CURRICULUM VITAE

Christopher R. Shaddix

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Education

1988	B.S.	University of California at Davis, highest honors Department of Mechanical Engineering
1990	M.A.	Princeton University
		Department of Mechanical and Aerospace Engineering
1993	Ph.D.	Princeton University
		Department of Mechanical and Aerospace Engineering
		Advisors: Prof. Irvin Glassman and Dr. Kenneth Brezinsky
		Dissertation: "An Experimental Study of the High-Temperature
		Oxidation of 1-Methylnaphthalene"
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Research Experience

Combustion Research Facility, Sandia National Laboratories, Livermore CA

2000- presentPrincipal Member of Technical Staff1995-1999Senior Member of Technical Staff

Principal Investigator on projects involving combustion and gasification of coal and biomass fuels (both solids and liquids), soot formation and radiation in laminar and turbulent diffusion flames, tunable diode laser measurements of soot, temperature, and gas species in fires, swirl burner combustion of syngas in diluted oxygen, alkali volatilization in glass melting furnaces, laser-based and extractive particle diagnostics for pulp mill recovery boilers, and analysis of optimal system configurations for coproduction of H_2 and power and for biofuel production. Have contributed to a number of other projects for DOE and industrial customers, including diode laser measurements during weapons demil operations and pyrometer design and analysis for basic oxygen furnace (BOF) and explosive test applications.

Building and Fire Research Lab, National Institute of Standards and Technology (NIST),

Gaithersburg, MD

1993–1995 National Research Council Postdoctoral Research Fellow

Applied laser diagnostics in laminar diffusion flames to measure soot properties and the concentrations of OH, PAH, CO, and NO. Developed improvements in quantitative application of laser-induced incandescence (LII) for measurement of soot concentration.

Mechanical and Aerospace Engineering Department, Princeton University, Princeton, NJ

1988–1993 Research Assistant

Conducted turbulent flow reactor experiments on high-temperature oxidation and pyrolysis chemistry of naphthalene, 1-methylnaphthalene, and phenylacetylene. Identified and quantified gas product concentrations using GC-FID and GC-MS techniques. Developed improvements in gas collection and handling to allow quantitative analysis of high-MW, low vapor pressure compounds. Determined oxidation pathways and estimated reaction path fluxes for oxidation of naphthalene and 1-methylnaphthalene.

Industrial Experience

Fluidized Bed Coal Combustion Group, Electric Power Research Institute (EPRI), Palo Alto CA 3/1988–8/1988 student intern

Analyzed equipment operational data from fluidized bed combustion demonstration projects: circulating fluidized bed power plant at Nucla, Colorado, and bubbling fluidized bed power plant at TVA's Shawnee site.

Rancho Seco Nuclear Power Plant, Sacramento Municipal Utility District (SMUD), Galt CA *5/1986–8/1986 engineering support*

Provided audio/video system support for B&W steam generator tube sleeving project; designed mechanical assemblies.

Professional Societies:

The Combustion Institute, 1989–present. Tau Beta Pi, engineering honor society, 1985–present.

Service:

Vice Chair, Western States Section of the Combustion Institute (WSS/CI), 2009–present.
Reprints Chair, Western States Section of the Combustion Institute (WSS/CI), 1997–2009.
Associate Editor, *Combustion Science and Technology*, 2009-present.
Lead, Chariton Valley Cofiring Project external peer review, 2003.
Proposal Review Board, University Coal Research Program, U.S. DOE, 2001–present.
Co-Chair, Colloquium on Heterogeneous Combustion and Material Synthesis, 32nd International Combustion Symposium, 2008.
Lead Organizer and Host, Fall Meeting of the Western States Section of the Combustion Institute, 2007.
Unsolicited Proposal Review Board, National Science Foundation, 2005.

