International Association for Fire Safety Science

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Fire Safety Science News

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Editors:

Nils Johansson, Lund University

Xinyan Huang, Hong Kong Polytechnic University

IAFSS was founded in 1985 with the primary objective of encouraging research into the science of preventing and mitigating the adverse effects of fires and of providing a forum for presenting the results of such research

Secretariat Office: Email: office@iafss.org

EDITORIAL BOARD

Our Aims

Fire Safety Science News aims to be a platform for spreading the work of IAFSS members, and to be the place where fire safety scientists can read what is not readily found elsewhere, thus favoring news and trending research. A digital archive of previous issues can be found online.

IF YOU HAVE NEWS OR OPEN POSITIONS TO POST TO THE WEBSITE

The newsletter only comes out twice a year, but the IAFSS website is always available for current association news and information. If you have information that you would like posted on the website, contact the team of webmasters at webmaster@iafss.org and they will help you out. The IAFSS website and its social media will regularly update job postings from universities and research institutes.

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LETTER FROM THE CHAIR

This is my first message as the Chair of the International Association for Fire Safety Science (IAFSS). I have been an enthusiastic member of IAFSS for over the last twenty years. Since its establishment in 1985, IAFSS has always been dedicated to advancing education and research in fire safety science and technology, as well as disseminating useful research results to the fire engineering community. Currently, we have a total of 676 active members, including 194 lifetime members, 79 three-year members, 145 one-year members, and 228 student members. It has been my great honor to be able to serve IAFSS with the support of many individuals within our association. Over the past ten years, I have collaborated with colleagues from the fire community and greatly appreciate the significant amount of time that many IAFSS members have volunteered towards our association's goals. Through our collective efforts, IAFSS has made remarkable progress in advancing fire safety science and engineering research, as well as promoting education on fire prevention and mitigation. The field of fire safety science has experienced rapid development with numerous achievements that have contributed to advancements in fire safety engineering and technologies. Thank you all for your tremendous support!

The success of IAFSS is strongly demonstrated by the International Symposium on Fire Safety Science (IAFSS Symposium). Over the past decade, I have actively participated in various capacities at the IAFSS Symposiums, including serving as the Chair for the Poster Session of the 12th Symposium (2017), Program Scientific Co-chair of the 13th Symposium (2020), and Symposium Planning Committee Co-Chair of the 14th Symposium (2023). In 2023, we witnessed the tremendous success of the highly acclaimed 14th IAFSS Symposium in Tsukuba, Japan during Oct. 22-27 held in-person format, with a total of 496 registered guests from 34 countries and regions. The symposium encompassed ten tracks covering Material flammability, toxicity, and related testing methods; Fire spread; Enclosure fire dynamics; Flame dynamics and modelling; Fire suppression; Structures in fire; Wildland fires and other large outdoor fires; Evacuation and human behavior; Fire risk analysis and fire safety design; as well as Emerging issues and special applications. The symposium featured a total of 150 oral presentations and 254 poster presentations. We successfully organized engaging workshops over two days, consisting of 15 sessions that attracted nearly 200 registered participants.

Additionally, we were honored to have an Emmons Invited Plenary Lecture delivered by Professor David Purser, along with five insightful plenary speeches from Professors. Yuki Akizuki, Eulàlia Planas, Stanislav Stoliarov, Jennifer Wen and myself. All of the great papers and presentations by our members continued the tradition of sharing high-quality research findings with the broader community. I would like to express my sincere gratitude to the Co-chairs and members of various committees for their exceptional contributions in putting together such a high-quality program of plenary talks, selected papers and posters, workshops and other activities. Special thanks are extended to Professors Arnaud Trouvé and Anna Stec as the Symposium Planing Co-chairs, Dr. Yi Wang and Professor Erica Kuligowski as the Program Scientific Committee Co-Chairs, as well as Professors Ritsu Dobashi, Kazu Kuwana and Yuji Nakamura as the Local Organizing Committee (LOC) Co-chairs. The representative LOC members from Tokyo University of Science, Kyoto University, Waseda University, and the Building Research Institute, as well as the Japanese Association for Fire Science and Engineering (JAFSE) and JTB (professional event supporter), are greatly appreciated.

Besides the IAFSS Symposium, significant progress has also been achieved in the working groups, committees, subcommittees, and related activities of the association over the past three years. I would like to express my heartfelt gratitude to Dr. Brian Meacham for his exceptional leadership as the IAFSS Chairperson. Undoubtedly, our association has faced numerous challenges during this period due to the COVID-19 pandemic. Throughout it all, Brian has demonstrated unwavering dedication and remarkable leadership qualities, ensuring substantial advancements in various aspects of the IAFSS. It is truly impressive that whenever I reached out to Brian with a message, he would promptly respond within minutes with detailed suggestions and opinions. We can all appreciate how much time and effort Brian has devoted to the success of our association. Thank you sincerely, Brian!

Additionally, I would like to thank the Management Committee members who have completed their service with significant contributions to our association. I am immensely grateful for the tremendous efforts of individuals such as Professor Arnaud Trouvé, Professor Elizabeth Weckman, Professor Margaret McNamee, Professor Charles Fleischmann, Professor Jennifer Wen, Professor Longhua Hu, Dr. Jason Floyd, Professor Patrick van Hees, Dr. Yi Wang, Prof. Erica Kuligowski, Professor Yuji Nakamura, Professor Ritsu Dobashi and many others. You play a crucial role in sharing this knowledge with the global community. The outstanding services and contributions

provided by each one of you have laid a solid foundation for the future development of the IAFSS. Thank you all sincerely!

Moreover, I would like to express my heartfelt gratitude to Barb Waronek, who has generously dedicated her time and expertise as the Secretariat for our association for several years. Her extensive experience in scientific associations (including the Combustion Institute and the IAFSS) and exceptional efforts have greatly benefited the IAFSS and made valuable contributions to the fire community. As of December 2023, she has retired from this position after making every effort to ensure a smooth transition to the new Secretariat. She also kindly provided me with insightful suggestions for potential improvements in the future. Thank you so much, Barb. It has been an absolute pleasure collaborating with you over these past few years.

I would also like to express my gratitude to the new editors of the IAFSS newsletter, Xinyan Huang (Hong Kong Polytechnic University) and Nils Johansson (Lund University), who have taken over this responsibility following the unfortunate loss of our esteemed former editor Dr. Rita Fahy. It brings me great joy to witness the exceptional work that Xinyan and Nils have been doing. Thank you.

With a history spanning over thirty years, IAFSS has evolved into a mature international organization. However, it is important to acknowledge that IAFSS is still relatively young and faces numerous challenges. Fire, as a phenomenon, possesses significant complexity due to its intricate interplay of chemical reactions, heat transfer, and fluid mechanics across diverse scenarios and controlling mechanisms. As Professor Hoyt C. Hottel (1903–1998) aptly described, “A case can be made for fire being, next to life processes, the most complex of phenomena to understand.” Moreover, fire safety science encompasses various disciplines and necessitates collaboration with multiple fields (naturally full-of-diversity). Addressing fire-related issues always presents an arduous task for humanity. The key challenges faced by the association include further promoting fire safety science, establishing connections between fundamental and applied fire research endeavors, fostering interdisciplinary collaborations among individuals from different backgrounds, and enhancing diversity in various activities undertaken by the association while also encouraging greater involvement of young people.

A major challenge in the governance of IAFSS arises from the fact that it now operates under a new structure, which includes the introduction of charity trustees and the Membership Advisory Council (MAC) as new entities within the association. This achievement is reflected in three essential official governance documents: the Constitution, the Rules, and the Terms of Reference (ToR). These documents encompass numerous clauses that delve into intricate details across various aspects. Special thanks are extended to Professor Beth Weckman, Dr. Brian Meacham and previous members of the Governance & Strategic Planning Committee who made significant contributions to drafting these documents.

We also face the challenge of promoting diversity, equity, and inclusion (DEI) within the fire community. These three interconnected values aim to create an inclusive environment for individuals from diverse racial backgrounds, ethnicities, religions, abilities, genders, and sexual orientations. Undoubtedly, the DEI principle plays a vital role in the success of the IAFSS by attracting more members from underserved populations and disciplines. It also enables expansion beyond our current three regions and fosters new relationships with other organizations. We will strive to fully support the IAFSS goal of becoming a diverse, inclusive, ethical, and environmentally responsible professional society that treats all its members and entities it interacts with during any activities equitably.

In 2023, charity trustees and members of the MAC were elected following a process outlined in the new governance documents, including myself as Chair. I am humbled and honored to be elected to this position, and I will do my best to serve the association in this capacity. The current trustees (as the Executive Committee members) are as follows:

- Professor Naian Liu, China – Chair
- Professor Albert Simeoni, USA - Honorary Treasurer / Vice Chair Finance
- Professor Anthony Abu, New Zealand - Honorary Secretary
- Professor Nieves Fernandez Anez, Norway - Vice-Chair Diversity, Equity, Inclusion
- Dr Eric Guillaume, France - Vice-Chair Member Services
- Professor Yuji Nakamura, Japan - Vice-Chair MAC & Symposium Planning Committee
- Professor Arnaud Trouvé, USA - Vice-Chair Education
- Professor Elizbeth Weckman, Canada - Vice-Chair Governance & Strategic Planning
- Professor Jennifer Wen, UK – Vice-Chair Research
- Dr Brian Meacham, USA – Immediate Past Chair

The current MAC members include Dr. Natalia Flores-Quiroz, South Africa; Dr. Bronwyn Forrest, Canada; Dr. Rory Hadden, Scotland; Prof. Kazunori Harada, Japan; Prof. Xinyan Huang, China; Prof. David Lange, Australia; Prof. Brian Lattimer, USA; Prof. Ken Matsuyama, Japan; Dr. Sara McAllister, USA; Prof. Shuna Ni, USA; Prof. Thomas Rogaume, France; Prof. Enrico Ronchi, Sweden; Dr. David Rush, Scotland; Prof. Miho Seike, Japan; Dr. Yi Wang, USA; Prof. Yu Wang, China; Prof. Wojciech Węgrzyński, Poland; Prof. Felix Wiesner, Canada.

