

14th International Conference and Exhibition on Fire and Materials 2015

San Francisco, California, USA
2-4 February 2015

Volume 1 of 2

ISBN: 978-1-5108-1410-3

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© (2015) by Interscience Communications Ltd
All rights reserved.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact Interscience Communications Ltd
at the address below.

Interscience Communications Ltd
1 Burnt Ash Lane
Bromley, BR1 4DJ, UK

Phone: +44(0)20 8692 5050

Fax: +44(0)20 8692 5155

office@intersciencecomms.co.uk

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

ELECTRO - TECHNICAL

<i>Emissions from flame retarded and non-flame retarded circuit board laminates</i>	2
Alex Morgan, M Kahandawala, Univ of Dayton and B Gullet, D Tabor, U.S. Environmental Protection Agency, USA	
<i>Small scale evaluation and characterization of simulated low voltage cables with and without electrical current</i>	12
Serge Bourbigot, J Sarazin, P Bachelet, Ecole Nationale Supérieure de Chimie de Lille (ENSCL), France	
<i>Characterization of the thermal exposure in the EN 50399 cable test apparatus</i>	23
Michael Försth, J Sjöström, P Andersson, SP Technical Research Inst of Sweden U Wickström, Luleå University of Technology, Sweden and B Girardin, ENSCL, France	
<i>Small scale tests and numerical modelling of fire performance for electrical cable</i>	38
Bertrand Girardin, G. Fontaine S. Duquesne S. Bourbigot, ENSCL, France, L. Delineau, L Studer AG, M. Försth, SP Technical Research Inst of Sweden and F. Hewitt, A. Witkowski, A.Stec, T R. Hull, University of Central Lancashire UK	
<i>Studying fire behaviour of photovoltaic panels with a Cone Calorimeter</i>	53
CL Chow, SS Han, Univ of Hong Kong, Hong Kong	
<i>An investigation of thermally-induced failure of a lithium ion battery</i>	64
Xuan Liu, S Stoliarov, Z Wang, University of Maryland and M Denlinger, A Masias, K Snyder, Ford Motor Company, USA	
<i>Energy release from lithium ion batteries in the Bomb Calorimeter</i>	78
Richard Walters, R Lyon, Federal Aviation Administration, USA	
<i>Influence of the state of charge on the heat release rate of Li-ion batteries</i>	87
Hubert Biteau, V Somandepalli, Exponent, USA	

FIRE TESTING

<i>Practical aspects of microscale combustion calorimetry</i>	104
Richard Lyon, R Walters, Federal Aviation Administration, N Safronava, Technology and Management International and S Stoliarov, University of Maryland, USA	
<i>Comparison of the heat release rate from the Mass Loss Calorimeter to the Cone Calorimeter for wood-based materials</i>	116
Laura Hasburgh, R White, M Dietenberger, C Boardman, USDA Forest Products Laboratory, USA	
<i>Development of large-format Cone Calorimeter for measuring low levels of heat release – Pertaining to duct flow rates</i>	127
Koichi Yoshida, Yokohama National University, H Yoshioka, National Inst for Land and Infrastructure and Management, T Hayakawa, Tokyo Systems Vac Inc and T Noguchi, University of Tokyo, Japan	
<i>Obtaining additional smoke characteristics using multi-wavelength light transmission measurements.</i>	136
Konrad Wilkens, P van Hees, Lund University, Sweden	
<i>An exercise in obtaining flame radiation fraction from the cone calorimeter</i>	149
James Quintiere, University of Maryland and R Lyon, S Crowley, FAA Technical Center, USA	

<i>Application of FTIR analyzers to fire gases - progress in apparatus and method validation for quantitative analysis</i>	162
Eric Guillaume, L Saragoza, LNE, France	

<i>Testing metal wall panel systems</i>	175
Michael Slocumb, FM Approvals, USA	

<i>A new fire performance test for cavity wall insulation</i>	186
Kristin Jamison, M Khan, FM Global and D Boardman, FM Approvals, USA	

IGNITION

<i>Challenges in determining critical mass flux for ignition</i>	198
Frida Vermina Lundström, P van Hees, Lund University, Sweden	

<i>An ignition model for wood under transient radiant exposures</i>	210
Matt DiDomizio, P Mulherin, E Weckman, University of Waterloo, Canada	

<i>A study of ignition by rifle bullets</i>	225
Sara McAllister, M Finney, T Maynard, I Grob, USDA Forest Service, USA	