Manuscript Reviews for Journals:

Regular reviewer

Fuel (1996–present) *Energy & Fuels* (2008-present) *Fuel Processing Technology* (2007-present) *Experimental Thermal and Fluid Science* (2007-present) *Combustion Science and Technology* (1991–present) *Proceedings of the Combustion Institute* (1992–present) *Combustion and Flame* (1994–present)

Occasional reviewer

Progress in Energy and Combustion Science, Biomass and Bioenergy, Journal of Pulp and Paper Science, International Journal for Hydrogen Energy, AIAA Journal, Applied Optics, Applied Physics B, Optics Letters, Journal of Heat Transfer, Carbon, Combustion Theory and Modeling, Journal of Propulsion and Power, Society of Automotive Engineering, International Journal of Heat and Mass Transfer, Environmental Science and Technology, Review of Scientific Instrument, Physics of Fluids, International Journal of Chemical Kinetics

Fellowships, Prizes, and Awards:

Sandia Employee Recognition Award, Biofuels Systems Analysis Team, 2009.
Honorable Mention Technical Paper, 22nd Annual International Pittsburgh Coal Conference, 2005.
Sandia Employee Recognition Award, Steel Sensors Team, 1999.
Sandia Employee Recognition Award, NTS X-Tunnel Demil Project Team, 1998.
Sandia Award for Excellence, China Lake Contained Rocket Motor Burn Tests, 1998.
Richard A. Glenn Award, ACS Div. Fuel Chemistry, Most Outstanding Paper 207th National Mtg, 1994.
National Research Council Postdoctoral Research Fellowship, 1992.
Luigi Crocco Award, for excellence in teaching, Princeton MAE Dept., 1990.
Grumman Award, for excellence in academic performance, Princeton MAE Dept., 1989.
National Science Foundation Graduate Fellowship, 1988.
University of California Regents Scholar, UC Davis, 1986.
Most Outstanding Sophomore Award, Phi Kappa Phi, UC Davis, 1985.

Refereed Journal Articles and Book Chapters:

- C.R. Shaddix, A. Molina, "**Ignition, flame stability, and char combustion in oxy-fuel combustion**," in <u>Oxy-fuel combustion for power generation and carbon dioxide (CO₂)</u> <u>capture</u> (L. Zheng, Ed.), Woodhead Publishing Ltd., 2011.
- E. Hecht, C.R. Shaddix, A. Molina, B.S. Haynes, "Effect of CO₂ gasification reaction on oxycombustion of pulverized coal char," *Proceedings of the Combustion Institute* 33 (2011) 1699-1706.
- C.R. Shaddix, A. Molina, **"Fundamental Investigation of NOx Formation during Oxy-Fuel Combustion of Pulverized Coal,"** *Proceedings of the Combustion Institute* 33 (2011) 1723-1730.
- J.J. Murphy, C.R. Shaddix, "Effect of Reactivity Loss on Apparent Reaction Order of Burning Char Particles," *Combustion and Flame* 157:535-539 (2010).
- C.R. Shaddix, T.C. Williams, "Soot Structure and Dimensionless Extinction Coefficient in Diffusion Flames: Implications for Index of Refraction," in Combustion-Generated Fine

Carbonaceous Particles (H. Bockhorn, A. D'Anna, A.F. Sarofim, H. Wang, Eds.), Karlsruhe University Press, 2009.

- C.R. Shaddix, T.C. Williams, "Evaluation of the irising effect of a slow-gating ICCD on laser-induced incandescence measurements of soot," *Review of Scientific Instruments* 80, 033702 (2009).
- C.R. Shaddix, T.C. Williams, "Measurements of the Velocity Field in Laminar Ethylene Inverse Jet Diffusion Flames," *Combustion and Flame* 156:942-945 (2009).
- A. Molina, J.J. Murphy, F. Winter, B.S. Haynes, L.G. Blevins, C.R. Shaddix, "Pathways for Conversion of Char Nitrogen to Nitric Oxide at Pulverized Coal Combustion Conditions," Combustion and Flame 156:574-587 (2009)
- C.R. Shaddix, A. Molina, **"Particle Imaging of Ignition and Devolatilization of Pulverized Coal during Oxy-Fuel Combustion,"** *Proceedings of the Combustion Institute* 32:2091-2098 (2009).
- C.R. Shaddix, "Carbon Particle Combustion," pp. 531-548, in <u>Combustion</u>, 4th Ed. (I. Glassman and R.A. Yetter, Eds.), Elsevier, Amsterdam, 2008.
- T.C. Williams, C.R. Shaddix, R.W. Schefer, "Effect of Syngas Composition and CO₂-Diluted Oxygen on Performance of a Premixed Swirl-Stabilized Combustor," *Combustion Science and Technology* 180:64-88 (2008).
- T.C. Williams, C.R. Shaddix, "Simultaneous Correction of Flat Field and Nonlinearity Response of Intensified Charge-Coupled Devices," *Review of Scientific Instruments* 78, 123702 (2007).
- T.C. Williams, C.R. Shaddix, R.W. Schefer, P. Desgroux, "The Response of Buoyant Laminar Diffusion Flames to Low-Frequency Forcing," Combustion and Flame 151:676-684 (2007).
- M.A. Mikofski, T.C. Williams, C.R. Shaddix, A.C. Fernandez-Pello, L.G. Blevins, "Structure of Laminar Sooting Inverse Diffusion Flames," *Combustion and Flame* 149:463-478 (2007).
- T.C. Williams, C.R. Shaddix, "Contamination of Carbon Monoxide with Metal Carbonyls: Implications for Combustion Research," *Combustion Science and Technology* 179(6):1225-1230 (2007).
- A. Molina, C.R. Shaddix, "Ignition and Devolatilization of Pulverized Bituminous Coal Particles during Oxygen/Carbon Dioxide Coal Combustion," Proc. Combust. Instit. 31:1905-1912 (2007).
- T.C. Williams, R.W. Schefer, J.C. Oefelein, C.R. Shaddix, "Idealized Gas Turbine Combustor for Performance Research and Validation of Large Eddy Simulations," *Review of Scientific Instruments* 78, 035114 (2007).