As the Chair, I am wholeheartedly dedicated to serving the international fire safety community with the utmost commitment and enthusiasm. My goal is to actively promote interdisciplinary development in the field of fire safety science. I am excited to collaborate with all members of IAFSS and other individuals within the fire community over the next two years, aiming to continue making a positive impact on the world. I eagerly anticipate working with our members and hope that you will be able to assist us in meeting the numerous challenges and achieving our association's goals.

Signed: Naian Liu, Chair of IAFSS, SKLFS, China

MEMBERSHIP REGISTRATION

Both current and new members can easily register online at www.iafss.org. *Current members: please sign-in before registering to maintain your account!*

Next year, when we ask you to renew your membership in IAFSS, you will see that the fees have increased from £25 to £50 per year. We recognize this will seem to be a very large increase; however, the need for higher membership dues is being driven by a number of factors.

First, look at all the benefits that you get for your membership fee! These include:

- Free online access to the Fire Safety Journal – the official journal of IAFSS (the new dues approximately equal the cost for two FSJ articles)
- Free access to all prior IAFSS Symposium Proceedings with full papers online
- Discounted registration fees for the IAFSS Symposium (the discount is more than the cost of yearly membership)
- Up-to-date job postings, PhD and post-doc opportunities, and latest news in fire safety science
- Access to, and participation in, working groups with international colleagues such as HBiF, LOF&BE, and MaCFP, including the growing webinar series.
- IAFSS Newsletters, where you can share your institution's activities and learn about others.
- Access to FRS fire research notes
- A vote in Association affairs
- Opportunities to network with colleagues

Looking forward, we want to do even more! We are currently exploring support for PhD Summer Schools (such as that recently held at the University of Maryland), support for new workshops or webinars, developing and expanding mentoring/networking opportunities for early career researchers, exploring partnerships at other fire related conferences, expanded student travel support to IAFSS symposia and more. Additional suggestions from you, our members, are always welcome. Per our mandate, supported activities will remain those that are beneficial to fire science and fire safety.

As you would guess, providing all that we do, and trying to do more, requires a sound financial footing and increased funding for the organization. A membership fee increase will help significantly with this. The fees for membership in IAFSS have not been changed in over 12 years. At the same time, we have expanded member benefits, upgraded our website, and our fixed expenses continue to rise due to inflation. Coupled to this, IAFSS re-registered with the UK Charity Commission as a Charitable Incorporated Organisation (CIO), which provides us protections over our past form of organization, enhances our ability to accept donations, and brings us into compliance with UK regulations. As a result of becoming a CIO, the organization will incur new, on-going costs associated with ensuring we comply with important regulations around such things as safeguarding members, diversity, equity and inclusion, data privacy and ensuring accessibility of our website.

At present, the reality is that dues cover only a fraction of the organization's expenses. For the remaining costs, IAFSS relies on income from investments and profit from our symposia, which as we learned with COVID-19, can be impacted by unforeseen events. Reliance on these two uncertain revenue streams for fixed expenses is not a best practice, nor does it leave any room for undertaking the many new initiatives that have been suggested by our membership. We hope you understand and are willing and able to help us continue to do more for you - our members - by continuing your membership next year and beyond, and continuing to volunteer your time for our association and to fire safety science and engineering more broadly. Thank you!

Please contact office@iafss.org with any questions about membership or how to register.

UPDATES FROM IAFSS WORKING GROUPS

Measurement and Computation of Fire Phenomena (MaCFP) Working Group

The general objective of the "IAFSS Working Group on Measurement and Computation of Fire Phenomena" (i.e., the "MaCFP Working Group") is to establish a structured effort in the fire research community to make significant and systematic progress in fire modeling, based on a fundamental understanding of fire phenomena.

The MaCFP Working Group is intended as an open, community-wide, international collaboration between fire scientists (both experimentalists and modelers). All members of the fire safety science community who are interested in participating in the MaCFP effort are encouraged to:

1. Star/watch the MaCFP repositories for regular updates (condensed-phase, gas-phase, radiation)
2. Join our mailing list (if you are not already receiving emails from us)

The MaCFP-3 Workshop:

Approximately 100 participants attended the third MaCFP workshop (MaCFP-3), which was held on Sunday October 22, 2023 as a pre-event to the 14th IAFSS Symposium in Tsukuba, Japan. The workshop featured oral and poster presentations of experimental data and computational results, and analysis of successes, challenges and knowledge gaps. It also provided time for open discussion and interactions amongst participants. Cases considered included:

- Condensed-phase experiments (gasification experiments of MaCFP-PMMA)
- Gas-phase fire configurations (liquid pool fires and co-flow diffusion flame experiments)
- Fully-coupled cases corresponding to flame spread over a combustible solid in a 1.5-m corner wall configuration (SBI) and a 2.44-m parallel panel configuration (FM 4910)
- Synthetic validation data for improved model descriptions of thermal radiation transport in fire as presented by the new MaCFP Radiation Subgroup.

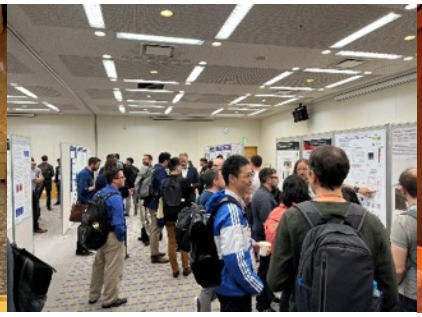
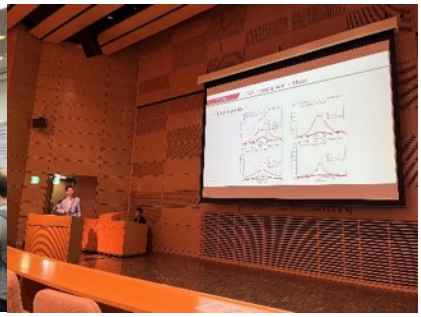
MaCFP-3 proceedings have been drafted and will be submitted for review by summer 2024. PDF copies of each of the MaCFP-3 presentations (including the workshop summary and participant feedback/discussion) are available online: https://github.com/MaCFP/macfp-db/releases/tag/macfp-3.0.

Next Steps:

All participants of the MaCFP-3 workshop are encouraged to provide feedback using this form (what worked, what didn't; timing of future meetings, next steps, how you can support the MaCFP effort).

Members of the organizing committees of each of the three MaCFP subgroups (condensed-phase, gas-phase, and radiation) will contact participants of their respective mailing lists to coordinate participation in interim meetings between 2024 and 2025 in preparation for the MaCFP-4 Workshop (which will be coordinated as a pre-event to the 15th IAFSS Symposium in La Rochelle, France [June 2026]).

For more information, please visit: https://iafss.org/macfp

Large Outdoor Fires and the Built Environment (LOF&BE) Working Group

On March 2024, ISO Technical Committee (TC) 92 Fire Safety, **Published** ISO 6021:2024 Firebrand Generator. The ISO firebrand generator is based on the firebrand generator developed by Samuel L. Manzello (Tohoku University, Japan and Reax Engineering, USA) and Sayaka Suzuki (Tokyo Institute of Technology, Japan). The firebrand generator is an experimental device that affords the ability to develop continuous firebrand showers seen in wildland-urban interface (WUI) fires, wildland fires, and urban fires. The ISO firebrand generator is a laboratory-scale version of the full-scale firebrand generator developed for large-scale experimentation, also developed by Manzello. These technologies are colloquially known as the Dragon. Firebrand showers are an important driver of fire spread in large outdoor fires. The ISO Firebrand Generator represents the first and only internationally accepted harmonized device for generating firebrand showers. Other approved work in ISO TC92/WG14 is the revision of ISO TR24188:2022. ISO/AWI TR 24188 - Large outdoor fires and the built environment — Global overview of different approaches to standardization.

Signed by Samuel L. Manzello (Convenor of ISO TC92/WG14, with Tohoku University, Japan and Reax Engineering, USA)

The Large Outdoor Fires and the Built Environment (LOF&BE), a permanent working group of the International Association for Fire Safety Science (IAFSS), held two workshops at the 14th IAFSS Symposium in Tsukuba, Japan on October 22, 2023. The first session focused on the Emergency Management and Evacuation (EME) subgroup. The EME subgroup focuses on developing the scientific basis for effective emergency management strategies for communities exposed to large outdoor fires. The second workshop session focused on the Ignition Resistant Communities (IRC) subgroup. The IRC subgroup focuses on developing the scientific understanding that will lead to new standards, testing methodologies, and mitigation strategies indicative of large outdoor fire exposures, including the ones from wildland to communities and within communities. In both workshops, progress from each subgroup was reported; several working group members gave short, invited presentations; and open discussions were held. A total of 53 participates pre-registered for the EME workshop, while 46 participants pre-registered for the IRC workshop. Countries of origin of the attendees include United States, Canada, Japan, China, Australia, New Zealand, South Africa, Spain, France, United Kingdom, Germany, and Norway. The workshop report has been completed and will appear soon.

