

Western States Section of the Combustion Institute Spring Technical Meeting 2010

**Boulder, Colorado, USA
22-23 March 2010**

ISBN: 978-1-61738-419-6

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2010) by the Western States Section/Combustion Institute
All rights reserved.

Printed by Curran Associates, Inc. (2010)

For permission requests, please contact the Western States Section/Combustion Institute
at the address below.

Western States Section/Combustion Institute
P.O. Box 969 M S 9052
Livermore, California 94551-0969

Phone: 925-294-3840
Fax: 925-294-2276

<http://wssci.us/>

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

INVITED PRESENTATION:

Climate Change and the Role of Renewable Energy	1
<i>Charles Kutscher</i>	

SESSION 1A: TURBULENT COMBUSTION

A Study of the Reynolds-Number Dependence of Model Parameters in the One-Dimensional-Turbulence Model	2
<i>Naveen Punati, James C. Sutherland, Evatt Hawkes</i>	
Convective Wave Motion During Combustion Instability in a Lowswirl Burner Flame	11
<i>J. A. Ranalli, D. Ferguson</i>	
Characterization of Laminar Flame Propagation for Non-unity Lewis Number Mixtures	20
<i>M. S. Day, A. J. Aspden, J. B. Bell</i>	

SESSION 1B: STATIONARY COMBUSTION

Development of a Standardized Water-Boiling Test for Determining the Efficiencies of Various Biomass Materials for Use in Traditional Cookstoves	29
<i>Aimie Faucett, Janet Ellzey</i>	
Predicting Bulk Flow Rate and Temperature for Chimney Effect Driven Combustion in a Biomass Cooking Stove and Observed Emissions Trends	45
<i>Joshua Agenbrood, M. DeFoort, Cory Kreutzer, C. L'Orange</i>	
Ammonium Bisulfate Formation Temperature in a Bench-Scale Single-Channel Air Preheater	68
<i>J. Menasha, D. Dunn-Rankin, L. Muzio, J. Stallings</i>	

SESSION 1C: IC ENGINES

Characterization of Gaseous and Particulate Emissions from the Combustion of Algal Methyl Esters in a Turbocharged Direct Injection Diesel Engine	75
<i>Bethany C. Fisher, J. Volckens, Jeff Collett, Taehyoung Lee, Anthony Marchese</i>	
Characterization of Mixture Preparation in a Direct-injection Internal Combustion Engine Fueled with Hydrogen Using PIV and PLIF	87
<i>V. M. Salazar, S. A. Kaiser</i>	
A Numerical Study of Ultra-high Efficiency Combustion of a Hydrogen-Oxygen-Argon Mixture in HCCI engines	101
<i>S. Saxena, V. H. Rapp, J.-Y. Chen, R. Dibble</i>	

SESSION 1D: FIRE

Effect of Ambient Pressure on Mass Loss Rate at Piloted Ignition	114
<i>Sonia Fereres, Chris Lautenberger, Carlos Fernandez-Pello, David Urban, Gary Ruff</i>	
Particle Size Distribution from a Controlled Biomass Burning in the Laboratory Using Fast Response Particle Instruments	134
<i>SeyedEhsan Hosseini, Qi Li, David Cocker, David Weise, Arthur Miller, Manish Sharivastava, Wayne Miller, Shankar Mahalingam, Marko Princevac, Mehmet Talat Odman, Tim Johnson, Jim Reardon, Heejung S. Jung</i>	
Impact and Fire Modeling for Complex Environment Simulation	158
<i>Alexander L. Brown</i>	

SESSION 2A: SPRAY AND HETEROGENEOUS COMBUSTION

Effects of Particle Size on Oxy-Fuel Combustion of Pulverized Coal	174
<i>M. Geier, C. R. Shaddix</i>	
Three-Dimensional Direct Numerical Simulation of Electrohydrodynamic Atomization for Fuel Injection Applications	182
<i>Bret P. Van Poppel, O. Desjardins, John W. Daily</i>	
The Influence of Density Ratio on the Primary Atomization of a Turbulent Liquid Jet in Crossflow	191
<i>M. Herrmann</i>	
Multiphysics Model to Simulate an Electrostatic Micropump	206
<i>Bradley M. Spatafore, Bret P. Van Poppel, John W. Daily, James A. Navity</i>	

SESSION 2B: LAMINAR FLAMES

Effect of Methane-Dimethyl Ether Fuel Blends on Flame Stability, Laminar Flame Speed, and Markstein Length	217
<i>W. B. Lowry, Z. Serinyel, M. C. Krejci, H. J. Curran, E. L. Petersen, G. Bourque</i>	
Modeling Hydrazine Decomposition and Combustion of Hydrogen/Ammonia Mixtures with Nitrous Oxide	229
<i>O. A. Powell, P. Papas</i>	
Studies of Non-Premixed Flames of C₃ and C₄ Saturated Alcohols	240
<i>Peter S. Veloo, Yang L. Wang, Fokion N. Egolfopoulos</i>	
Combustion Flow Visualization of a Subsonic Jet Engine	254
<i>B. Vazquez, E. Cruz, H. Luong, S. Ibarra</i>	