- T.C. Williams, C.R. Shaddix, K.A. Jensen, and J.M. Suo-Anttila, **"Measurement of the Dimensionless Extinction Coefficient of Soot within Laminar Diffusion Flames,"** *Int. J. Heat and Mass Transfer* 50:1616-1630 (2007).
- A. Molina, P.M. Walsh, C.R. Shaddix, J.W. Neufeld, L.G. Blevins, "Effect of Furnace Operating Conditions on Alkali Vaporization, Batch Carryover, and the Formation of SO₂ and NO in an Oxy-Fuel Fired Container Glass Furnace," *Glass Technology: European J. of Glass Science and Technology, Part A* 47(6):177-187 (2006).
- M.A. Mikofski, T.C. Williams, C.R. Shaddix, L.G. Blevins, **"Flame Height Measurement of Laminar Inverse Diffusion Flames,"** *Combustion and Flame* 146:63-72 (2006).
- A. Molina, P.M. Walsh, C.R. Shaddix, J.W. Neufeld, L.G. Blevins, "Implications of Air Infiltration in Oxygen/Fuel Fired Glass Furnaces," *Journal of the Energy Institute* 79:84-91 (2006).
- A. Molina, P.M. Walsh, C.R. Shaddix, S.M. Sickafoose, L.G. Blevins, "Laser-Induced Breakdown Spectroscopy of Alkali Metals in High-Temperature Gas," *Applied Optics* 45:4411-4423 (2006).
- J.J. Murphy, C.R. Shaddix, "Soot Property Measurements in a Two-Meter Diameter JP-8 Pool Fire," *Combustion Science and Technology* 178:865-894 (2006).
- J.J. Murphy, C.R. Shaddix, "The Combustion Kinetics of Coal Chars in Oxygen-Enriched Environments," *Combustion and Flame* 144:710-729 (2006).
- A. Molina, C.R. Shaddix, S.M. Sickafoose, P.M. Walsh, L.G. Blevins,, "Effect of Temperature and CO₂ Concentration on Laser-Induced Breakdown Spectroscopy Measurements of Alkali Fume," Spectrochimica Acta Part B: Atomic Spectroscopy 60(7-8):1103–1114 (2005).
- J.J. Murphy, C.R. Shaddix, "Influence of Scattering and Probe Volume Heterogeneity on Soot Measurements using Optical Pyrometry," Combustion and Flame 143:1–10 (2005)
- C.R. Shaddix, Á.B. Palotás, C.M. Megaridis, M.Y. Choi, N.Y.C. Yang, **"Soot Graphitic Order in Laminar Diffusion Flames and a Large-Scale JP-8 Pool Fire,"** *Intl. J. Heat Mass Transfer* 48(17):3604–3614 (2005).
- C.R. Shaddix, T.C. Williams, L.G. Blevins, R.W. Schefer, "Flame Structure of Steady and Pulsed Sooting Inverse Jet Diffusion Flames," *Proceedings of the Comb. Institute* 30:1501–1508 (2005).
- D.J. Maloney, E.R. Monazam, K.H. Casleton, C.R. Shaddix, "Evaluation of Char Combustion Models: Measurement and Analysis of Variability in Char Particle Size and Density," *Proceedings of the Comb. Institute* 30:2197–2204 (2005).