Dr. David Rush has stepped down after the IAFSS in Japan. IAFSS LOF&BE thanks him for his many years of service! After an open call for new members to join the Fire Service Advisory Panel (FSAP), and the IRC subgroup co-leadership, the following new members have been added:

IAFSS LOF&BE Management Team
Co-Leaders
Samuel L. Manzello, Reax Engineering, USA and Tohoku University Japan
Sara McAllister, USDA Forest Service, USA
Sayaka Suzuki, Tokyo Institute of Technology, Japan

Ignition Resistant Communities (IRC) Subgroup Leaders
Alexander Filkov, University of Melbourne, Australia
Nima Masoudvaziri, Berkshire Hathaway Specialty Insurance, USA
Rafal Porowski, AGH University of Krakow, Poland

Emergency Management and Evacuation (EME) Subgroup Leaders
Rahul Wadhwani, USDA Forest Service, USA
Yu Wang, USTC, China

Fire Service Advisory Panel (FSAP)
Haonan Chen, USTC and Henan Fire and Rescue Brigade, China
Mark Chubb, Seattle Fire Department, John Jay College of Criminal Justice, City University of New York, USA
Robert Cook, Tesco UK Fire Safety Manager, UK
Ethan Foote, CALFIRE, Retired, USA
Charles Scawthorn, University of California at Berkeley and SPA Risk LLC, USA
Chia Lung (Farian) Wu, Chang Jung Christian University, Taiwan, formerly National Fire Service of Taiwan

Signed: Samuel L. Manzello, Sara McAllister, and Sayaka Suzuki (IAFSS LOF&BE Co-Leaders)

Updates from LOF&BE members: Fire Safe African Homes in the Wildland-Urban Interface Project (AfriWUIFire). The Japan Science and Technology Agency (JST), under the program known as Africa-Japan

Collaborative Research (AJ-CORE), has funded a new three-year initiative for Japan to join together with Botswana and South Africa to improve the resilience of African homes located in the wildland-urban interface (WUI). Work will be centered on homes and structures in communities located in WUI areas in Southern Africa. Specifically, the project will address the impact of firebrands on property loss. WUI fires continue to spread across the globe, and experts from Botswana, Japan, and South Africa are joining together to try to help the thousands of people impacted by these disasters in Southern Africa. A kick-off workshop, organized by DRST(Botswana)-NRF (South Africa)-JST(Japan), is being held in Maun, Botswana, in April, 2024. The project team is a joint effort among the following organizations:

Tokyo Institute of Technology, Japan

Prof Sayaka Suzuki is an Associate Professor at Department of Mechanical Engineering, Tokyo Institute of Technology, Japan since 2023. Sayaka obtained her PhD in Chemical Engineering from University of Tokyo in 2009. After graduation, Sayaka was a Guest Researcher in the Fire Research Division, NIST for 3 years, working on Wildland-Urban Interface (WUI) fires. Sayaka spent next 10 years at National Research Institute of Fire and Disaster, Japan, expanding her research into urban fires. She is the recipient of the 2018 Uchida Award from JAFSE, the 2017 Young Investigator Award and the 2021 IAWF Early Career Award in Fire Science.

Tohoku University, Japan

Prof Samuel L. Manzello is visiting Professor, Tohoku University, joint with Reax Engineering, Inc. His research is featured in *Nature* and *Science,* and he received the Samuel Wesley Stratton Award, NIST's highest award for fundamental research. Samuel was an invited speaker by the National Academies of Science, Engineering, and Medicine. He has served as Guest Editor for six different journals. Service includes convenor of ISO TC92/WG14 and co-leader of the IAFSS working group LOF&BE. Springer Nature requested him as Editor in Chief on the first encyclopedia on wildland fires/WUI fires. He obtained his PhD in Mechanical Engineering from the University of Illinois-Chicago.

Botswana University of Agriculture and Natural Resources

Prof Rejoice Tsheko graduated from McGill University and the University of Newcastle Upon Tyne. He teaches engineering and remote sensing at the Botswana University of Agriculture and Natural Resources. His completed research and consultancy projects include UNESCO "the Application of Remote Sensing for Integrated Management of Ecosystems and water Resources in Africa"; European Space Agency Sponsored Tiger Project; Desert Margins Program; AMESD Program and MESA. He was also engaged by the AUC through the AMESD project to develop the SADC THEMA agriculture service products validation protocol. He is competent in advanced image classification methods. He developed e-modules for "remote sensed information for crop monitoring and food security" Joint Research Council IES.

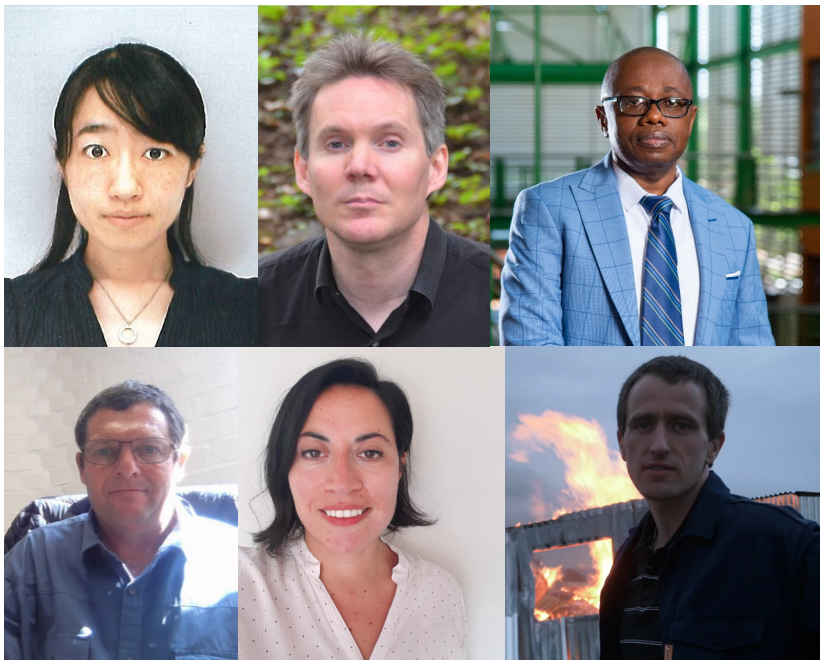
Sol Plaatje University, South Africa

Dr Doug Harebottle is the head of the Risk and Vulnerability Science Centre at SPU and has extensive experience in biodiversity, risk, GIS, and other associated fields. He has a background in zoology with extensive contributions in ornithology. He was part of the Kimberley Tri-Biome project under the Expanded Freshwater and Terrestrial Observation Network. He served as head of department of the Biological and Agricultural Sciences Department at SPU. He is the associate editor of the Journal of African Ornithology. He coordinates research activities of his team focused on climate change with a focus on the arid zone and Northern Cape.

Stellenbosch University, South Africa

Prof Richard Walls is the head of the fire engineering team at Stellenbosch University. Various fire related topics are currently being investigated, such as the design of steel structures in fire, analysis of structures in fire, forensic fire investigations, 3D printed concrete in fire, material behaviour, multi-storey timber fires and informal settlement fire behaviour. Consulting work has been done for companies developing rational structural fire design systems, repairing fire-damaged structures, forensic investigations and technical guidance on fire safety specifications. He was part of the team analysing the Knysna fire disaster that investigated why almost 1000 homes were lost in South Africa's largest wildland fire disaster.

Dr Natalia Flores Quiroz is senior lecturer with experience in fire safety engineering. She worked for five years as a fire safety engineer in the mining industry before joining academia. Her PhD focused on fire investigations in informal Settlements where I reconstructed past incidents to understand the fire spread, the residents' behaviour and the firefighters' operations. Her main research areas are reconstruction of incidents in low-income settlements (i.e., informal settlements, refugee camps) and wildland urban interface (WUI) fires. She was one of the Research Fellows for the Society of Fire Protection Engineers Grand Challenge Initiative and is on the Membership Advisory Council for the International Association for Fire Safety Science.



Top images from left to right: Prof. Sayaka Suzuki, Prof. Samuel L. Manzello, Prof. Rejoice Tsheko
Bottom images from left to right: Dr. Doug Harebottle, Dr. Natalia Flores Quiroz, Prof. Richard Walls

Signed: Sayaka Suzuki (Tokyo Institute of Technology, Japan), Samuel L. Manzello (Tohoku University, Japan and Reax Engineering, USA), Rejoice Tsheko (Botswana University of Agriculture and Natural Resources, Botswana), Doug Harebottle (Sol Plaatje University, South Africa), Richard Walls and Natalia Flores-Quiroz (Stellenbosch University, South Africa)

Human Behaviour in Fires (HBiF) Working Group

The IAFSS Human Behaviour in Fires (HBiF) permanent group is currently focused on two tasks, namely, 1) the development of a research roadmap for our field and 2) a webinar series to promote the exchange of knowledge.

