

# Combustion Institute Canadian Section Spring Technical Meeting 2013



Université Laval  
May 13-16, 2013  
Final Technical Program



## Monday, May 13th 2013

17:00 - 20:00 Registration & Reception Cocktail - Vachon Building Atrium

## Tuesday, May 14th 2013

### Vandry Building : VND-2245B

07:50 - 08:10 **Welcome and Opening Remarks**  
Co-Chairs: Alain deChamplain & Sophie Ringuette

08:10 - 09:00 **Plenary Lecture # 1**  
Marc-Antoine Cantin, President SBI International  
Challenges Facing the Wood Burning Appliances Industry in the Coming Years  
Chair: Alain deChamplain/Sophie Ringuette

09:00 - 09:20 Coffee Break sponsored by SBI - Vandry Building

### Vandry Building : VND-2245B

#### Numerical Methods and Simulations 1

Chair: Kendal Bushe

### Vandry Building : VND-2289A

#### Detonation, Explosions and Supersonic 1

Chair: Gaby Ciccarelli

09:20 - 09:40 08-001: RANS Simulation of a Turbulent Lifted Jet Flame Using Conditional Source Estimation -  
*D. Dovizio, J. Labahn, C.B. Devaud*

05-001: Sensitivity of aluminum/metal oxide nanothermites to laser ignition - *C.F. Petre, S. Ringuette, R. Stowe, D. Chamberland, T. Ringuette*

09:40 - 10:00 08-002: Numerical Investigation on Catalytic Combustion of H<sub>2</sub> Enriched Natural Gas -  
*H. Qi, H. Zhu, S.L. Xiong, J.Z. Wen*

05-002: Isobaric and Freely-Propagating Spherical Flames n Aluminium and Aluminium-Methane Clouds within balloons - *P. Julien, S. Whitley, S. Goroshin, J. Bergthorson, D. Frost*

10:00 - 10:20 08-003: Numerical investigation of Flame Propagation in Small Thermally-Participating Adiabatic Tubes - *G.P. Gauthier, G.M.G. Watson, J.M. Bergthorson*

05-003: Dynamic Shear Initiation of Self-Propagating High-Temperature Synthesis Compositions - *M. Serge, A. Nabavi, A. Higgins, F. Tang, P.H. Chiu, V.F. Nesterenko*

10:20 - 10:40 08-007: Conditional moment closure modeling of differential diffusion in a hydrogen jet flame -  
*M.C. Ma, C.B. Devaud*

05-004: The Ignition Process of Boron and Aluminium Particle Agglomerates -  
*X. Mi, S. Goroshin, A. Higgins*

10:40 - 11:00 Coffee Break sponsored by SBI - Vandry Building

**Tuesday, May 14th 2013**

<b>Tuesday, May 14th 2013</b>		
	<b>Vandry Building : VND-2245B</b>	<b>Vandry Building : VND-2289A</b>
	<b>Gas Turbine Combustion</b> Chair: Pierre Gauthier	<b>Engine Combustion 1</b> Chair: Kendal Bushe
11:00 - 11:20	08-004: Simulation of Fuel-Air Unmixedness on NOx Emissions in DLE Industrial Gas Turbine Combustion - <i>J. Flood, G. Bourque, R. Gordon</i>	04-001: Development of a Photographic Technique for Observing Flame Propagation in a Hot Surface Assisted Direct Injected Natural Gas Combustion Apparatus - <i>D. Chown, J. Wallace</i>
11:20 - 11:40	08-014: CFD Modelling of the Post-Shutdown Heat Soak-Back Phenomenon in a Gas Turbine Combustor - <i>A. Bazin, M. A. Ghazlani, A. deChamplain</i>	04-002: Preliminary study of Clean Combustion using Direct Injection Neat n-Butanol in a Diesel Engine - <i>T. Yanai, X. Han, G.T. Reader, M. Zheng, J. Tjong</i>
11:40 - 12:00	04-004: Thermo-acoustic Velocity Coupling in a Swirl Stabilized Gas Turbine - <i>V. Caux-Brisebois, A. Steinberg, C.M. Arndt, W. Meier</i>	04-003: A study of diesel engine intake flow field to improve in-cylinder air motion - <i>S. Dev, Q. Han, K. Xie, M. Zheng, P. Henshaw</i>
12:00 - 12:20	08-016: Modeling of Biodiesel Combustion for Gas Turbine Applications - <i>M. Youssef, A. deChamplain, R. Tahir</i>	02-002: Investigation and modeling of engine knock phenomena: a review - <i>M.F. Ebna Alam, B. Akih-Kumgeh</i>
12:20 - 14:00	<b>Lunch - Pouliot Building Café</b>	
	CI/CS Board of Directors Meeting - Pouliot Building Café (PLT-1122)	
	<b>Soot and Particulates 1</b> Chair: Seth Dworkin	<b>Reaction Kinetics 1</b> Chair: Gilles Bourque
14:00 - 14:20	01-003: Particle Size Effects in Packed Bed Combustion III - <i>W. Hallett, T. Machula</i>	08-015: Application of the Laminar Flamelet Concept to the Simulation of Turbulent Jet-A Spray Flames - <i>A. Fossi, A. deChamplain, B. Paquet</i>
14:20 - 14:40	09-003: Modeling Soot Particle Nucleation as a Rare Event - <i>N. Eaves, M.J. Thomson, S. B. Dworkin</i>	02-003: Validation of Chemical Kinetic Models against Experimental Measurements of Premixed Laminar C1-C4 alcohol-Air Flames - <i>P. Versailles, J.D. Munzar, G.M. Watson, J.M. Bergthorson</i>
	<b>Combustion/Turbulent Flame 1</b> Chair: Adam Steinberg	<b>Biomass 1</b> Chair: Mahdi Salehi
14:40 - 15:00	08-013: Structure of methane inversed diffusion flames with cooled coflowing combustion products - <i>C. Barks, D. Haggith, X. Zhao, A. Sobiesiak</i>	01-001: Experimental and Modeling Studies on a Biomass Gasification Process - <i>M.S. Lavaee, A. Chansomwong, L. R-Sandoval, J. Nathwani, J.Z. Wen</i>
15:00 - 15:20	03-002: Flame front thickness of ultra-lean premixed turbulent methane/air flames in the thin reaction zones regime - <i>P. Tamadonfar, Ö.L. Gülder</i>	06-003: Numerical modeling of crown forest fires spread - <i>V. Perminov</i>
15:20 - 15:40	Coffee Break sponsored by SBI - Vandry Building	