- A. Molina, J.J. Murphy, C.R. Shaddix, L.G. Blevins, "The Effect of Potassium Bromide and Sodium Carbonate on Coal Char Combustion Reactivity," *Proceedings of the Comb. Institute* 30:2187–2195 (2005).
- L.G. Blevins, C.R. Shaddix, S.M. Sickafoose, P.M. Walsh, "Laser-induced breakdown spectroscopy at high temperatures in industrial boilers and furnaces," *Applied Optics* 42(30):6107-6118 (2003).
- R.J. Santoro, C.R. Shaddix, "Laser-Induced Incandescence," pp. 252-286, in <u>Applied</u> <u>Combustion Diagnostics</u>, (K. Kohse-Höinghaus and J.B. Jeffries, Eds.), Taylor and Francis, New York, 2002.
- P.O. Witze, S. Hochgreb, D. Kayes, H.A. Michelsen, C.R. Shaddix, "Time-resolved laserinduced incandescence and laser elastic scattering measurements in a propane diffusion flame," *Applied Optics* 40:2443-2452 (2001).
- C.R. Shaddix, "Correcting Thermocouple Measurements for Radiation Loss: A Critical Review," HTD99-282, Proc. of 33rd National Heat Transfer Conference, ASME, New York, 1999.
- C.R. Shaddix and P.J. Tennison, **"Effects of Char Content and Simple Additives on Biomass Pyrolysis Oil Droplet Combustion,"** *Proceedings of the Comb. Institute* 27:1907–1914 (1998).
- M.M. Lunden, N.Y.C. Yang, T.J. Headley, and C.R. Shaddix, "Mineral-Char Interactions During Char Combustion of a High-Volatile Coal," *Proceedings of the Comb. Institute* 27:1695–1702 (1998).
- K.C. Smyth, C.R. Shaddix, and D.A. Everest, "Aspects of Soot Dynamics as Revealed by Measurements of Broadband Fluorescence and Flame Luminosity in Flickering Diffusion Flames," *Combustion and Flame* 111: 185–207 (1997).
- C.R. Shaddix and S.P. Huey, "Combustion Characteristics of Fast Pyrolysis Oils Derived from Hybrid Poplar," <u>Developments in Thermochemical Biomass Conversion</u>, (A.V. Bridgwater and D.G.B. Boocock, Eds.), Blackie Academic and Professional, London, 1997, pp. 465–480.
- K. Brezinsky and C.R. Shaddix, "**The Power of Analogies in Chemical Kinetics**," <u>Physical and</u> <u>Chemical Aspects of Combustion: A Tribute to Irvin Glassman</u>, (F.L. Dryer and R.F. Sawyer, Eds.), Gordon and Breach Science Publishers, Amsterdam, 1997, pp. 87–104.
- C.R. Shaddix, K. Brezinsky, and I. Glassman, "Analysis of Fuel Decay Routes in the High Temperature Oxidation of 1-Methylnaphthalene," *Combustion and Flame* 108: 139–157 (1997).
- D.A. Everest, K.C. Smyth, and C.R. Shaddix, "Quantitative Two-Photon Laser-Induced Fluorescence Imaging of CO in Flickering CH₄/Air Diffusion Flames," *Proceedings of the Comb. Institute* 26:1161–1169 (1996).

- C.R. Shaddix and K.C. Smyth, "Laser-Induced Incandescence Measurements of Soot Production in Steady and Flickering Methane, Propane, and Ethylene Diffusion Flames," *Combustion and Flame* 107: 418–452 (1996).
- K.C. Smyth and C.R. Shaddix, "The Elusive History of m = 1.57 0.56i for the Refractive Index of Soot," *Combustion and Flame* 107: 314–320 (1996).
- C.R. Kaplan, C.R. Shaddix, and K.C. Smyth, "Computations of Enhanced Soot Production in Time-Varying CH₄/Air Diffusion Flames," *Combustion and Flame* 106: 392–405 (1996).
- C.R. Shaddix, J.E. Harrington, and K.C. Smyth, "Quantitative Measurements of Enhanced Soot Production in a Flickering Methane/Air Diffusion Flame," *Combustion and Flame* 99:723-732 (1994).
- C.R. Shaddix, K. Brezinsky, and I. Glassman, "Oxidation of 1-Methylnaphthalene *Proceedings of the Comb. Institute* 24:683–690 (1992).