Regarding the research roadmap, we have published the first journal paper out of our work, which presents a bibliometric analysis of the human behaviour in fire field. The paper is called "Human behaviour in fire: Knowledge foundation and temporal evolution" and has been authored in Fire Safety Journal by M. Haghani, R. Lovreglio, M. Langridge Button, E. Ronchi and E. Kuligowski. You can find an open access link to download the article here: https://doi.org/10.1016/j.firesaf.2023.104085

We are currently working on additional journal articles assessing the research gaps in the field and presenting the results of the workshops arranged in Autumn 2023 regarding research obstacles that contribute to them. During IAFSS 2023 in Japan, we also conducted a successful workshop during which there was fruitful discussion concerning the ongoing and future activities of the Human Behaviour in Fire group. Most importantly, we also presented a memorial for Dr Rita Fahy, a worldwide known expert in our field who recently passed away.

Our webinar series is continuing, and recordings of our past events are available on the working group's YouTube channel, where we crossed the milestone of 3,500 views and 200 subscribers. You can subscribe to our YouTube channel here: https://www.youtube.com/channel/UCSqMIEaZ08r5BrtOb5q2d0Q

Our most recent webinars are:
Webinar 9 – Human Behaviour in wildfire evacuation: Data collection challenges and research needs– by Stephen Wong, University of Alberta, Canada
Recording: https://www.youtube.com/watch?v=Rv0N8Hdn7a4

Webinar 10 – Early career researchers on crowd evacuation – by Hossein Tavana (Hydrock, UK), Yunhe Tong (University of Edinburgh, UK) and Khadija Baig (Carleton University, Canada)
Recording: https://www.youtube.com/watch?v=2v1PKWfxehM

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We would like to thank all task group leads for the research roadmap:
Natalie van der Wal, Delft University of Technology, The Netherlands
Erica Kinkel, Delft University of Technology, The Netherlands
Milad Haghani, University of New South Wales, Australia
Ruggiero Lovreglio, Massey University, New Zealand
Mary Button, Delta Fire Engineering Ltd, UK
Kate Kapalo, Western Fire Chiefs Association, USA

Signed:
Erica Kuligowski (RMIT University, Australia) - erica.kuligowski@rmit.edu.au
Enrico Ronchi (Lund University, Sweden) - enrico.ronchi@brand.lth.se

FIRE SAFETY JOURNAL: THE OFFICAL JOURNAL OF IAFSS

Fire Safety Journal is the official journal of IAFSS. Its scope is purposefully wide, as it is deemed important to encourage papers from all sources within this multidisciplinary subject. Research covers a range of topics including but not limited to:

- Fire chemistry and physics
- Fire dynamics (including gas explosions)
- Active fire protection systems, including detection and suppression
- Passive fire protection methods
- People/fire interactions (physical, physiological and psychological)
- Fire safety management
- Assessment and quantification of fire risk (including acceptability of risk)
- Fire investigation
- Fire safety design (including consumer items, industrial plant, transportation, buildings)
- Fire safety legislation
- Fire safety education.
- Original contributions relating to any of the above topics are invited, particularly if they incorporate a quantitative approach to the subject in question.

Editors are Luke Bisby and Bart Merci

Link to Fire Safety Journal (ScienceDirect)

NEWS FROM MEMBERS

News submitted by members are included in this section, the contributions are not arranged in any specific order. Editorial edits have been made in the submissions.

ARUP

Arup will be actively participating in key conferences within the Europe Region over the Spring and Summer of 2024. We look forward to sharing insights on the risks posed by emerging technologies when developing robust performance-based design solutions. We will also be speaking on the need to revisit many of the design assumption associated with residential evacuation, exploring novel solutions to address aging residential stock. Some upcoming conferences where we will be sharing these insights are:

Copenhagen SFPE Fire Safety Conference and Expo on Performance Based Design 17th to 19th April 2024

- An Australian Regulatory Response to the Grenfell Building Fire- Impacts on Performance Based Fire Safety Engineering. Speaker: Peter Johnson Arup.
- Safe Evacuation for All - Fire Safety Equity at Scale: Enabling Lift Evacuation in Existing Residential Buildings- Speaker: Tony Park Arup.
- External Fire Spread Considerations for Timber Buildings. Speaker: Rory Turnbull Arup.
- Revisiting Seminal Experiments that Led to Very Low Fire Resistance Periods for Car Parks – Speaker Sigurjon Ingolfson.
- Applications of Holistic Quantitative Risk Assessments- A Case Study. Speaker: Sigurjon Ingolfson, Nate Lobel, Arup.
- Poster Presentation on Lessons learned from Safety Cases in High Rise Residential Buildings. Presented by Lorna Johnson.
- Performance-based fire safety strategy case study for a proposed Co-living/living Facility project: Presented by Joshua Teh, Gizelle Danine Jamero, Annachiara Nardone with Students from the IMFSE programme.

Portugal 19th to 21st June 2024

13th International Conference on Structural Fire

- Revisiting Carpark Structural Fire Requirements. Speaker: Sigurjon Ingolfson Arup

Signed: Kenneth Wynne

University of Cantabria

Project GAIA receives funding for research in forest fires prevention, management and reforestation

The University of Cantabria (UC), represented by the GIDAI Group, is actively involved in the national research project GAIA. The primary aim of GAIA is to enhance the understanding of forest environments by employing intelligence, context awareness, and real-time assessment of fire hazard levels, as well as to provide support in decision-making. This goal will be achieved through the development and implementation of innovative technologies in the forestry sector. These technologies include intelligent autonomous systems, sensor integration into firefighting gear (such as suits and exoskeletons), embedded systems, artificial intelligence, and command and control centers.

The consortium comprises 10 partners, including 6 companies, 2 technological centers, and 2 universities. Among these partners are CIC Consulting Informático, FECSA - Fábrica española de Confecciones, Gogoa Mobility Robots, CELESTIA | TST, ZENON INNOVATIONS S.L., Tekniker, University of Cantabria, Rey Juan Carlos University, Andalusian Foundation for Aerospace Development, with GTD-System & Software Engineering leading the consortium. The project has a budget of approximately 5.8 million euros, with funding of nearly 4 million euros, and is set to continue until the end of December 2026.

GAIA is a national research project funded by CDTI Innovación, a public entity under the Ministry of Science, Innovation, and Universities, in collaboration with the State Research Agency. It falls under the 'R&D&I Projects in Strategic Lines - Transmissions 2023' program, which promotes public-private partnerships to address

challenges identified as thematic priorities. The project has been awarded the Grant PLEC2023-010303, funded by MICIU/AEI/10.13039/501100011033.

From past to future: The role of computational fluid dynamics in advancing nuclear safety in Spain and Portugal

A paper entitled "From past to future: The role of computational fluid dynamics in advancing nuclear safety in Spain and Portugal" has been published in the journal International Nuclear Engineering and Design. This paper explores the role of CFD in nuclear safety studies, with a particular focus on advancements in Spain and Portugal. The field of nuclear safety has increasingly included CFD models to address complex safety–critical phenomena, given their ability to capture three-dimensional behavior with high resolution. In the context of Spain and Portugal, this document shows the contribution to CFD applications for nuclear safety research. The topics covered code development and validation, combustion studies, simulations of nuclear spent casks, fuel assembly analyses, and investigations into containment safety issues. These advances have mainly contributed to improving the predicting capabilities of CFD models for applications in various safety–critical domains. In addition to detailing the achievements and contributions in the field of CFD in Spain and Portugal, readers will find a comprehensive overview of the current challenges and future perspectives of CFD within the domain of nuclear fission technology.

The paper highlights the role of the Universidad de Cantabria together with the Spanish Nuclear Safety Council in the study and computational modelling of fires in Nuclear Power Plants. The paper is available for consultation at: https://doi.org/10.1016/j.nucengdes.2024.113083

Two new publications associated with the TRACES project

Two recent scientific contributions related to the project "TRACES: UNDERSTANDING HUMAN BEHAVIOUR IN CASE OF TERRORISM ATTACKS IN MASS GATHERING BUILDINGS" funded by MICIU/AEI/10.13039/501100011033 under grant PID2019-106025RB-100, have been released.

The first publication, titled “Uncovering non-emergency-related factors in threat responses: Logistic regression analysis of online experimental data for behaviour patterns”, has been published in the International Journal of Disaster Risk Reduction. This paper addresses human behavior and evacuation decisions during emergencies such as fire alarms, explosions, and shootings. It analyzes 18 trials involving 1,807 participants, examining the impact and influence of 20 non-emergency-related factors using logistic regression and resulting in a predictive decision model for each situation. In all scenarios, a significant majority of individuals chose to stay rather than evacuate. The study concluded that the factors and their level of influence vary across emergencies. The paper can be downloaded at: https://doi.org/10.1016/j.ijdrr.2024.104349

The second publication, titled “Logistic regression vs machine learning to predict evacuation decisions in fire alarm situations”, has been published in the journal Safety Science. This study focuses on analyzing fire alarm data. Using a data-driven approach, the performance of logistic regression techniques and seven machine learning algorithms were evaluated to predict evacuation decisions. Key contributions include: 1) Confirming and supporting observations from previous studies indicating that most occupants do not react effectively to fire alarms, 2) Generating quantitative data with potential use for predicting human behavior in fire evacuation situations, and 3) Finding that both logistic regression and machine learning models are capable of accurately predicting factors influencing people's evacuation decisions during fire alarms. The paper can be downloaded at: https://doi.org/10.1016/j.ssci.2024.106485

Signed: Mariano Lázaro

University of Canterbury

Christmas Tree Burning Event

The UC Fire Engineering Group demonstrated the burning of Christmas trees. The event was hosted at the Fire Laboratory of the University of Canterbury, attracting a diverse crowd of research students, academic faculty, and industry professionals. To illustrate the growth of the fire, Professor Fleishmann set alight three types of Christmas trees: an artificial tree, a freshly cut tree, and a dry tree. It was a valuable opportunity to facilitate dialogue and cooperation among academics and industry professionals, and to demonstrate the hazard associated with this kind of fire to a wider audience.

