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Centre for Energy
The University of Western Australia
WA 6009 Australia
Tel: +61 8 6488 7600

and

Department of Chemical Engineering
Curtin University
WA 6102 Australia
Tel: +61 8 9266 7581

WEBSITE: <http://cfe.uwa.edu.au/news/acs2013>

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***Message from the Chairman
Australian and New Zealand Section of The Combustion Institute***

The Australian Combustion Symposium is a key biennial event in the calendar of the Australian and New Zealand Section of the Combustion Institute. It provides an excellent opportunity for our “budding” combustion scientists and research students to mingle with others and to present recent advances in their respective fields. The 2013 conference has two special features: (i) it is the first time that it is held in Western Australia, and (ii) it is dedicated to celebrating the 70th birthday and exemplary career of Professor Terry Wall AM FTSE. Congratulations Terry!

Following the generous donations made by Professor Dongke Zhang FTSE and then by Professor Terry Wall AM FTSE, the perpetual Terry Wall Best Student Paper Award has been established to become a regular feature of this conference. It will be awarded this year for the first time.

Combustion has never been so important considering current concerns over energy security and environmental pollution. The need to burn cleanly and efficiently remains a challenge to the international community and the theme of our 2013 conference “*Combustion Research Improving Industrial Productivity*” attempts to focus on the close connection between combustion science and engineering. The conference program brings together an excellent suite of invited speakers and draws a record number of contributed papers that address a wide range of topics covering basic and applied combustion.

Earlier this year, our community was saddened by the loss of one of its valued members, Professor Sam Luxton who passed away on the 24th of May 2013. Sam was an outstanding researcher, a brilliant communicator and an inspiring leader who was loved and respected by our community. Our section mourns the loss of Sam as an active member of the Combustion Institute and dedicates in this conference a Memorial Session to celebrate his life and achievements. An obituary for Sam was also distributed to our members.

As Chairman of the ANZ-Section and on behalf of all our membership and delegates, I would like to thank Winthrop Professor Dongke Zhang FTSE, from The University of Western Australia and his outstanding team of organizers for their tireless work and dedication in making the 2013 Australian Combustion Symposium an outstanding success. Our thanks also go to:

Dr Mingming Zhu, The University of Western Australia
Dr Yu Ma, The University of Western Australia
Dr Kai Zeng, The University of Western Australia
Dr Yun Yu, Curtin University
Dr Yasir Al-Abdeli, Edith Cowan University
A/Prof Hari Vuthaluru, Curtin University
Mr Zhezi Zhang, The University of Western Australia
Ms Yii Leng Chan, The University of Western Australia

We hope you enjoy this conference and we look forward to seeing you at the upcoming 35th International Combustion Symposium in San Francisco in 2104.

Professor Assaad Masri
Sydney, November 2013

Preface

On behalf of the Organising Committee of the 2013 Australian Combustion Symposium (ACS2013), it is my great pleasure to present this volume of the Proceedings of the Australian Combustion Symposium (2013). This is one of the biennial events organised by the Australian and New Zealand Section of the Combustion Institute.

This symposium series is highly relevant considering that combustion remains central to global concerns about energy conversion technologies and the environment. Recent symposia were held in Newcastle (2011), Brisbane (2009), Sydney (2007), Adelaide (2005; in conjunction with ASPACC2005), Melbourne (2003), and Adelaide (2001). This present ACS was held at a high-class events venue in Perth, The University Club of Western Australia at The University of Western Australia. It was proudly dedicated to celebrating the 70th birthday and the wonderful career of my PhD adviser, Professor Terry Wall AM FTSE.

The proceedings volume contains five invited lectures delivered by speakers of international repute, covering the topical issues of solid fuels and carbon capture, kinetics, turbulent combustion, fire dynamics, fuel processing, and air pollution. A record number of ninety contributed papers, selected from a total of ninety seven submitted manuscripts, were accepted for publication in this volume, following vigorous peer reviews by at least two reviewers, coordinated by the Technical Committee. The total number of participants was one hundred and forty two, the highest in the ACS series so far.