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<b>Tuesday, May 14th 2013</b>		
	<b>Vandry Building : VND-2245B</b>	<b>Vandry Building : VND-2289A</b>
	<b>Spray &amp; Droplet Combustion 1</b> Chair: Madjid Birouk	<b>Fire Studies</b> Chair: Beth Weckman
15:40 - 16:00	10-004: Droplet vaporization process of diesel, biodiesel and their blends in turbulent environment at elevated pressure and temperature conditions - <i>S. L. Toth, M. Birouk</i>	06-001: Predicting Mechanical Strength of In-Use Firefighter's Protective Clothing Using Infrared Spectroscopy - <i>M. Rezazadeh, D.A.Torvi, S.D. Noble</i>
16:00 - 16:20	10-005: Characterization of Coal-Water Slurry Sprays for Gasification, Part 1: Experimental Facility and Optical Imaging - <i>C. Lam, O. Ramadan, R. W. Hughes, P.E.G. Gogolek, P.M. Hughes, S.G. Daviault</i>	06-002: Convection within the Liquid Phase of Methanol Pool Fire - <i>A. Vali, D.S. Nobes, L.W. Kostiuik</i>
16:20 - 17:20	<b>CI/CS Annual Business Meeting - Vandry Building: VND-2245B</b>	

**Wednesday, May 15th 2013**

08:00 - 08:10	Announcements - Chair: Sophie Ringuette/Alain deChamplain
08:10 - 09:00	<b>Plenary Lecture # 3 - Vandry Building: VND-2245B</b> Robert Stowe - Weapons Systems, Defence Scientist Propulsion Research at DRDC Valcartier Chair: Sophie Ringuette/Alain deChamplain
09:00 - 09:20	Coffee Break sponsored by Numérica Technologies Inc. - Vandry Building