MODELING

<i>Pyrolysis simulation of fiber reinforced polymer (FRP) composites: challenges of zero-dimensional testing of resin and additive mixtures to measure kinetic parameters</i>	241
Nicholas Dembsey, B Gillespie, M Long, N McMillan, C Walde, WPI and William Kreysler, Kreysler & Associates, USA	

<i>A model to predict fire behaviors of combustible materials under external heat flux</i>	256
Long Shi, V Novozhilov, CESARE, Victoria University, Australia and M Yit Lin Chew, National University of Singapore, Singapore	

<i>Challenges in predicting the pyrolysis rate of solid materials</i>	271
Marc Janssens, SwRI, USA	

<i>Experimental and pyrolysis modeling study of delaminating materials</i>	285
Dong Zeng, M Chaos, Y Wang, S Dorofeev, FM Global, USA	

<i>Using the Cone Calorimeter to develop a detailed model of carpet for flammability studies</i>	300
Kathryn Butler, J R Shields, NIST and K Ranjan Samant, E.I. DuPont de Nemours and Co, USA	

<i>Pyrolysis of solid materials exposed to high thermal radiative heat flux</i>	313
Mathieu Gillet, Direction Générale de l'Armement - DGA / DT / TA / MT / MTO, G. Rambaud, CEA, DAM, GRAMAT, France	

<i>Numerical modeling of vertical flame testing of nylon-cotton and flame resistant fabric combat uniforms</i>	326
Esther Kim, T Godfrey, NSRDEC and N Dembsey, WPI, USA	

<i>FireFOAM modeling of standard class 2 commodity rack storage fires</i>	340
Ning Ren, J de Vries, K Meredith, M Chaos, Y Wang, FM Global, USA	

FURNITURE & MATTRESSES

- Cigarette ignition of cellulosic materials with non-fire standards compliant (non-FSC) cigarettes* 357
James Lord, J Geiman, ATF Fire Research Laboratory, USA
- Furniture fire safety solutions: A study on the Open Flame Ignition Resistance of California Technical Bulletin 117-2013 compliant upholstered furniture* 370
Carl Powell, R Campbell, M Moore, Great Lakes Solutions, USA
- Fire behavior of bed mattress on the viewpoint of flame-spread* 385
Kye-Won Park, FILK, South Korea, J-J Jeong, M Mizuno, Y Ohmiya, Tokyo University of Science, Japan

FLAME RETARDANTS & COATINGS

- Milligram-scale Flame Calorimeter: A novel instrument for flammability assessment using mg-sized samples*..... 397
Fernando Raffan, X Ding, S Stoliarov, University of Maryland, USA and R Kraemer, BASF-SE, Germany
- Combustion characteristics of flat panel televisions with and without fire retardants in the casing*.... 410
Matthew Blais, K Carpenter, SwRI, USA
- Fire Properties of borated polyethylene* 429
Dan Madsen, Grontmij AB, P van Hees, Lund University, F Jörud, ESS AB, Sweden
- New phosphate epoxy flame retardants for polyurethanes* 442
Vladimir Benin, A Morgan, Univ of Dayton, USA
- Thermal protection of natural fibre-thermoplastic composites using sol-gel coating*..... 453
Baljinder Kandola, W Pornwannachai and E Caminade, Univ of Bolton, UK and J Alongi, Politecnico di Torino, Italy
- Low emissivity surfaces for improved fire performance*..... 464
Robert Svensson, M Försth, SP Fire Research, Sweden
- Revealing the inner secrets of intumescent chars by advanced small scale tests combined with μ -CT* 478
Michael Morys, B Illerhaus, H Sturm, B Schartel, BAM Germany
- Effect of flame retardants on polymer heat release rate* 484
Marcelo Hirschler, GBH International, USA
- Simulations of gas-phase interactions of phosphorus flame retardants with diffusion flame structure* 499
Fumiaki Takahashi, Case Western Reserve University, V Katta, Innovative Scientific Solutions and G Linteris, V Babushok, NIST, USA
- Experimental and numerical simulations of the gas-phase effectiveness of phosphorus compounds* 513
G Linteris, N Bouvet, V Babushok, NIST, Fumiaki Takahashi, Case Western Reserve University, V Katta, Innovative Scientific Solutions, USA and R Krämer, BASF SE, Germany