The ACS2013 Special Plenary Lecture was delivered by Professor Terry Wall AM FTSE (The University of Newcastle). The Bilger Lecture was delivered by Professor John Abraham (The University of Adelaide). The other Keynote Speakers were Professor Fei Qi (University of Science and Technology, China), Professor Jos éTorero Cullen (The University of Queensland), and Professor Minghou Xu (Huazhong University of Science and Technology, China).

Topics covered by the contributed papers cover a broad range of topics including turbulent flames, combustion of solid fuels, fuel conversion and processing, kinetics, diagnostic, ignition, emissions and carbon capture.

In May this year, the Australian combustion community lost one of its valued members, Professor Russel (Sam) Luxton. To many of us, Sam was an academic father and we always remember him as a friend with twinkling eyes, cheeky grin and indomitable spirit. In mourning the loss of Sam as a mentor and an inspiring leader of the Combustion Institute, we dedicated the Sam Luxton Memorial Session on Turbulent Reactive Flow at this ACS to celebrating Sam's life and achievements.

On behalf of the organising committee, I thank all who have contributed to the symposium, especially members of the Technical Committee and reviewers for the time they spent on their thoughtful, constructive and helpful reviews. I also gratefully acknowledge our nine sponsors for providing the financial supports without slight hesitation when requested. Their generous supports have made the organising of the symposium in a fast-moving and most expensive city much easier.

Winthrop Professor Dongke Zhang FTSE

Conference Chair

on behalf of the Organising Committee of the 2013 Australian Combustion Symposium

Perth, November 2013

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Dr Yasir Al-Abdeli, Edith Cowan University (Workshop Coordinator)

List of Reviewers

The technical committee would like to acknowledge and convey special thanks to the following respected reviewers for sparing their invaluable time to review the assigned papers submitted to the ACS2013 and providing the constructive feedback which helped in improving the quality of manuscripts for the 2013 Australian Combustion Symposium.

Prof Assaad Masri, The University of Sydney
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Dr Qing Nian Shaun Chan, The University of New South Wales
Dr Shawn Kook, The University of New South Wales
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Dr Woei Saw, The University of Adelaide

	The University of Newcastle	North China Electric Power University	The University of Southern Queensland	The University of Adelaide	The University of Sydney	The University of New South Wales; Argonne National Laboratory
9.00-9.20	<p><i>A3-02</i></p> <p>A Dynamic Study on the Impacts of CO₂ on SO₂ Absorption into Sodium Based Aqueous Solutions in Oxy-fuel Scrubber</p> <p><i>D. Liu</i> <i>T.F. Wall</i> <i>Y. Liu</i></p> <p>The University of Newcastle</p>	<p><i>B3-02</i></p> <p>A Study of Combustion Characteristics of Pulverised Coal under MILD Combustion Conditions</p> <p><i>M. Saha</i> <i>B.B. Dally</i> <i>P.R. Medwell</i> <i>E.M. Cleary</i></p> <p>The University of Adelaide</p>	<p><i>C3-02</i></p> <p>Control Oriented Modelling of Submarine Diesel Engines</p> <p><i>T. Broomhead</i> <i>C. Manzie</i> <i>M. Brear</i> <i>P. Hield</i> <i>O. Tregenza</i> <i>M. Newman</i></p> <p>The University of Melbourne; Defence Science and Technology Organisation</p>	<p><i>D3-02</i></p> <p>Planar and Volume Cross-LIF Imaging to Identify Out-of-Plane Motion in Turbulent Flames</p> <p><i>S. Meares</i> <i>M. Juddoo</i> <i>A.R. Masri</i></p> <p>The University of Sydney</p>	<p><i>E3-02</i></p> <p>Effect of Oxygenates Addition on the Combustion Characteristics of Single Droplets of Diesel</p> <p><i>M.M. Zhu</i> <i>Z.Z. Zhang</i> <i>Y. Ma</i> <i>D.K. Zhang</i></p> <p>The University of Western Australia</p>	<p><i>F3-02</i></p> <p>The auto-Ignition of Propane and n-butane during Octane Rating: Engine Experiments and Detailed Chemical Kinetic Modelling</p> <p><i>K. J. Morganti</i> <i>T.M. Foong</i> <i>M.J. Brear</i> <i>G. Silva</i> <i>Y. Yang</i> <i>F.L. Dryer</i></p> <p>The University of Melbourne; Princeton University</p>
9.20-9.40	<p><i>A3-03</i></p> <p>Cost Estimates for the Sulfur Removal in Oxy-fuel Thermal Power Plant</p> <p><i>K. Shah</i> <i>R. Spörl</i></p>	<p><i>B3-03</i></p> <p>The Influence of Coal Particle and Air Jet Momenta on MILD Combustion in a Recuperative Furnace</p> <p><i>E.M. Cleary</i> <i>P.R. Medwell</i></p>	<p><i>C3-03</i></p> <p>Structural Transitions of Lifted Laminar Dimethyl Ether Flames with Temperature Variation</p> <p><i>A. Krisman</i> <i>E.R. Hawkes</i></p>	<p><i>D3-03</i></p> <p>Spectral Assessment of Interferences to Two-line Atomic Fluorescence (TLAF) in Turbulent Sooty Flames</p> <p><i>D.H. Gu</i> <i>Z.W. Sun</i></p>	<p><i>E3-03</i></p> <p>Ignition Delay of Bio-fuels in a Common-rail Compression Ignition Engine</p> <p><i>T.A. Bodisco</i> <i>P.X. Pham</i></p>	<p><i>F3-03</i></p> <p>Mixture Fraction Probability Density Functions in Sparse Spray Flames with Spark Ignition</p> <p><i>A.P. Wandel</i></p>