Academic staff

The University of Canterbury is proud to announce that **Prof. Jean-Marc Franssen** will be joining our faculty as Visiting Erskine Fellow. Professor Franssen is a renowned expert in the field of fire engineering, having created the SAFIR (Structural Analysis tool) using finite element method for analysing the behaviour of structures during fires. The students at the University of Canterbury will greatly benefit from Professor Franssen's extensive experience and invaluable contributions to the field of structural fire engineering.

The University of Canterbury welcomed **Dr. Aatif Ali Khan** as a lecturer in Fire Engineering. He earned his PhD in structural fire engineering from The Hong Kong Polytechnic University. Aatif is also a Chartered Engineer (*CEng*) from the *Institution of Fire Engineers* (UK) and a *Chartered Member of Engineering New Zealand (*CMEngNZ*).* His research interests include fire modelling, structural fire safety, fire investigation of structural fire accidents and the application of artificial intelligence in fire engineering problems. Currently, he is focusing on developing the fire safety design for firefighters during emergency response and smart firefighting.

New PhD Students

Jeihan Hapsari has just started her PhD which focuses on understanding the vulnerabilities of New Zealand WUI built environment when exposed to wildfires, in the context of a recently granted Minister of Business and Innovation (MBIE) Endeavor Bid “Extreme wildfire: Our new reality, are we ready?”. Previously, Jeihan graduated from the Universitas Indonesia for her master’s degree, research-based with the topic of the dynamics of peatland fires.

<u>Conferences and workshops</u>

Andres Valencia presented his work on Wildland Fire Behaviour at the IX International Conference on Forest Fire Research in Coimbra, Portugal. His work consisted of largescale shrubland wildfire observations using UAV technology.

In a workshop conducted during the 12th International Conference on Structures in Fire (SiF 2022), **Aatif Khan** presented his work and explained how OpenFIRE – a tool for conducting CFD-FEM – can be used by researchers and industry professionals in performance-based designs and fire investigations.

<u>Scholarship and research opportunities</u>

Fire research at the University of Canterbury is diverse and encompasses a broad spectrum of areas, such as the fire safety of mass timber buildings, renewable energy systems, and the built environment, as well as Wildland Urban Interface fire design and modelling, smart firefighting, and other related fields.

A PhD opportunity is available in ‘Wildland Evacuation’. This PhD research aims to assess if and to what extent different urban planning stakeholders consider wildfire evacuation in the New Zealand context. The objective is to determine the impact and retention of the training outcomes. The subject area for this PhD is Civil Engineering (ENCI). The candidate will be part of a much larger team. If this sounds interesting to you, email **Daniel Nilsson** at daniel.nilsson@canterbury.ac.nz with the subject line: Wildfire Evacuation PhD. For more information about this research please visit this link.

Another PhD opportunity is available in the field of wildland fires. This research will be focused on studying the wildfire behaviour of different types of fuel (grass, shrub and crown fires) and explore possibilities to use this

knowledge in the fire engineering space. If interested, contact **Andres Valencia** at andres.valencia@canterbury.ac.nz

Signed: Aatif Khan

European University of Cyprus - CERIDES

Two fire researchers have recently defended their viva. Dr. Anna Marie Gjedrem defended her thesis titled "*Innovative and Sustainable Solutions for WUI Fire Risk Management in Costal Norway*" in November 2023 (supervised by Professor George Boustras, EUC and Professor Monica Metallinou Log, University of Western Norway), Dr. Judith Alexandra Kirschner defended her thesis titled "*Governing wildfire regimes: Creating urgency without a crisis*" in March 2024 (supervised by Professor George Boustras, EUC). Anna moved on as a postdoctoral researcher at the University of Tasmania and Judith as a postdoctoral researcher at the University of Bern.

CERIDES – Excellence in Innovation and Technology coordinates the Horizon Europe WIDERA funded project "SEMEDFIRE – South East Mediterranean Excellence Development in Fire Research". This project is aimed at using the expertise of advanced partners (HazeLab at Imperial College London, Pyrogeography Group at the University of Wageningen, Securite Civile of the French Republic, Nimes Metropole and Pau Costa Foundation) to support CERIDES to become a fire science hub in SE Med. In the context of SEMEDFIRE, in early April 2024 a 3-day workshop in "Integrated Fire Management" was held in Nicosia and Troodos Mountain. The workshop aimed to provide a training background to the fire fighting forces of the Republic of Cyprus. A follow-up workshop was held in Limassol in the context of the Horizon Europe-funded project "ResAlliance - Landscape resilience knowledge alliance for agriculture and forestry in the Mediterranean basin" with an aim to train the local communities and the local on the use of fire landscape design as a means of prevention.

Signed: George Boustras

Fire Testing and Research Center of Hubei, China

The center carries out fire-induced structural collapse tests on a real building

In early November 2023, Professor Chao Zhang's team from Wuhan University, along with research teams from Tongji University, The Hong Kong Polytechnic University, and other units, conducted a full-scale steel truss structure fire collapse real-time warning test in an abandoned building in Yichang City, Hubei Province. The test was led and designed by Professor Guo-Qiang Li 's team from Tongji University, with support from the Department of Fire and Rescue of Hubei Province and the Yichang City Fire Rescue Department for test site provision and on-site assistance. Professor Chao Zhang's team organized and implemented the test through the Fire Testing and Research Center of Hubei Province.

The research on structural fire safety emerged in the 1990s, involving multiple disciplines such as fire science, heat transfer, and structural engineering. It primarily focuses on studying the mechanisms of structural damage during fires and the protective measures to prevent such damage. Previous studies were limited to the evaluation of fire performance of building materials and structures, lacking research on the collapse behavior of structures in real fire scenarios. Additionally, there was a disconnect between research efforts and practical firefighting and rescue operations. The current challenge and frontier of structural fire safety discipline lies in how to bridge this gap and apply research findings to guide firefighting and rescue efforts effectively.

This test perfectly demonstrated the determinism (predictability of structural collapse behavior) and uncertainty (unpredictability of real fire behavior) of real structural fire tests. It also validated for the first time the feasibility of the theory and methods proposed by Professor Guo-Qiang Li's team at Tongji University in recent years, which are based on real-time perception and measurement of fire scenes and AI technology, for building fire collapse warning in real building fire scenarios. This has significant implications for structural fire safety research to be applied in firefighting and rescue operations, marking an important advancement in this field.

Signed: Chao Zhang

Fire Protection Research Foundation

Fire Protection Research Foundation (FPRF) receives funding for two new projects - The Fire Protection Research Foundation, the research affiliate of the National Fire Protection Association® (NFPA®), has received funding for two new projects: (1) One-year project to develop a digital collaborative decision-making tool in the *WUI-SHOW: Assessment of Wildfire Evacuation Data Needs and Prototyping of a WUI-NITY Visualizer* from the National Institute of Standards and Technology (NIST). (2) One-year NIST fire grant to capture current data on smoke alarm and carbon monoxide (CO) alarm installation and operability in U.S. homes in the *Survey on Usage and Functionality of Smoke Alarms and CO Alarms in Households and Data Collection, Evaluation, and Analysis of Local Codes, Regulations, and Laws in Place for the Municipalities Areas Conducted in the Survey – Final Phase".*

2024 Suppression, Detection and Signaling Research and Applications Conference (SUPDET® 2024)– SUPDET® will be held in tandem with the International Conference on Automatic Fire Detection (AUBE'24) in Duisburg, Germany September 24-26th. This conference brings together leading experts in the field of fire protection for the purpose of sharing recent R & D on techniques used for fire suppression, detection, and signaling. Conference registration is forthcoming. Additional information is available here.