	<b>Vandry Building: VND-2245B</b>	<b>Vandry Building: VND-2289A</b>
	<b>Combustion/Turbulent Flame 2</b> Chair: Beth Weckman	<b>Spray &amp; Droplet Combustion 2</b> Chair: Madjid Birouk
09:20 - 09:40	08-011: Modeling of combustion within an anode baking furnace used in the primary aluminum industry - <i>F. Gregoire, L. Gosselin</i>	10-003: Investigation and Characterization of the Effects of Distilled Water, Salt Water, and Hydrochloric Acid Solution on Flare - <i>M. Kazemimanes, L.W. Kostiuik, D. Nobes, J.S. Olfert, M.R. Johnson</i>
09:40 - 10:00	03-008: Methodologies and Uncertainties for Measuring Combustion Completion in Turbulent Non-premixed Flames - <i>D.J. Corbin, M.R. Johnson</i>	10-006: Characterization of Coal-Water Slurry Spray for Gasification Part 2: Phase Doppler Anemometry Measurements - <i>C. Lam, O. Ramadan, R. W. Hughes, P.E.G. Gogolek, P.M. Hughes, S.G. Daviault</i>
10:00 - 10:20	03-009: Stabilized Iron-Methane-Air-Flames - S. Whiteley, P. Julien, S. Goroshin, D.L. Frost, J.M. Bergthorson	10-002: Characterization of Coal-Water Slurry Spray for Gasification Part 3: Computational modeling - R. Yandon, A. Runstedtker, A.J. Majeski, C. S. Lam, P. Gogolek, R. Hughes
10:20 - 10:40	03-010: Emission Measurements of Various Biofuels using a Commercial Swirl-Type Airblast Dual Fuel Injector - <i>J. Agou, A. deChamplain, B. Paquet</i>	10-007: Assessment of the Flight Envelope for Aircraft Operation with New Jet Biofuels - <i>J. Jean, A. deChamplain, B. Paquet</i>
10:40 - 11:00	Coffee Break sponsored by Numérica Technologies Inc. - Vandry Building	

	<b>Soot and Particulates 2</b> Chair: Matthew Johnson	<b>Detonation, Explosions and Supersonic 2</b> Chair: Petre Catalin-Fortin
11:00 - 11:20	07-003: Influence of a Wood Stove Design on Cleaner Combustion with Reduced Particulate and Gaseous Emissions - <i>H. Marcoux, S. Kalla, A. deChamplain</i>	05-005: Burning rate of nano-Aluminium-Water Propellant - <i>W. Georges, S. Goroshin, A. Higgins, Y. Yavor, S. Ringuette, R. Stowe</i>
11:20 - 11:40	09-005: Optimum Detection Wavelength Selection for Simultaneous LaserInduced Incandescence and Elastic Light Scattering Measurement of Soot Volume Fraction and Primary Particle Diameter - <i>B.M. Crosland, M.R. Johnson, K.A. Thomson</i>	05-006: Influence of elevated temperature on minimum burning pressures in ammonium nitrate emulsion - <i>S. Goldthrop, C.M. Badeen, R. Turcotte, C. Iyogun, S.K. Chan</i>
11:40 - 12:00	09-006: Detailed Study of Soot Oxidation in Laminar Diffusion Flames by O <sub>2</sub> and OH - <i>A.Khosousi, S.B. Dworkn, M.J. Thomson</i>	05-007: Front Dynamics for a Detonation Waves with Pressure Dependent Reaction Rate - <i>J. Li, A.J. Higgins</i>
12:00 - 12:20		05-008: Dust Explosibility Characteristics of Torrefied Biomass - <i>A.Boskovic, P.Basu, P. Amyotte</i>
12:20 - 14:00	Lunch - Pouliot Building Café	

Wednesday, May 15th 2013

Wednesday, May 15th 2013		
Vandry Building: VND-2245B		Vandry Building: VND-2289A
Combustion/Turbulent Flame 3 Chair: Cecile Devaud		Flames/Diagnostics Chair: Cecilia Lam
14:00 - 14:20	03-004: Topology of Turbulent Premixed V-shaped Flames - <i>S. Kheirkhah, Ö.L. Gülder</i>	07-001: Synthesis and Characterization of YAG:Dy and YABG:Dy for High Temperature Thermographic Phosphor Thermometry - <i>W.Y. Kwong, M. Sakosky, A.M. Steinberg, Y.-H. Chin</i>
14:20 - 14:40	01-007: Validation of Numerical Simulations for a Residential Wood Log Stove - <i>S. Kalla, A. deChamplain, B. Paquet</i>	07-002: Flame Chemiluminescence Measurement for Real Time Air/Fuel Ratio control - <i>Sewon Kim</i>
14:40 - 15:00	03-003: Turbulent Premixed Combustion in V-shaped Flames: Flame Front Position and Flame Brush Thickness - <i>S. Kheirkhah, Ö.L. Gülder</i>	07-004: Detailed Ignition Sequence Studied with a Fast Infrared Camera - <i>F. Marcotte, A. deChamplain, J. Jean</i>
15:00 - 15:20	Coffee Break sponsored by Numérica Technologies Inc. - Vandry Building	