Journal Articles (submitted):

C.R. Shaddix, **"Advances in gasification for biofuel production,"** to appear in <u>Chemical and</u> <u>Biochemical Catalysis for Next Generation Biofuels</u> (B. Simmons, Ed.), RSC Publishing, Cambridge, UK, 2011.

Y. Liu, M. Geier, A. Molina, C.R. Shaddix, "Pulverized Coal Stream Ignition Delay under Conventional and Oxy-Fuel Combustion Conditions," submitted to *Int. J. Greenhouse Gas Control.*

Journal Articles (in preparation):

- J. Zhang, C.R. Shaddix, R.W. Schefer, "Simultaneous 2-D imaging of OH/soot and PAH/soot in a turbulent nonpremixed jet flame," to be submitted to *Applied Physics B*.
- J. Zhang, C.R. Shaddix, R.W. Schefer, "Quantitative measurements of soot volume fraction in a turbulent nonpremixed ethylene jet flame," to be submitted to *Combustion and Flame*.
- J. Zhang, C.R. Shaddix, R.W. Schefer, "Design of a turbulent non-premixed jet burner for higher-C fuels that is conducive to modeling," to be submitted to *Review of Scientific Instruments*.
- T.C. Williams, C.R. Shaddix, "Soot Formation and Radiation in Laminar Jet Diffusion Flames Fueled by Ethylene and JP-8 Surrogate," to be submitted to *Combustion and Flame*.
- A. Molina, C.R. Shaddix, "Effect of O₂ and CO₂ Concentrations on Pulverized Coal Char Particle Combustion Rates," to be submitted to *Combustion and Flame*.

- J.J. Murphy, C.R. Shaddix, "Soot Property Measurements in a Two-Meter Diameter JP-8 Pool Fire: Further Results," to be submitted to *Combustion Science and Technology*.
- C.R. Shaddix, "Correcting Thermocouple Measurements for Radiation Loss," to be submitted to *Progress in Energy and Combustion Science*.
- C.R. Shaddix, K. Brezinsky, I. Glassman, "The High-Temperature Fuel-Rich Oxidation of Phenylacetylene," to be submitted to *Combustion Science and Technology*.
- C.R. Shaddix, E.T. Johnson, P.M. Walsh, "The Combustion Kinetics of Residual Oil Coke," to be submitted to *Combustion and Flame*.

Refereed Internal Reports:

- C.R. Shaddix, J. Zhang, R.W. Schefer, J. Doom, J.C. Oefelein, S. Kook, L.M. Pickett, and H. Wang, **"Understanding and Predicting Soot Generation in Turbulent Non-Premixed Jet Flames,"** Sandia National Labs Internal Report, SAND2010-7178, October 2010.
- C.R. Shaddix, E. Hecht, K.-Y. Teh, G. Buffleben, D. Dibble, and A.E. Lutz, "Development of Efficient, Integrated Cellulosic Biorefineries: LDRD Final Report," Sandia National Labs Internal Report, SAND2010-7141, October 2010.
- C.R. Shaddix, T.C. Williams, R.W. Schefer, J.C. Oefelein, K.H. Law, and A.E. Lutz, "Novel System for Zero-Emission Electricity and Hydrogen Production from Coal and Biomass: LDRD Final Report," Sandia National Labs Internal Report, SAND2008-0599, January 2008.
- Shaddix, C.R., Scott, D.D., and Suo-Anttila, J.M., "Evaluation of Diagnostic Instruments for Characterizing Blast and Explosive Environments: 4-Color Pyrometry and Thermocouples," Sandia National Labs Internal Report, SAND2007-4030, June 2007.
- Shaddix, C.R., Wessel, R.A., Baxter, L.L., and Verrill, C.L., "Characteristics and Sources of Intermediate Size Particles in Recovery Boilers: Final Project Report," Sandia National Labs Internal Report, SAND2005-0296, February 2005.
- Shaddix, C.R., Williams, T.C., Blevins, L.G., Schefer, R.W., Jensen, K.A., Suo-Anttila, J.M., and Kearney, S.P., "Soot Formation, Transport, and Radiation in Unsteady Diffusion Flames: LDRD Final Report," Sandia National Labs Internal Report, SAND2004-5060, October 2004.
- Shaddix, C.R., and Holve, D.J., **"Development of Laser Diagnostics for** *In Situ* **Measurements of Entrained Particles in Recovery Boilers: Final Project Report,"** Sandia National Labs Internal Report, SAND2004-8184, March 2004.
- Murphy, J.J., and Shaddix, C.R., "Soot Properties and Species Measurements in a Two-Meter Diameter JP-8 Pool Fire: 2003 Test Series," Sandia National Labs Internal Report, SAND2004-8085, March 2004.