SESSION 2C: SOOT

Large Eddy Simulation Modeling for Sooting Turbulent Flames	263
<i>M. E. Mueller, H. Pitsch</i>	
Extended Simulations of Graphene Growth with Updated Rate Coefficients	279
<i>Russell Whitesides, Xiaoqing You, Michael Frenklach</i>	
Chemical Kinetic Modeling of Tar Formation During Biomass Gasification	288
<i>P. Pepiot, M. W. Jarvis, M. R. Nimlos, G. Blanquart</i>	
Detailed Tar Analysis and Char Imaging from White Oak Pyrolysis in a Laminar Entrained Flow Reactor	297
<i>M. W. Jarvis, Katherine Gaston, Kristina Iisa, M. R. Nimlos, Thomas Haas, Byron Donohoe, John W. Daily</i>	

SESSION 2D: FIRE

Critical Mass Flux for Flaming Ignition of Dead, Dry Wood As a Function of External Radiant Heat Flux	326
<i>Sara McAllister, Mark Finney, Jack Cohen</i>	
Characterization of Fire Blanket Materials for Structure Protection in Wildland-Urban Interface Fires	336
<i>Fumiaki Takahashi, Amber Abbott, Sheng-Yen Hsu, James S. T'ien, Sandra L. Olson</i>	
Ignition of Combustible Fuel Beds by Hot Particles: An Experimental and Theoretical Study	346
<i>Rory Hadden, Sarah Scott, Chris Lautenberger, Carlos Fernandez-Pello</i>	

SESSION 3A: DROPLET COMBUSTION

A Numerical Study on the Impact of Supporting Fibers on Tethered Droplet Ignition under Microgravity Conditions	362
<i>Tanvir Farouk, F. L. Dryer, Anthony Marchese, Timothy L. Vaughn, Kenneth Kroenlein</i>	
Transient Convective Burning of Fuel-Droplet Arrays	382
<i>Guang Wu, William A. Sirignano</i>	

SESSION 3B: SURROGATES OF PRACTICAL FUELS

A Functional Group Based Kinetic Model for the Simulation of Fuel Surrogates	405
<i>Marco Mehl, W. J. Pitz, Charles K. Westbrook, H. J. Curran</i>	
Experimental and Kinetic Modeling Study of Combustion of JP-8, its Surrogates and Components in Laminar Premixed Flows	421
<i>Kalyanasundaram Seshadri, Alessio Frassoldati, Alberto Cuoci, Tiziano Faravelli, Ulrich Niemann, Patrick Weydert, Eliseo Ranzi</i>	
Detailed Chemical Mechanism and Surrogate Formulations for Engine Fuels	439
<i>G. Blanquart, P. Pepiot-Desjardins</i>	

SESSION 3C: SOOT

Influence of Stove Type and Cooking Pot Conditions on Particle Size and Mass Emissions from Biomass Cook Stoves	448
<i>C. L'Orange, J. Volckens, M. DeFoort</i>	
Radical Chemistry in the Thermal Decomposition of Anisole and Deuterated Anisoles: An Investigation of Aromatic Growth	468
<i>Adam M. Scheer, Calvin Mukarakate, David J. Robichaud, G. Barney Ellison, M. R. Nimlos</i>	
Pyrolysis of Phenethyl Phenyl Ether Generates PAH Precursors	487
<i>M. W. Jarvis, David J. Robichaud, M. R. Nimlos, John W. Daily, Hans-Heinrich Carstensen, Anthony M. Dean</i>	

SESSION 3D: EXPERIMENTAL METHODS

Shock Tube Study of the Reactions of Methyl Radicals with cis-2-Butene	516
<i>Jeffery A. Manion, Iftikhar A. Awan, Wing Tsang</i>	
A Time-resolved, Isomer-resolved Study of the Propargyl Self Reaction Using a Multiplexed Photoionization Mass Spectrometer	523
<i>David L. Osborn, Craig A. Taatjes, Fabien Goulay, Talitha M. Selby, Peng Zou, Askar Fahr</i>	
Cavity Enhanced Magneto-optic Rotation (CEMOR) Spectroscopy: A Prospective Technique for Concentration Measurements of HO₂ Radicals in a Stabilized Cool Flame Reactor	531
<i>J. Lane, N. P. Cernansky, D. L. Miller</i>	

SESSION 4A: CATALYTIC COMBUSTION AND DETONATIONS

Study of Nickel Catalyzed Wall Reactions in the Combustion of Hydrogen-Rich Syngas	550
<i>Kimberly N. Jasch, G. Barney Ellison, John W. Daily</i>	
Hydrogen Detonation and Supersonic Combustion for Turbulent and Laminar Flow Mixing Schemes	557
<i>T. Buhler, S. Esparza, C. Olmedo, D. Guillaume</i>	
CFD Simulation of Compressible Reacting Flow in a Hyperthermal Tubular Reactor	564
<i>Qi Guan, John W. Daily, G. Barney Ellison</i>	
Comparing Analytical and Numerical Heat Transfer in a Catalytic Plasma Torch	583
<i>Ronald J. Royce, J. Steciak, R. Budwig</i>	