Engine Combustion 2 Chair: Gaby Ciccarelli		Reaction Kinetics 2 Chair: Jeffrey Bergthorson
15:20 - 15:40	04-005: Heat Release and Auto-Ignition Characteristics of an HCCI Engine Fuelled by n-Heptane/Toluene Blends - <i>H. Guo, R. Lowe, W. S. Neill</i>	02-004: Characterization of a Counter-Flow Laminar Flame for Studying Natural Gas Catalytic Combustion - <i>K. Pan, H. Qi, A. Petro, H. Zhu, S.L. Xiong, J.Z. Wen</i>
15:40 - 16:00	04-006: Comparing Particulate Matter Emissions between E0 & E10 in a GDI Engine - <i>P. Mirreault, M. Ramos, J.S. Wallace</i>	02-005: Extinction Characteristics of Liquid Hydrocarbon Diffusion Flames and Multiple Solutions to Flame Stability - <i>A.E. Karatas, Ö.L. Gülder</i>
16:00 - 16:20	04-007: Effects of Transient Valve Timing on Particle Emission Concentration During Homogeneous Charge Compression Ignition Combustion - <i>D.S. Bullock, A. Schramm, A. Momenimovahed, C.R. Koch, J.S. Olfert</i>	02-006: Experiments and Numerical Simulations of Extinction Limits for Laminar Non-premixed Flames of Jet-A1 / Biofuel Blends - <i>A. Zia, J.D. Munzar, P. Versaille, J.M. Bergthorson</i>
16:20 - 16:40	04-008: Preliminary investigation of the influence of low temperature combustion on diesel engine heat release profiles - <i>G. Bryden, C. Aversa, X. Han, M. Zheng</i>	02-007: The effects of hydrogen addition on methane combustion in plug flow reactor using detailed and skeletal mechanism - <i>A. Beheshti, H.E. Kebria, A.G.M. Yazd</i>
18:00	Busses depart from Vandry Building to Conference Banquet	
18:30 - 22:00	Conference Banquet - Loews Hôtel Le Concorde Spinning Restaurant Sponsored by NSERC CREATE Program in Clean Combustion Engines	

**Thursday, May 16th 2013**

08:30 - 08:40	Announcements - Chair: Sophie Ringuette/Alain deChamplain
08:40 - 09:30	<b>Plenary Lecture # 3 - Vandry Building: VND-2245B</b> Kevin Gross, Professor/Researcher, US Air Force Institute of Technology Imaging Fourier-Transform Spectrometry for Combustion Diagnostics Chair: Alain deChamplain/Sophie Ringuette
09:30 - 09:50	Coffee Break - Vandry Building

	<b>Vandry Building: VND-2245B</b>	<b>Vandry Building: VND-2289A</b>
	<b>Numerical Methods and Simulation 2</b> Chair: Rocco Farinaccio	<b>Detonation, Explosions and Supersonic 3</b> Chair: Ben Akih-Kumgeh
09:50 - 10:10	08-005: Linear-Eddy Model Formulated Probability Density Function Model for Premixed Turbulent Combustion - <i>H.P. Tsui, W. K. Bushe</i>	05-009: Shock Ignition of n-heptane - <i>J. MacLean, M. Kellenberger, G. Ciccarelli</i>
10:10 - 10:30	08-006: RANS Simulation of a confined turbulent non-premixed methane flame using Conditional Source Estimation - <i>J.W. Labahn, C.B. Devaud</i>	05-010: Scaling between the Minimum Diameter and Thickness for Detonation Limits in Highly Argon Diluted Mixtures - <i>Y. Gao, N. Mehrjoo, H. Dick Ng, J.H.S. Lee</i>
10:30 - 10:50	08-010: Numerical modelling of laminar inverted coflow methane/air diffusion flames - <i>F. Liu, K.T. Thomson, G.J. Smallwood</i>	05-011: Flame acceleration through a matrix of cylinders - <i>T. Pinos, G. Ciccarelli</i>
10:50 - 11:10	03-001: Conditonal source-term estimation for large eddy simulation of turbulent premixed flames in complex geometries - <i>G.V. Nivarti, M.M. Salehi, W.K. Bushe</i>	05-012: A Model of Supersonic Bulk Metal Combustion - <i>A. Devito, A.J. Higgins</i>
11:10 - 11:30	Coffee Break - Vandry Building	

	<b>Biogas/Syngas Combustion</b> Chair: Adam Steinberg	<b>Biomass 2</b> Chair: Ben Akih-Kumgeh
11:30 - 11:50	03-005: Turbulent non-premixed biogas flame: Effect of co-flow low swirl strength - <i>M. Saeddiamiri, M. Birouk, J.A. Kozinski</i>	01-005: Fast pyrolysis of lignocelluloses – a new technology concept with fixed-bed reactors - <i>S. Nanda, A.K.Dalai, J.A. Kozinski</i>
11:50 - 12:10	03-007: Experimental Study of cellular instabilities of premixed syngas air flames - <i>D. Lapalme, P. Seers</i>	01-006: Simulation of Gasification and Combustion in a Downdraft Gasifier - <i>S. Hajitaheri, J.Z. Wen</i>