- Shaddix, C.R., Allendorf, S.W., Ottesen, D.K., Lemieux, P.M., and Miller, C.A., "Evaluation of Near-Infrared Tunable Diode Lasers for Detection of Transient Emissions from a Rotary Kiln," Sandia National Labs Internal Report, SAND2003-8721, December 2003.
- Murphy, J.J., and Shaddix, C.R., "Effects of Stefan Flow on Heat Transfer from Reacting Carbon Particles," Sandia National Labs Internal Report, SAND2002-8072, December 2003.
- Murphy, J.J., and Shaddix, C.R., **"Soot Properties and Species Measurements in a Two-Meter Diameter JP-8 Pool Fire,"** Sandia National Labs Internal Report, SAND2003-8246, June 2003.
- Shaddix, C.R., Allendorf, S.W., Hubbard, G.L., Ottesen, D.K., and Gritzo, L.A., "Diode Laser Diagnostics for Gas Species and Soot in Large Fires: LDRD Project Final Report," Sandia National Labs Internal Report, SAND2001-8383, June 2001.
- T.J. Tanaka, E. Baynes, Jr., S.P. Nowlen, J. Brockmann, L. Gritzo, and C. Shaddix, "LDRD Report: Smoke Effects on Electrical Equipment," Sandia National Labs Internal Report, SAND2000-0599, Mar. 2000.
- J. Lipkin et al., "Department of Defense/Department of Energy Joint Demilitarization Technology Demonstration Program. Executive Summary of Phase II Demonstrations: The Low-Pressure Rocket Motor Burns in X-Tunnel," Sandia National Labs Internal Report, SAND2000-8202, Jan. 2000.
- C.R. Shaddix and J. Lipkin, "Chamber Leakage Effects on Measured Gas Concentrations During Contained Demilitarization Tests at NTS X-Tunnel," Sandia National Labs Internal Report, SAND2000-8209, Dec. 1999.
- C.R. Shaddix and D.R. Hardesty, "Combustion Properties of Biomass Flash Pyrolysis Oils: Final Project Report," Sandia National Laboratories Internal Report, SAND99-8238, April 1999.
- S.W. Allendorf, C.R. Shaddix, D.K. Ottesen, H. Johnsen, L. Carillo, and J. Lipkin, "Tunable Diode Laser Spectroscopy: Report on JDT X-Tunnel Munitions Tests," Sandia National Labs Internal Report, SAND98-8230, Feb. 1998.
- S.W. Allendorf, C.R. Shaddix, D.K. Ottesen, H.A. Johnsen, L.R. Carillo, and J. Lipkin,
 "Tunable Diode Laser Spectroscopy: Report on JDT Contained Rocket Motor Burn Tests," Sandia National Labs Internal Report, SAND98-8247, Sept. 1998.

General Science Journals:

C.R. Shaddix and T.C. Williams, **"Soot: Giver and Taker of Light,"** *American Scientist* 95: 232-239 (2007).

Recent Unrefereed Conference Proceedings:

M. Geier, and C.R. Shaddix, "A Modified Single-Film Char Consumption Model for CFD Simulations of Oxy-Combustion of Pulverized Coal," Paper 2F07, Proceedings of the 7th U.S. National Combustion Conference, Atlanta, GA, March 20–23, 2011.

E. Hecht, C.R. Shaddix, W. Houf, L. Tessier, and F. Schneider, **"Evaluation of Light-Off** Limits for a Novel Oxy-Combustion Process for Advanced EOR," Paper 2E01, Proceedings of the 7th U.S. National Combustion Conference, Atlanta, GA, March 20–23, 2011.

C.R. Shaddix, E. Hecht, and M. Geier, "Evaluation of the Combustion Rates of Lignin Residues from Cellulosic Ethanol Production," Paper 1H07, Proceedings of the 7th U.S. National Combustion Conference, Atlanta, GA, March 20–23, 2011.