Notice of recent FPRF research reports

- ***Fire Service Applications of Robots: A Literature Review*** Technological advancements in robotics have resulted in potential use and development of robots for numerous firefighting applications to support firefighters during various fire scenarios such as structure, vehicle, hazmat, wildland fires etc. In addition, robots can support firefighters with other emergency response operations such as search and rescue, sizing up and locating fire, controlling, and suppressing fire. This literature review report summarize the applications of robots in firefighting including case studies where robots are applied for real-world firefighting applications and identify the recent advancements in robotics technology. For additional information, please visit: https://www.nfpa.org/education-and-research/research/fire-protection-research-foundation/projects-and-reports/fire-service-applications-of-robots-a-literature-review
- ***Evaluation of Multipurpose (ABC) Dry Chemical for Use on or Near Aircraft*** Multipurpose ABC type dry chemical fire extinguishers used near aircraft could disperse into the surrounding environment either by direct impingement or natural dispersion of the particulate. The ABC type dry chemicals consist of monoammonium phosphate as their major component. However, it is not completely understood if monoammonium phosphate is harmful to the aircraft machinery and components with particular regard to corrosion of typical aircraft materials. In this work, a literature review was conducted on the corrosive effects of ABC and BC type dry chemicals on aircraft structures, electrical equipment, and cleaning procedures. A comparison was made to assess the risk of using ABC type fire extinguishers on aircrafts. It is recommended

to avoid the use of ABC type dry chemical fire extinguishers on aircrafts due to the risk of corrosion. For additional information, please visit: https://www.nfpa.org/education-and-research/research/fire-protection-research-foundation/projects-and-reports/evaluation-of-multipurpose-abc-dry-chemical-for-use-on-or-near-aircraft

- ***Review of Emergency Egress and Rescue Challenges in Rail Tunnels*** The aim of the overall research project is to evaluate the consequences on available egress time and emergency response capabilities of new criteria for both distances between exits and means of egress widths in rail tunnels. A literature review and case studies were used as the foundation to define representative fire and egress scenarios in rail tunnels. The U.S. population physical and health characteristics were reviewed for a period extending form the year 2000 to the year 2018. Fire and egress models were developed and executed to evaluate the impact on egress times of: changes in characteristics of the population over time, means of egress changes (i.e. increase of egress walkway width, reduction of exit spacing), emergency responders counterflow during occupants' egress, uni-directional egress. For additional information, please visit: https://www.nfpa.org/education-and-research/research/fire-protection-research-foundation/projects-and-reports/review-of-emergency-egress-and-rescue-challenges-in-rail-tunnels

For more information, visit: www.nfpa.org/foundation

Signed: Jacqueline R. Wilmot

FM Global

FM Global Open Source CFD Fire Modeling Workshop
We are excited to welcome attendees to the 2024 FM Global Open Source CFD Fire Modeling Workshop. This year we have 36 presentations from 17 institutions covering a diverse range of topics including fire dynamics and heat transfer modeling, wildland fires, battery fires, AI/ML, and many more.

The content from past and current workshops is available through the workshop website: https://github.com/fmglobal/firemodelingworkshop.

The next workshop will be held in spring 2025 with further details to be announced later this year.

Post-Doc Program
Open Position
We are seeking high-quality applicants for a post-doctoral position in fire dynamics and material flammability. The position is for a term of up to three years. The role is focused on performing publishable work as part of FM Global's strategic research program under the guidance of senior research staff.

Key areas of research include material flammability and flame heat transfer, advanced laser diagnostic for buoyant turbulent flames, lithium-ion battery fire hazard analysis. The experimental and theoretical studies will be closely integrated with computational fluid dynamic (CFD) model development and validation within the work group.

Full details of the position are available on the FM Global website.

Recently Completed
Lauren Gagnon
Lauren joined FM Global in mid 2021 as a post-doctoral researcher working on the topic of lithium-ion battery fires. Lauren made many valuable contributions to developing our understanding of thermal runaway propagation phenomena in lithium-ion batteries, a crucial topic for fire safety in a world increasingly dependent on battery energy storage systems. Lauren has started her new position as a Fire Protection Consultant with Fire & Risk Alliance, LLC.

Chris Almodovar
Chris joined FM Global in early 2022 as a post-doctoral researcher in the explosions team. His work focused on characterizing the process of thermal runaway in lithium-ion batteries, with a view to better understanding the explosion hazard presented by these systems. This included compositional analyses of gas released by lithium-ion batteries under a variety of conditions. This work has contributed to a greater understanding of the explosion hazard presented by lithium-ion batteries. Chris has started his new position as Researcher for KLA.

We would like to acknowledge Lauren's and Chris' contributions and wish them the best in their future endeavors!

Internships

FM Global offers opportunities for students and early career academics to participate in research programs under the supervision of senior research staff. This summer we welcome four interns who will be working on a range of exciting projects.

- Leidong Xu, University of Connecticut, AI and CFD modeling.
- Shuguo Sun, University of Delaware, Lithium-ion battery safety.
- Anran Jiao, Yale University, scientific ML and radiation modeling.
- Aleksei Sorokin, Illinois Institute of Technology, scientific ML and fire modeling.

Signed: Alex Krisman

University of Greenwich

1) New Research Centre: Centre for Safety, Resilience and Protective Security:

In 2023 the University of Greenwich (UoG) implemented a restructuring of its research activities, with a new focus on research Centres rather than research Groups. Research Centres are intended to be larger units than research groups, involve a wider range of related research topics, a greater selection of interdisciplinary research and result in greater impact. The Fire Safety Engineering Group (FSEG), founded and led by Prof Ed Galea over 30 years ago, with a focus on fire and evacuation modelling research, is now part of a new research centre called the Centre for Safety, Resilience and Protective Security (CSRPS). FSEG still exists as an entity within the Centre and is active in all its previous research areas, but is now part of a larger organisation, with a wider remit. Prof Ed Galea is the director of both FSEG and CSRPS.

Launched in Feb 2024, our vision is to advance societal safety, resilience, and security by addressing engineering challenges in the built and urban-scale environments, in transportation, and in the pedestrian environment. We will do this by employing innovative computational methodologies and immersive technologies to address critical challenges in fire safety engineering, disaster resilience, protective security, and airborne pathogen dispersion. CSRPS will achieve these aims by seeking to revolutionise the design and application of computational models, virtual and mixed reality tools, and agent-based modelling and by applying these models to a range of problems. The societal challenges CSRPS addresses include:

- **Computational fire safety engineering** – improving societal fire safety in aviation, the built environment, maritime/offshore and rail infrastructure through the design and application of advanced computational fire and evacuation modelling and virtual and mixed reality tools.
- **Disaster resilience** – strengthening societal resilience to natural and anthropogenic hazards such as wildfires, floods, earthquakes and hazmat incidents through research into urban-scale evacuation behaviour and modelling and the application of virtual and mixed reality tools.
- **Protective security** – protecting citizens, first responders and security services from terrorist-related incidents involving marauding armed terrorists and deliberate release of chemical warfare agents in crowded places through advanced agent-based modelling, computational fluid dynamics (CFD) modelling and virtual and mixed reality tools.
- **Dispersion of airborne pathogens** – reducing the risk of infection from airborne pathogens within ventilated spaces through modelling the dispersion of respiratory aerosols and other airborne pathogens using CFD models and agent-based modelling to explore physical, mechanical and pharmaceutical mitigation strategies.

2) FSEG RESEARCH PROJECTS:

FSEG is involved in a number of on-going and new research projects including, wildfire evacuation, evacuation due to marauding armed terrorists, fires in baled waste, cladding fires, living wall fires, dispersion of airborne pathogens, dynamic signage, passenger ship evacuation and aircraft evacuation. A brief over-view of some new projects is highlighted below.

Fire Safety Engineering Group
safety in numbers

(a) M^{3}4Impact project

FSEG in collaboration with its sister research group, the Computational Science and Engineering Group (CSEG) has been awarded over £9 millions of funding from the Expanding Excellence in England (E3) fund of Research England to support its Multi-scale, Multi-disciplinary Modelling for Impact (M^{3}4Impact) platform. In addition, the UoG has pledged an additional £2 million to support. The £11 million funding will support the activities of the team over a five-year period from August 2024 to July 2029.

Our vision is to expand our world-leading Multi-Disciplinary and Multi-Scale Modelling expertise in both reach and ability, to tackle major societal challenges affecting the environment, quality of life, safety, security, and the economy. This will be achieved through the amalgamation and expansion of two existing award-winning teams,

FSEG and CSEG, creating the Multi-scale, Multi-disciplinary Modelling for Impact ($M^3$4Impact) platform. Both teams excel at developing and applying mathematical models, computational simulations and bespoke software to create digital worlds that predict physically accurate outcomes addressing a wide range of societal challenges.

$M^3$4Impact links three cross-cutting research and enterprise themes: ***Safety and Security***, covering disaster resilience, fire and evacuation, dynamically coupling both urban-scale and building scale evacuation modelling with hazard models, and protective security incorporating real-time interactivity through Virtual/Mixed Reality, from FSEG; ***Materials Science and Engineering***, focusing on the design and manufacture of lighter, stronger materials for transport and aerospace (targeting recyclability, low waste and energy efficiency), from CSEG; and ***Digital Cities***, where interdisciplinary research will develop the evidence-base to protect UK cities/populations from pollution, pathogen dispersal, natural/anthropogenic disasters and to support policy decisions using a multi-scale approach from cityscape to street level, jointly from FSEG and CSEG. As part of the $M^3$4Impact expansion, we will be investing heavily in new staff, PhD students and computing infrastructure. Planned investments include:

- **NEW HIGH PERFORMANCE COMPUTING INFRASTRUCTURE**

As part of $M^3$4Impact, we are investing £1 million in new high-performance computing infrastructure to support our ambitious CFD, AI and VR/MR developments.

- **RECRUITING NEW STAFF AND PhD STUDENTS**

We are also expanding our existing staff base, with 17 new permanent research staff posts to be advertised over the next 2 years and 17 new fully funded PhD student places. In the first wave, FSEG plans to employ, before the end of 2024: 2 new research professors, 1 new research associate professor and 3 research software engineers. We also plan to engage 4 new PhD students. If you are interested in any of these upcoming posts, please contact Prof Ed Galea and keep an eye on the FSEG/CSRPS web pages.