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	Professor Sam Luxton Memorial Session on Turbulent Reactive Flow <i>Chair: Professor Graham Nathan</i>	Solid Fuel Combustion <i>Chair: Professor Shusheng Pang</i>	Chemical Kinetics and Mechanism <i>Chair: Professor Tingyu Zhu</i>	Diagnostic <i>Chair: Professor Fei Qi</i>	Ignition, Fuels and Engine <i>Chair: Dr Anand Veeragavan</i>	Ignition, Fuels and Engine <i>Chair: Associate Professor Peter Ashman</i>
10.30-10.50	<i>Special Speech given by Mr Daniel Luxton; Professor Terry Wall AM FTSE; Professor Assaad Masri; Professor Dongke Zhang FTSE; Professor Graham Nathan;</i>	<i>B4-01</i> Investigations into the Air Heater Ash Deposit Formation in Large Scale PC Fired Boiler <i>H.B. Vuthaluru D.H. French</i>	<i>C4-01</i> Reaction Pathways to Soot Formation in Petrodiesel and Biodiesel Combustion <i>G. Cai J. Abraham</i>	<i>D4-01</i> The Optimisation of a Turbulent Swirl Nozzle Using CFD <i>B. Thomas Y.M. Al-Abdeli M.T. Matthews Z.U. Ahmed</i>	<i>E4-01</i> In-Cylinder Heat Transfer in a Reciprocating Hydrogen Engine <i>P.A. Dennis P.J. Orbaiz M.J. Brear H.C. Watson</i>	<i>F4-01</i> Effect of Fuel Injection Timing on Size and Structure of In- Flame Soot Particles Sampled from an Automotive-Size Diesel Engine <i>R. Zhang S. Kook</i>
		Curtin University; CSIRO Energy Technology	Universiti Malaysia Pahang; University of Southern Queensland	Edith Cowan University	The University of Melbourne	The University of New South Wales

