

# **Western States Section of the Combustion Institute Spring Technical Meeting 2014**

**Pasadena, California, USA  
24-25 March 2014**

**ISBN: 978-1-63266-521-8**

**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© (2014) by the Western States Section/Combustion Institute  
All rights reserved.

Printed by Curran Associates, Inc. (2014)

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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

<b>LES Simulations of a Lean Direct Injected Gas Turbine Combustor with Adaptive Mesh Refinement</b> .....	1
<i>Scott A. Drennan</i>	
<b>Zimont Scale Vortex Interactions with Premixed Flames</b> .....	9
<i>Runhua Zhao, Nicole Aeina, Vyaas Gururajan, Fokion N. Egolfopoulos</i>	
<b>Characteristics of Piloted Premixed Turbulent-Jet Flames of Methane and C<sub>6</sub>-C<sub>8</sub> Hydrocarbons</b> .....	22
<i>Francesco Carbone, Jennifer L. Smolke, Adam M. Fincham, Fokion N. Egolfopoulos</i>	
<b>An Efficient Semi-implicit Time-integration Scheme for Stiff Chemical Source Terms</b> .....	38
<i>Y. Xuan, B. Savard, B. Bobbitt, G. Blanquart</i>	
<b>Assessing the Accuracy of Large Eddy Simulation in a Jet In Cross Flow Configuration</b> .....	58
<i>A. M. Ruiz, G. Lacaze, J. C. Oefelein</i>	
<b>Broken Reaction Zone and Differential Diffusion Effects in a High Karlovitz <i>n</i>-C<sub>7</sub>H<sub>16</sub> Premixed Turbulent Flame</b> .....	84
<i>B. Savard, G. Blanquart</i>	
<b>Spatially Resolved Measurements of Radiant Emission from Turbulent Ethylene and JP-8 Non-Premixed Jet Flames</b> .....	100
<i>Christopher R. Shaddix, Jiayao Zhang</i>	
<b>High Karlovitz <i>n</i>-Heptane Premixed Flame DNS: Turbulence Transformation</b> .....	107
<i>B. Bobbitt, G. Blanquart</i>	
<b>Triple Flame: Inherent Asymmetries and Pentasectional Character</b> .....	120
<i>Albert Jorda Juanos, William A. Sirignano</i>	
<b>Simulations of Hydrocarbon Combustion using Rate-Controlled Constrained Equilibrium</b> .....	142
<i>Simon Lapointe, G. Blanquart</i>	
<b>The Role of Surface Functional Groups and Nanostructure on the Oxidation Rate of Soot Derived from an Oxygenated Fuel</b> .....	152
<i>Hossein Ghiassi, Paulo Perez, JoAnn S. Lighty</i>	
<b>Non-linear Extrapolation of Laminar Flame Properties from Spherically Expanding Flames</b> .....	164
<i>S. Coronel, N. Bitter, V. Thomas, R. Mevel, J.E. Shepherd</i>	
<b>Experimental and Numerical Studies of Non-premixed Hydrogen Flames at Elevated Pressures</b> .....	180
<i>Okjoo Park, Peter S. Veloo, Hugo Burbano, Fokion N. Egolfopoulos</i>	
<b>Evaluating Flamelet Configurations for Simulating Stretched Laminar Flames</b> .....	190
<i>Shyam Menon, Runhua Zhao, Jagan Jayachandran, Fokion N. Egolfopoulos</i>	
<b>The Influence of Hydrogen and Carbon Monoxide on the Structure and Extinction of Counterflow Premixed Flames</b> .....	206
<i>Vaishali Amin, Roel van Duren, Kalyanasundaram Seshadri</i>	
<b>The Effect of Mixture Fraction on Edge Flame Propagation Speed</b> .....	217
<i>Richard S. Boles, Wenyu Li, Phillip Wang, David Matinyan, Hatsachai Prahanphap, Jesse Piotrowicz, Hang Song, P. Ronney</i>	
<b>Influence of Emulsions and Steam Injection on Continuous Diesel Fuel Combustion Performance</b> .....	226
<i>Meagan Sung, Vincent McDonell</i>	
<b>Transient Plasma Discharge Ignition for Internal Combustion Engines</b> .....	240
<i>S. Shen, K. Gunasekera, J. Yang, J. Flamenco, P. Ronney</i>	
<b>An On-line Method for Determining Flame Ionization Detector Effective Response Factor of Hydrocarbons from Combustion Sources</b> .....	250
<i>A. Avenido, G. Lucachick, W. Northrop</i>	
<b>A New Fuel Index for LTC Engines Based on Operating Envelopes in Light-Duty Driving Cycle Simulations: Primary Reference Fuels</b> .....	260
<i>Kyle E. Niemeyer, William J. Cannella, Christopher L. Hagen</i>	
<b>Flameholding Tendencies of Bluff-Body and Wall-Recess Stabilized Hydrogen and Natural Gas Flames at Elevated Temperatures and Pressures</b> .....	274
<i>Elliot Sullivan-Lewis, Vincent McDonell</i>	
<b>Emission Reduction Using Three-Way Catalyst on Methane-Fueled Engine</b> .....	285
<i>R. Seiser, X. Shi, J.-Y. Chen, R. Dibble, R. Cattolica</i>	
<b>Estimation of Semi-Volatile Particle Composition from Premixed Low Temperature Diesel Combustion Using Evaporative Tandem Differential Mobility Analysis</b> .....	296
<i>G. Lucachick, A. Avenido, W. Northrop</i>	
<b>Experimental Evaluation of Diesel and Dual Fuel Combustion in a 6.8 Liter Compression Ignition Engine</b> .....	307
<i>Wan Nurdiyana Wan Mansor, Jennifer S. Vaughn, Daniel B. Olsen</i>	