(b) Healthy Sailing Project (for details see https://fseg.gre.ac.uk/fire/healthysailing.html**)**

FSEG is part of the Healthy Sailing EU Horizon Europe consortium that successfully bid for and won a €3.2 million project (project code: 101069764) as part of the HORIZON-CL5-2021-D6-01 call. The project runs from 2022 to 2025. Its aim is to develop prevention, mitigation and management measures for airborne disease control on passenger ships. FSEG leads the core modelling and experimental work to generate a scientific evidence base to evaluate proposed risk mitigation measures. FSEG is using its SMARTFIRE CFD fire modelling environment to explore the impact of the dispersion of airborne respiratory pathogens (aerosol base) within ventilated spaces in cruise ship environments. This research builds on FSEG research modelling Covid-19 aerosol dispersion and Infection Risk analysis in buildings, aircraft and trains. Other partners involved in this research include University of Surrey, who are conducting full-scale experiments onboard a cruise ship and VTT Finland, who are modelling short range droplet interactions to assess infection risks from directly inhaled near-field droplets and surface contamination with fomites.

(c) OneHeart (Out of Cycle Next Generation Highly Efficient Air Transport) Project

FSEG is part of the OneHeart consortium that successfully bid for and won a large project supported by the UK Aerospace Technology Institute (ATI) (https://www.ati.org.uk/) and Innovate UK (Innovate UK proposal number 10003388). OneHeart is led by Airbus Operations Ltd and runs from September 2022 to December 2026. With a budget share of £1.2 million, FSEG is a major partner in the project. The work of FSEG is focused on aircraft evacuation modelling for novel aircraft designs, developing new technologies to assist in the rapid evacuation of aircraft, and designing and running full-scale evacuation trials to test new evacuation technologies and collect an evidence base for model validation.

(d) BIM (Building Information Modelling) and fire safety engineering Project

FSEG is leading an international collaboration to develop an openBIM standard for pedestrian and fire modelling. Part of this effort is a project under the administration of openBIM standards organisation buildingSMART International (bSI) called, Information Delivery Specification for Occupant Movement Analysis. The project team includes FSEG staff Dr Asim Siddiqui and Dr Peter Lawrence, who are currently co-leading the project and Dr Peter Thompson (Univ of Canterbury NZ), Dr Angelika Kneidl and Mr Simon Brunner (accu:rate, Germany), Dr Rainer Könnecke (IST GmbH, Germany), Mr Frederick Frank (Bentley, UK), Mr Timo Lehtoviita and Mr Jarno Rautiainen (LAB University of Applied Sciences, Finland), Dr Roland Geraerts (Utrecht University, the Netherlands), Dr Jimmy Abualdenien (Nemetschek, Germany), and Mr John Utstrand (COWI, Norway).

(e) Living Walls (LWs) Project (for details see https://bit.ly/4cTFQl9)

FSEG is exploring fire safety issues associated with LWs. LWs are vertical, vegetated structures consisting of modular panels which are fixed to external building facades. An aim of this work is to assess whether current building fire safety guidelines within England, and associated fire test standards, are appropriate to mitigate and

minimise fire risks associated with external LWs. The work suggests that the legislative environment for England is woefully confused and inadequate. An arguably more appropriate approach to assessing LW installations is suggested and involves a combination of BS 8414 testing and CFD modelling. A CFD model based on the SMARTFIRE software has been developed to simulate LW BS 8414 testing and is recommended as a pre-test prior to committing to expensive large-scale fire testing.

3) FSEG STAFF AND PhD STUDENT NEWS:

- **FSEG researcher, Dr John Ewer** was promoted to Associate Professor of Applied Fire Safety Engineering in 2022.
- **FSEG researcher, Dr Lynn Hulse** was promoted to Senior Research Fellow in 2023.
- **Dr Michael Joyce-Badea**, successfully defended his PhD thesis, entitled "Representing the Spatial and Kinematic Constraints of Movement Assistance Devices within Evacuation Simulation Models" on 16 Feb 2024. His examination team consisted of Dr. Nikolai Bode, University of Bristol and Dr. Mohammad Majid al-Rifaie, UoG. Both examiners were impressed with his work and only required minor corrections. His supervisory team consisted of Dr. Peter Lawrence and Prof. Ed Galea.
- **Dr Hooshyar Azizpour,** a PhD student at HVL Norway (joint PhD programme in Nautical Operations), successfully defended his PhD entitled, "Quantifying human performance for simulation of passenger ship evacuation in polar climate" on 22 August 2023. His supervisory team consisted of, Dr Helle Oltedal, Dr Bjorn Morten Batalden, Dr Sveinung Erland and main technical supervisor, Prof Ed Galea. His opponents were, Dr Karen Boyce (Ulster Univ UK) and Dr Steven Mallam (Memorial Univ Canada).
- **Mr Chan Sorayudh Chanthir**, from Cambodia with a background in Computer Science (MSc from UoG and BSc from University of Technology, Cambodia) joined FSEG in Jan 2024 as a PhD student undertaking research into BIM based digital workflow for Fire Safety Engineering.

Mr Chan's PhD is jointly funded by a UoG VC PhD Scholarship (50%) and OFR Consultants, UK (50%). His supervisory team is based at the UoG and are FSEG staff, Dr Asim Siddiqui, Dr Peter Lawrence and Prof Ed Galea.

4) FSEG SHORT COURSES:

FSEG has been running its well-established 5-day short courses, Principles and Practice of Fire Modelling (PPFM) and Principles and Practice of Evacuation Modelling (PPEM) since 1997, and 2024 marks the 27th year in which they have been offered, probably making them the longest running short courses in computational fire engineering, in the world. Since 2020, we have been offering both courses in distance learning mode, live over the internet. In 2024, we ran both courses in distance learning mode, PPFM in January and PPEM in February. FSEG staff also ran a two-day version of PPEM face to face in Athens, Greece for the Hellenic Fire Services in January 2024. You can register on our courses from our web pages at: http://bit.ly/FSEG-SC

5) LINKS TO FSEG NEWS:

You can keep up with the latest news from FSEG and join in topical fire research and fire engineering discussions by following us on social media:

- FSEG facebook page: https://www.facebook.com/FSEG.UK/
- FSEG Twitter: @evacguy
- FSEG YOUTUBE: https://www.youtube.com/user/FSEGresearch
- FSEG LINKEDIN: https://www.linkedin.com/in/ed-galea-1297358
- FSEG staff and PhD opportunities: https://fseg.gre.ac.uk/fire/positions.html

Signed: Edwin Galea

Hiroshima University

Large Enclosed Space Fire Safety Lab (LES-FS) is focusing on tunnel, and underground safety. Smoke behavior in tunnels and evacuation behavior are studied exeperimentally in model-scale (photo 1) and full-scale tunnels (Photos 2 and 3).

When there is a fire in large enclosed spaces such as tunnels, underground spaces, subways, and metros, high-temperature thermal fume flows along the ceiling with the smoke and toxic gases but smoke descends (Haselden and Hinkley, 1970) to the floor at several hundred meters due to loss of buoyancy, then disturbs the smooth evacuation such as road tunnel fires. In tunnel fires, people who exist near the fire source are influenced by high-temperature thermal fume, radiation, smoke, and toxic gases. Meanwhile, the others who exist far from the fire source are influenced by worsen of visibility due to smoke. Breathing the toxic gas is one of the components of the evacuation. They can cover their mouth by a handkerchief or mask but they cannot cover their eyes in smoke. Hence it is necessary to consider the smoke diffusion situation.

The past 30 years road-tunnel fire accidents with victims' situation told us the smooth evacuation was one side and completely best situation. The truth is that some evacuees had no evacuation or other behavior excluding walking. For their evacuation safely, we could find out the two behaviors such as the smooth evacuation and other behaviors and these other behaviors related to the emotion in Table. For the smooth evacuation, accurate assessment, and optimal strategies for evacuees, it would be better to consider the relationship between negative emotion and walking speed in the smoke. Hence, our lab's aim is to clarify the relationship between negative emotion and walking speed (see Figure) in the smoke filled tunnel.