	<i>Dr Yun Yu</i>	<i>Professor Honggang Chen</i>	<i>Dr Michael Stockenhuber</i>	<i>Dr Kuang Chuan Lin</i>	<i>Evatt Hawkes</i>	<i>Yasir Al-Abdeli</i>
13.30-13.50	<p><i>A5-01</i></p> <p>Investigation on the Oxy-fuel combustion of Victorian Brown Coal in a 3MW Pilot-scale Facility</p> <p><i>X. Wu J. Zhang L. Zhang K. Yan X. Xu J. Zhang Y. Ninomiya</i></p> <p>Monash University; R&D Division Shanghai Boiler Works Co Ltd; Chubu University</p>	<p><i>B5-01</i></p> <p>Differential Diffusion effects in Multiple Mapping Conditioning (MMC) mixing model</p> <p><i>L. Dialameh M.J. Cleary A.Y. Klimenko</i></p> <p>The University of Queensland; The University of Sydney</p>	<p><i>C5-01</i></p> <p>Conditional Moment Closure Modelling for HCCI with Temperature Inhomogeneities</p> <p><i>F. Salehi M. Talei E.R. Hawkes C.S. Yoo T. Lucchini G. D'Errico S. Kook</i></p> <p>The University of New South Wales; Politecnico di Milano</p>	<p><i>D5-01</i></p> <p>Oxidation of a Model PCB (4-Chlorobiphenyl) in Catalytic and Non-Catalytic Flow Reactors and Formation of PCDF</p> <p><i>M. Altarawneh J.C. Mackie S. Hou E.M. Kennedy B.Z. Dlugogorski</i></p> <p>The University of Newcastle</p>	<p><i>E5-01</i></p> <p>Parametric study of EDC model constants for modelling lifted jet flames in a heated coflow</p> <p><i>M.J. Evans P.R. Medwell Z.F. Tian</i></p> <p>The University of Adelaide</p>	<p><i>F5-01</i></p> <p>Detailed soot emissions predictions from a thermodynamic diesel engine model</p> <p><i>V. Rao D. Honnery</i></p> <p>Monash University</p>
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	<i>Z.Z. Zhang</i> <i>M.M. Zhu</i> <i>D.K. Zhang</i> The University of Western Australia	<i>E.R. Hawkes</i> The University of New South Wales	<i>M.J. Brear</i> The University of Melbourne	 The University of Sydney	 The University of Newcastle	<i>A.P. Wandel</i> University Putra Malaysia; University of Southern Queensland
14.10-14.30	<i>A5-03</i> Circulating Fluidized Bed Co-combustion of Waste Biomass and Coal: From Laboratory to Industrial Tests <i>K. Zhang</i> <i>J. Chang</i> <i>K.H Zhang</i> <i>H.G. Chen</i> <i>Y.S. Zhang</i> <i>Y.P Yang</i> North China Electric Power University	<i>B5-03</i> A Kinetic Modelling Study of the Flammability of Pyrolysis Gas from a Pine Sawdust <i>Y.L. Chan</i> <i>M.M. Zhu</i> <i>Z.Z. Zhang</i> <i>D.K. Zhang</i> The University of Western Australia	<i>C5-03</i> Mixing model evaluation for transported PDF modelling of non- premixed ethylene flames <i>J.C.K. Tang</i> <i>E.R. Hawkes</i> <i>D.O. Lignell</i> <i>A. Krisman</i> <i>J.H. Chen</i> The University of New South Wales	<i>D5-03</i> Numerical Study of Oxygen Dilution and Temperature Distribution of Biogas Combustion in Bluff- Body MILD Burner <i>M.M. Noor</i> <i>A.P. Wandel</i> <i>T. Yusaf</i> Universiti Malaysia Pahang; University of Southern Queensland	<i>E5-03</i> Prediction of extinction modes for turbulent premixed combustion with an MMC-Partially Stirred Reactor <i>B. Sundaram</i> <i>A.Y. Klimenko</i> <i>M.J. Cleary</i> <i>U. Maas</i> The University of Queensland; The University of Sydney; Karlsruhe Institute of Technology	<i>F5-03</i> Droplet Dynamics of an Auto-Ignition Burner with Dense Spray Boundary Conditions <i>A. Kourmatzis</i> <i>A.R. Masri</i> The University of Sydney
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