<b>Flame Propagation at Low Lewis Number in Narrow Slots</b> .....	320
<i>Jonathan Gross, Xiaolin Pan, P. Ronney</i>	
<b>Direct Numerical Simulation of a Reacting Turbulent Mixing Layer</b> .....	327
<i>Y. Xuan, G. Blanquart</i>	
<b>Simulation of Detonation using Cantera and OpenFOAM</b> .....	334
<i>Aditya Prakash Singh</i>	
<b>Theory of Interaction of Small-Scale Turbulence with Strong Detonations</b> .....	352
<i>Cesar Huete, Forman A. Williams</i>	
<b>On the Interpretation of Mobility Measurements of Nascent Soot Particles</b> .....	369
<i>Sydney Lieb, Hai Wang</i>	
<b>Investigating Local Equivalence Ratio of Reacting Air Jet in Rich Crossflow Using Cassegrain Optical System</b> .....	378
<i>Howard H. Lee, Vincent McDonell</i>	
<b>OH PLIF of an Impinging Flame</b> .....	387
<i>D. Escofet-Martin, Y.C. Chien, D. Dunn-Rankin</i>	
<b>Schlieren Imaging of Chemi-Ion Driven Flows in a Time Varying Electric Field</b> .....	394
<i>J. Tinajero, D. Dunn-Rankin, J. Bai, M. Plascencia</i>	
<b>Size Evolution of Soot Formed in Premixed C6 Hydrocarbon Flames</b> .....	403
<i>Joaquin Camacho, Hai Wang</i>	
<b>Further Considerations of Flame Ignition in Counterflow Configuration</b> .....	414
<i>Abtin Ansari, Fokion N. Egolfopoulos</i>	
<b>Effects of Preheating and Dilution on Lean Premixed Methane/Air Flame Characteristics</b> .....	426
<i>Ingmar Schoegl, Mohsen Ayoobi</i>	
<b>Temperature Measurement Over a Quenching Plate with Electric Field Flames</b> .....	436
<i>Y.C. Chien, D. Dunn-Rankin</i>	
<b>Propagation of Butanol/Air Flames at Sub-Atmospheric Pressures</b> .....	447
<i>Robert R. Burrell, Fokion N. Egolfopoulos</i>	
<b>Fuel Reforming Using Counter-Current Heat-Recirculating Combustors</b> .....	458
<i>Shrey Trivedi, Swapnil Desai, Andrew Lawson, Chien-Hua Chen, P. Ronney</i>	
<b>Experimental Investigation of Sparkplug Ion Sensor Signals in HCCI Combustion Using Sodium, Potassium, and Cesium Acetates As Additives</b> .....	465
<i>J.H. Mack, R.H. Butt, S. Saxena, J.-Y. Chen, R. Dibble</i>	
<b>Thermal Ignition - One-Step Modeling of the Transition from Slow Reactions to Ignition</b> .....	481
<i>P. A. Boettcher, V. Thomas, R. Mevel</i>	
<b>Thermal Decomposition Mechanism of <math>\text{HNNO}_2\text{H}</math> Dissociated from Mononitrobiuret and 1,5-Dinitrobiuret</b> .....	495
<i>Hongyan Sun, Ghanshyam L. Vaghjiani</i>	
<b>The Role of the Surface Growth Reactions on Soot Formation</b> .....	500
<i>Chiara Saggese, Joaquin Camacho, Tiziano Faravelli, Eliseo Ranzi, Hai Wang</i>	
<b>A Comparative Study of Methyl Methacrylate Flame Inhibition with Bromine and Phosphorus Dopants</b> .....	509
<i>Okjoo Park, Enoch Dames, Fokion N. Egolfopoulos, Peter S. Veloo</i>	
<b>Effect of Pressure and Oxygen Concentration on the Flame Spread Limits of Fire Resistant Fabrics</b> .....	520
<i>Danielle E. Kirchmeyer, Hugo Wagner, Carlos Fernandez-Pello</i>	
<b>Effects of Season and Heating Mode on Ignition and Burning Behavior of Three Species of Live Fuel Measured in a Flat-Flame Burner System</b> .....	530
<i>Jonathan R. Gallacher, Victoria Lansinger, Sydney Hansen, Dan Jack, D.R. Weise, Thomas H. Fletcher</i>	
<b>Cellulose Spot Fire Ignition by Hot Metal Particles</b> .....	544
<i>James L. Urban, Casey D. Zak, Carlos Fernandez-Pello</i>	
<b>Effects of Season on Ignition of Three Species of Live Wildland Fuels Using the FIST Apparatus</b> .....	551
<i>S. McAllister, D.R. Weise</i>	
<b>Role of Gas Radiation in the Mechanism of Opposed-Flow Flame Spread in a Microgravity Environment</b> .....	563
<i>Jeanie Ray Villaraza, Luca Carmignani, Subrata Bhattacharjee</i>	
<b>Flame Spread over Thermally Thick Polymethylmethacrylate in a Narrow Channel Apparatus</b> .....	579
<i>Garrett R. Bormand, Greg J. Sullivan, Fletcher Miller</i>	
<b>Oxygen Lewis Number Effects in Reduced Gravity Combustion of Methanol Droplets</b> .....	586
<i>B.D. Shaw, C.L. Vang</i>	
<b>Computational Study of the Effects of Support Fiber in Fiber-Supported <i>n</i>-Heptane Droplet Combustion in Reduced Gravity</b> .....	600
<i>N. Ghata, B.D. Shaw</i>	