SESSION 4B: REACTION KINETICS ALTERNATIVE FUELS

An Experimental and Kinetic Modeling Study of Methyl Decanoate Combustion	591
<i>S. M. Sarathy, M. J. Thomson, W. J. Pitz, T. Lu</i>	
Examination of the Role of C₂O Radical in Methyl Ester NO_x Formation	619
<i>Anthony Marchese, Timothy L. Vaughn, Torben Grunstrup</i>	
Comparative IQTTM Ignition Delay Times of the Isomeric Butanols	628
<i>F. M. Haas, J. Heyne, J. A. Grieb, F. L. Dryer</i>	
An Updated Model and Discussion of Modeling Challenges in High-Pressure H₂/O₂ Flames	637
<i>M. P. Burke, M. Chaos, Y. Ju, F. L. Dryer</i>	

SESSION 4C: SOOT

Molecular Dynamics Simulations of Laser Induced Incandescence (LII) of Soot Using the ReaxFF Reactive Force Field	649
<i>Amar Kamat, Adri C. T. van Duin</i>	
Development and Application of a ReaxFF Reactive Force Field for Hydrogen Combustion	659
<i>Satyam Agrawalla, Adri C. T. van Duin</i>	

SESSION 4D: NEW TECHNOLOGY

Kinetics of OH Radicals below Self-Ignition Threshold in Plasma Enhanced Combustion	677
<i>Liang Wu, J. Lane, N. P. Cernansky, D. L. Miller, Alexander A. Fridman, Andrey Yu. Starikovskii</i>	
Experimental and Numerical Analysis of Radiation Effects in Heat Recirculating Combustors	693
<i>Sandeep Gowdagiri, Chien-Hua Chen, Paul D. Ronney</i>	
Remediation of Oil Drilling Waste Using Smoldering Combustion	699
<i>Thomas Browder, Christine Switzer, Paolo Pironi, Guillermo Rein, Jason I. Gerhard, Jose L. Torero</i>	
Conversion of Bio-butanol to Syngas via Filtration Combustion	717
<i>Colin H. Smith, Casey D. Zak, Janet Ellzey</i>	

INVITED PRESENTATIONS

Production and Characterization of Algal Biofuels	739
<i>Anthony Marchese</i>	
The Chemistry and Physics of Biomass Gasification	740
<i>M. R. Nimlos</i>	

SESSION 5A: REACTIVE FLOWS

Performance Characteristics of a Small Turbine-less Jet Engine	741
<i>C. C. Wu, L. Ly, N. Doan</i>	
Analysis of Dense Particulate Flow Dynamics Using a Euler-Lagrange Approach	754
<i>O. Desjardins, P. Pepiot</i>	
Filtered Density Functions from Direct Numerical Simulation of a Reactive Jet in Cross-flow	766
<i>R. W. Grout, E. S. Richardson, A. Gruber, C. S. Yoo, J. H. Chen</i>	
Characteristics of Knock in Hydrogen-Oxygen-Argon SI Engine	772
<i>Nick J. Killingsworth, V. H. Rapp, Daniel L. Flowers, Salvador M. Aceves, J.-Y. Chen, R. Dibble</i>	

SESSION 5B: REACTION KINETICS

New Experiments and Validated Master-equation Modeling for OH Production in Propyl + O₂ and Ethyl + O₂ Reactions	779
<i>Hai Feng Huang, Daniel J. Merthe, Judit Zádor, Leonard E. Jusinski, Craig A. Taatjes</i>	
Kinetic Modeling of One-Ring Aromatic Compounds	788
<i>Enoch Dames, Hai Wang</i>	
A Jet Fuel Surrogate Formulated By Real Fuel Properties	799
<i>Stephen Dooley, Sang Hee Won, M. Chaos, J. Heyne, Y. Ju, F. L. Dryer, Kamal Kumar, Chih-Jen Sung, Haowei Wang, Matthew A. Oehlschlaeger, Robert J. Santoro, Thomas A. Litzinger</i>	
Autoignition Behavior of Unsaturated Hydrocarbons in the Low and High Temperature Regions	817
<i>Marco Mehl, W. J. Pitz, Charles K. Westbrook, Kenji Yasunaga, H. J. Curran</i>	

SESSION 5D: NEW TECHNOLOGY

High Performance Direct Flame Fuel Cell Using Air/Propane Flames	850
<i>Kang Wang, Pingying Zeng, Jeongmin Ahn</i>	
Experimental Study of Syngas Production in a Non-Catalytic Counterflow Reactor	873
<i>Erica Belmont, Janet Ellzey</i>	
Author Index	