BUILDING FIRES

- Regulation of foam plastic insulation by US construction codes***..... 529
Marcelo Hirschler, T Earl, GBH International, USA
- Challenges for fire safety in ETIC systems with polystyrene insulation***..... 543
Anja Hofmann, S Kaudelka, BAM and A Ruhs, Frankfurt Fire and Rescue Service, Germany
- Fire safety of textile membranes in temporary structures***..... 554
Per Blomquist, A Bergstrand, N Neumann, I Larsson, P Thureson, SP Technical Research Inst of Sweden and S Bengtsson, Brandskyddslaget, Sweden
- Polystyrene foam insulation with a sustainable flame retardant: Transition update***..... 568
Christine Lukas, Dow Chemical Company UK Ltd, UK, L Ross, Intech. Consulting Inc., USA, I Beulich, H Hollnagel, Dow Europe GmbH, Switzerland, Mark Beach, J Davis, J Hull, B King, S Kram, T Morgan, M Porter, W Stobby, The Dow Chemical Company, USA
- A case study on the effect of building construction type, height and area on the building fire risk using the fire risk assessment model CURisk*** 584
Xiao Li, P Rao, X Zhang, G Hadjisophocleous, Carleton University, Canada

COMPARTMENT FIRES

- Cone calorimeter and room corner fire testing of balsa wood core / Phenolic composites skin sandwich panels*** 601
Alexander Morgan, E Toubia, Univ of Dayton, USA
- Gas and particle effluents released from boundaries of fire compartments: First results and analyses*** 613
Miroslav Smolka, Rockwool Intl, Denmark, V Mozer, Univ of Zilina, Slovakia and P Tofilo, The Main School of Fire Service, Warsaw, Poland

FIRE RESISTANCE

- Optical characterization of high temperature deformation in novel structural materials*** 626
John Gales, Carleton University and M Green, Queen's University, Canada
- Performance and design of intumescent coatings on concrete filled hollow steel sections*** 641
David Rush, L Bisby, Uni of Edinburgh and A Jowsey, International Paint Ltd, UK
- Heat transfer in small-scale models of exterior wall designs***..... 652
C Aire, D Torvi, University of Saskatchewan, M DiDomizio, Elizabeth Weckman, University of Waterloo and R Roos, Roxul Inc, Canada
- Analysis of cross-laminated timber charring rates upon exposure to non-standard heating conditions*** 667
Alastair Barlett, R Hadden, L Bisby, University of Edinburgh and A Law, Arup, UK
- Revisiting normalised heat load and its application in a compartment fire model***..... 682
Colleen Wade, BRANZ and C Fleischmann, M Spearpoint, A Abu, University of Canterbury, New Zealand

TRANSPORTATION

<i>Car bumpers reaction to fire</i>	698
Célia Rich, LCPP, France / University of Lausanne, Switzerland, B Vanlerberghe, N Risler, S Pereira-Rodrigues, LCPP, France and O Delémont, University of Lausanne, Switzerland	
<i>Motorcoach tire fire prevention</i>	706
Rhoads (Rody) Stephenson, Friedman Research Corp and J Huczek, SwRI, USA	
<i>Motorcoach engine compartment test procedure development</i>	720
Jason Huczek, SwRI and R Stephenson, Friedman Research Corporation, USA	
<i>Aircraft blanket ignition and toxic emission in simulated aircraft cabin fires using the Cone Calorimeter</i>	734
Gordon Andrews, M Bell, L Tang, A Alarifi, H Phylaktou, University of Leeds, UK	
<i>Challenges in establishing design fires for passenger rail vehicles</i>	749
Joe Zicherman, Fire Cause Analysis and C Lautenberger, A Wolski, Reax Engineering, USA	
<i>Thermo mechanical behaviour of panels' assembly exposed to an ISO 834 fire test</i>	765
Jean-Charles Craveur, B Mercier, J Bournot, ISMANS and S Lair, MAPAC Panel, France	

VENTILATION-CONTROLLED FIRES

<i>Determination of the fire behaviour of an acrylonitrile butadiene styrene material using a Controlled Atmosphere Cone Calorimeter</i>	776
Fabien Hermouet, LNE / Institut P', É Guillaume, LNE, T Rogaume, F Richard, Institut P' and X Ponticq, Centre d'Etude des Tunnels (CETU), France	
<i>Experimental investigation of externally venting flames in under-ventilated compartment fires</i>	788
Eleni Asimakopoulou, D Kolaitis, M Founti, National Technical University of Athens, Greece	