M. Geier, C.R. Shaddix, and B.S. Haynes, **"Oxy-Combustion of Pulverized Coal: Modeling of Char-Combustion Kinetics,"** Proceedings of the 27th Annual International Pittsburgh Coal Conference, Pittsburgh, PA, October 11–14, 2010.

C.R. Shaddix, E.S. Hecht, M. Geier, A. Molina, B.S. Haynes, "Effect of Gasification Reactions on Oxy-Fuel Combustion of Pulverized Coal," Proceedings of the 35th International Technical Conference on Clean Coal & Fuel Systems, Clearwater FL, June 6–10, 2010.

M. Geier, C.R. Shaddix, "Effects of Particle Size on Oxy-Fuel Combustion of Pulverized Coal," Proceedings of Spring 2010 Meeting of the Western States Section of the Combustion Institute, Paper 10S-13, Boulder, CO, Mar. 21–23, 2010.

C.R. Shaddix, J. Zhang, and R.W. Schefer, **"Towards Quantitative Measurements of Soot Concentration in Strongly Sooting Turbulent Jet Diffusion Flames,"** OSA LACSEA Conference, San Diego, CA, Feb. 1–3, 2010.

M. Geier, E.S. Hecht, and C.R. Shaddix, "Evaluation of Effect of Particle Size on Oxy-Fuel Combustion of Pulverized Coal," Proceedings of the 26th Annual International Pittsburgh Coal Conference, Pittsburgh, PA, September 20–23, 2009.

C. Shaddix, E. Hecht, S. Jimenez, S.M. Lee, and A. Molina, **"Detailed Investigation of the Effects of Oxy-Fuel Combustion Conditions on Pulverized Coal Ignition and Char Burning Rate,"** 1st Oxyfuel Combustion Conference, Cottbus, Germany, Sept. 7-10, 2009.

C.R. Shaddix, E.S. Hecht, S. Jimenez, and S.M. Lee, **"Evaluation of rank effects and gas temperature on coal char burning rates during oxy-fuel combustion,"** Proceedings of the 34th International Technical Conference on Coal Utilization and Fuel Systems, Clearwater FL, May 31 – June 4, 2009.

A. Molina, E.S. Hecht, and C.R. Shaddix, **"Ignition of a Group of Coal Particles in Oxyfuel Combustion with CO₂ Recirculation,"** Proceedings of the 34th International Technical Conference on Coal Utilization and Fuel Systems, Clearwater FL, May 31 – June 4, 2009. J. Zhang, C.R. Shaddix, and R.W. Schefer, "Investigation of Soot Formation in Turbulent Nonpremixed Ethylene Jet Flames by 2D Laser-Induced Incandescence and Planar Laser-Induced Fluorescence," Proceedings of 6th U.S. National Combustion Meeting, Ann Arbor, MI, May 17–20, 2009.

C.R. Shaddix, T.C. Williams, S. Jimenez, and S.M. Lee, "Influence of Coal Rank and Gas Temperature on Oxy-Fuel Combustion Properties," Proceedings of 6th U.S. National Combustion Meeting, Ann Arbor, MI, May 17–20, 2009.

A. Molina and C.R. Shaddix, "Effect of O₂ and High CO₂ Concentrations on PC Char Burning Rates during Oxy-Fuel Combustion," Proceedings of the 34th International Technical Conference on Coal Utilization and Fuel Systems, Clearwater FL, June 1-5, 2008.

J. Zhang, T.C. Williams, C.R. Shaddix and R.W. Schefer, "Application of Planar LIF and LII Imaging to a Turbulent Nonpremixed Sooty Ethylene Jet Flame," Proceedings of Spring 2008 Meeting of the Western States Section of the Combustion Institute, Los Angeles, CA, Mar. 16–18, 2008.

C.R. Shaddix and T.C. Williams, **"Soot Formation and Radiation in a Laminar Jet Flame of Prevaporized JP-8 Surrogate Burning in Air,"** Proceedings of Fall 2007 Meeting of the Western States Section of the Combustion Institute, Paper 07F-33, Livermore, CA, Oct. 16–17, 2007.

C.R. Shaddix and A. Molina, **"NOx Formation in Laboratory Investigations of Oxy-Coal Combustion,"** Proceedings of Fall 2007 Meeting of the Western States Section of the Combustion Institute, Paper 07F-43, Livermore, CA, Oct. 16–17, 2007.

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