Labs (10/2005)
11. *Quantitative temperature measurements in high-pressure flames with multi-line nitric oxide (NO)-LIF thermometry*, The 2005 Joint Meeting of the US sections of the combustion institute, Drexel University, PA (03/2005).
12. *Carbon Dioxide UV-LIF in High Pressure Flames*, The Thermal and Fluid Sciences Affiliates Conference, Stanford University USA (02/2004)
13. *Laser Based Diagnostics for Gaseous Flows*, TSD Thermosciences Seminar, Thermosciences Division, Stanford University USA (Spring/2003)
14. *Carbon Dioxide UV-LIF in High Pressure Flames*, Gordon Research Conference on Combustion Laser Diagnostics, Oxford University UK (08/2003)
15. *Quantitative Temperature Imaging in High-Pressure Flames with Multi-Line Laser-Induced Fluorescence of NO*, Gordon Research Conference on Combustion Laser Diagnostics, Oxford University UK (08/2003)
16. *Quantitative Multi-line Temperature Imaging in High Pressure Flames A-X(0,0), (0,1), and (0,2) excitation*, AIAA 41st Aerospace Sciences Meeting, Reno, NV. (01/2003)
17. *Quantitative Imaging of Nitric Oxide in High Pressure Flames*, TSD Thermosciences Seminar, Thermosciences Division, Stanford University (Spring/2002)
18. *LIF of Nitric Oxide in High Pressure Flames*, TSD Thermosciences Seminar, Thermosciences Division, Stanford University (Fall/2001)