WILDLAND/URBAN INTERFACE

<i>Climate impact on forest fire risk in Sweden</i>	804
Francine Amon, J Sjöström, L Vylund, S Fasth, SP Technical Research Inst of Sweden, Sweden	
<i>A model to evaluate infrastructures vulnerability in case of forest fires in wildland-urban interfaces zones</i>	818
Laura Bonora, National Research Council, F Martelli, National Research Council, Italy, N Brchetti Montorselli, DSISTAF, University of Florence and E Tesi, Tuscany Region - Settore programmazione forestale, Italy	
<i>Firebrand accumulation zones in front of structures in wildland-urban interface (WUI) fires</i>	826
Samuel Manzello, NIST, USA and S Suzuki, NRIFD, Japan	
<i>Effect of siding treatment on firebrand production from building components</i>	836
Sayaka Suzuki, NRIFD, Japan and S Manzello, NIST, USA	
<i>On the safety of LPG tanks located in the Wildland Urban Interface during a wildfire</i>	848
Frederic Heymes, L Aprin, P Lauret & S Forestier, Ecole des Mines d'Alès, France	

FIRE INVESTIGATION – Wildland

<i>Relative humidity and wildland fire ignition by cigarettes</i>	860
Tara Henriksen, C Warren, K Lewis, CASE Forensics Corp, USA	
<i>Influence of moisture and organic content on cigarette ignition of potting soil samples</i>	867
Amanda Robbins, M Bodnar, M Lejeune, P Senez, SERECA, Canada	
<i>Spot fire ignition of natural fuel beds by hot aluminum particles</i>	879
James Urban, C D Zak and C Fernandez-Pello, University of California Berkeley, USA	

FIRE INVESTIGATION

<i>Effects of cooking on the thermal ignition behavior of vegetable oil</i>	889
Delmar Morrison, S Dee, B Cox, R Hart, R Farina, Exponent Inc, USA	
<i>How can a wood pellet stove cause a fire?</i>	905
Herve Breulet, ISSeP, Belgium	
<i>Investigation of the fire hazard of mixed material piles in recycling facilities</i>	919
Nicole Nagy, P Mulherin, M DiDomizio, E Weckman, University of Waterloo, Canada	
<i>How PVC-insulated cables exposed to radiant heat fluxes cause short circuits and arc beads</i>	933
Tomoyasu Iwashita, Yamanashi Prefectural Police HQ / Tokyo Univ of Science, Y Hagimoto, Hagimoto Fire Research Lab, O Sugawa, Tokyo Univ of Science, Japan and M Keller, ATF Fire Research Lab, USA	
<i>Fish tank heater fire analysis</i>	946
Kevin Lewis, D Murphy, S Scheiff, T Henriksen, Case Forensics, USA	
<i>A detailed look at the necked vessel flame thrower effect</i>	957
Richard Meier, P Kennedy, G Gorbett, K Smith and P Powell, John A Kennedy Assocs, USA	
<i>Gas-fired space heaters: Defective products, defective standards, and burned victims</i>	972
Vytenis Babrauskas, Fire Science & Technology Inc., USA	
<i>Assessment of damage by fire investigators</i>	987
Lee McCarthy, Crane Engineering, J Geiman, Fire & Risk Alliance, USA	
<i>Investigation on the Pontine Tower fire</i>	1002
Cristina D'Angelo, Department of Firefighters, Department of Environmental Protection and Green-Civil Protection, Rome Municipality, S Di Maria, Fire Brigade of Latina, Ministry of the Interior, Italy	
<i>Evaluation of fire spread in the large Lærdal fire, January 2014</i>	1014
Anne Steen-Hansen, A Gagnat Bøe, K Hox, R Fjellgaard Mikalsen, J Stensaas, K Storesund, SP Fire Research AS, Norway	
Author Index	1025
LATE PAPERS	1030
<i>Time until flashover as a function of polyurethane content in a cell or structure</i>	1031
Kate Grimwood, Australian Inst of Forensic Fire Investigation, M Tahtouh and C Roux, University of Technology, Sydney, Australia	
<i>Gas temperature and concentration measurements in the vicinity of a burning/decomposing carbon-epoxy aircraft composite material</i>	1046
Sean Kearney, A Dodd, A Bohlin, C Kliewer, Sandia National Laboratories, USA	