Photo 1 Model-scale tunnel

Photo 2 Smoke generation in full-scale tunnel

Photo 3 Students' activity

Table Behaviors and emotions from man-made and natural disasters

Behavior	Disaster type	Emotion influence
Normalcy bias	**Tunnel fire** (Fraser-Mitchell and Charters, 2005); building fire (Kuligowski and Gwynne, 2009)	Mental stress (Proulx, 1993)
Getting lost	**Tunnel fire** (Fraser-Mitchell and Charters, 2005); tunnel evacuation experiment (Seike et al., 2020); factory explosion (Quarantelli, 1954)	Anxiety (Levi, 1979)
Giving up	Tunnel evacuation experiment (Seike et al., 2020); ship fire explosion (Quarantelli, 1975, 1979)	Sadness, anxiety, fear, shame, anger, disgust, and boredom, etc. (Frijda et al., 1989)
Hysterical crying and screaming	**Tunnel fire** (Fraser-Mitchell and Charters, 2005); building fire, ship fire, and flood (Tyhurst, 1951)	Fear, anger, and sadness, etc. (Shaver et al., 1987)
Panic flight	**Tunnel fire** (CNN news, 1995); subway explosion (Philpot and Levine, 2022); ship fire explosion (Quarantelli, 1954, 1979).	Fear (Quarantelli, 1954, 1979)

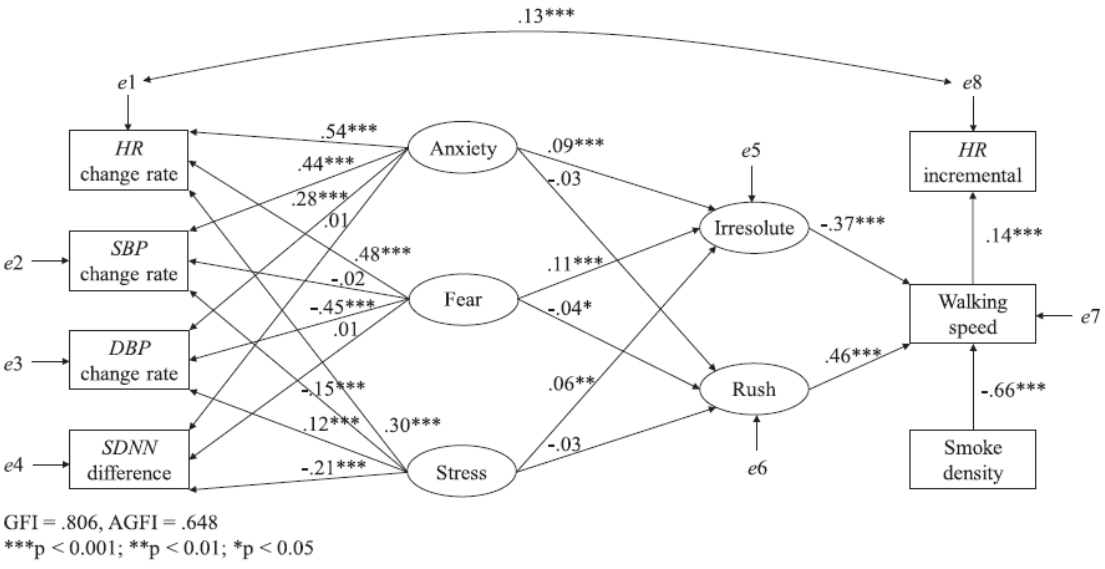


Fig. 12. Standardized estimation results obtained through SEM.

Figure of the results from experiments between emotion and behavior in smoke (Li et al. 2024)

Signed: Miho Seike

The Hong Kong Polytechnic University

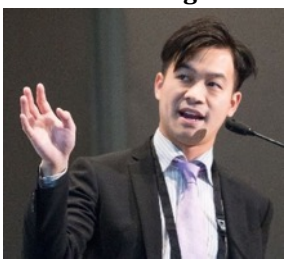
PolyU Fire Group attended the 14th IAFSS Symposium in Japan

More than 20 students and all professors in fire research from the PolyU attended the 14th International Symposium at Tsukuba, Japan, organised by the International Association of Fire Safety Science (IAFSS 2023). In total, we gave 5 oral presentations and 20+ poster presentations in the symposium. Tianwei Chu, supervised by Dr Liming Jiang, Received the Sheldon Tieszen Student Award at IAFSS.

Dr Xinyan Huang got Outstanding Young Teacher Award and Edited a book on Smart Firefighting

Dr Xinyan Huang has been honoured with the Faculty FCE Award 2023 in the category of Teaching (Outstanding Young Teacher). He also edited a new book with Dr Andy Tam from NIST titled "Intelligent Building Fire Safety and Smart Firefighting" published in Springer. This is the first book dedicated to new concept of Smart Firefighting with new technologies of AI and digital twin.

Dr Anthony Chun Yin Yuen has cracked into the Standford Top Scientist and received new funding

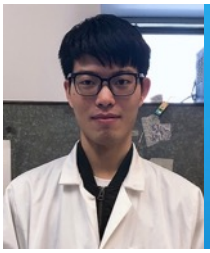
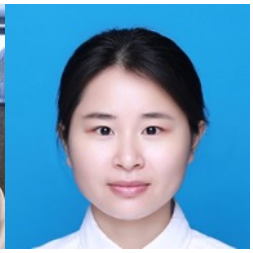


Dr Anthony Chun Yin for the first time, has cracked into the World's Top 2% Scientists by Stanford University 2023. His research project entitled "Coupling Fire and Toxicity Predictions Using CFD-MD Simulations for Enhanced Pedestrian Movement Modelling and Fire Resilience Designs of Metro Stations" was awarded for the new scheme MTR Research Fund. This project will enhance the reliability of MTR station fire prediction and evacuation models with a new strategy by coupling non-linear pyrolysis-combustion kinetics via Molecular Dynamics simulations and studying the influence towards crowd dynamics.

Anthony co-organised the AOFSM'5 Conference in Sydney

After eight months of preparation, the 5th Asia-Oceania Symposium on Fire Safety Materials Science and Engineering (AOFSM'5) conference was successfully organised and concluded. **Dr Yuen** served as a local organising committee member for the AOFSM'5 conference at UNSW, Sydney, Australia, with his current and former colleagues at PolyU/UNSW

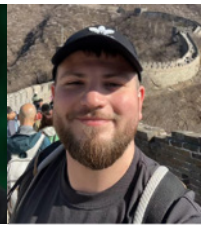
New PhD Graduates

Dr Xiaoning Zhang was awarded his PhD in Feb 2024 with the thesis titled "Smart Tunnel Fire Forecast and Safety Management Driven by Artificial Intelligence of Things", supervised by Dr Xinyan Huang, and his thesis was rated as excellent.

Dr Jin Qiu was awarded her PhD degree in Mar 2024, supervised by Dr Liming Jiang, and her thesis defence was rated as excellent. With a thesis titled "Simulation of Building Structures in Fires with Slabs Using High-efficiency 3D Models". Her modular AI work published in the prestigious journal "Engineering Structures" has received the Editors Featured Paper Award.

Visiting Professor and Students

Prof. Suwen Chen visited the PolyU fire research group from Nov 2023 to Jan 2024, supported Kwang-Hua Education Foundation. Prof. Chen is a full professor at Tongji University and she primarily worked on fire and blast safety engineering. The host researchers for Prof Chen's visit are Prof. Asif Usmani and Dr Liming Jiang.


Jakub Bielawski visited Dr Xinyan Huang for 6 months. He is a PhD student supervised by Prof. Wojciech Wegrzynski. During his time collaborating with the PolyU on tunnel fire research.

Picha visited Dr Xinyan Huang for one month. She is a PhD student from Tokyo University of Science, supervised by Prof. Kazunori Kuwana.

Me Mohammed Hassoune, from Saad Dahlab University of Blida, is visiting Dr Liming Jiang for 6 months.

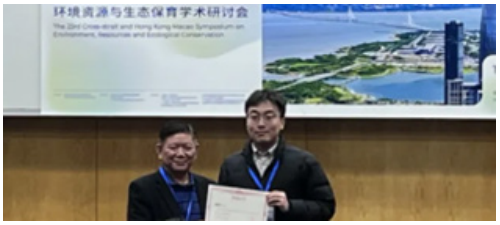
PolyU welcomes visiting students and professors all year round.

Awards

Smart Firefighting Robot Winning Gold Award

Meng Wang (PhD student) received a Gold Award for the project "Smart Firefighting Robot" in the "China International College Students' Innovation Competition 2023". This project is the only Gold Award in PolyU and one of the total 10 Gold-Award projects from HK-Macao-Taiwan. Team members include Xiaoning Zhang, Wai Kit Cheung, and Yifei Ding, and the supervisor is Dr Xinyan Huang.

Yunzhu receives Best Presentation Award



Yunzhu Qin (PhD student) presented his latest research on peat fire behaviours under the impact of snow at the 23rd Cross-strait and Hong Kong Macao Symposium on Environment, Resources and Ecological Conservation. After 2-days of the conference at the Chinese University of Hong Kong, Yunzhu won the Best Student Presentation Award out of 100+ presentations.

Tianhang Receives Best Presentation Nomination

Dr Tianhang Zhang (Postdoc) delivered a presentation entitled Artificial Intelligence-Driven Digital Twin Framework for Smart Firefighting at the 3rd Digital Twin International Conference 2023 and won the Best Presentation Nomination Award. In the presentation, he introduces the application of Digital Twin in building fire risk recognition and forecasting critical fire events.

Zhuojun Nan Receives SFPE Student Award

Zhuojun Nan was recognised for her research on a practical workflow for structural analysis under realistic fire scenarios, supervised by Prof. Asif Usmani, Dr Xinyan Huang, and Dr Liming Jiang. She was one of Nine Recipients of the Annual SFPE Foundation Awards. She is currently a Postdoc Fellow at Delft University of Technology (TU Delft).

Lam Ying Tung Best Undergraduate Research Project Award

The undergraduate student, Lam Ying Tung, received the Best Project Award for the Undergraduate Research and Innovation Scheme (URIS) project "Study of fire impact on glass panels" supervised by Dr Liming Jiang. In addition, Miss Lam also received HKIE Outstanding Paper award for young engineers, the FSICA award, and the HKIE (Fire Division) Scholarship for her research project performance under the supervision of Dr Jiang.

Signed: Xinyan Huang

Imperial College London

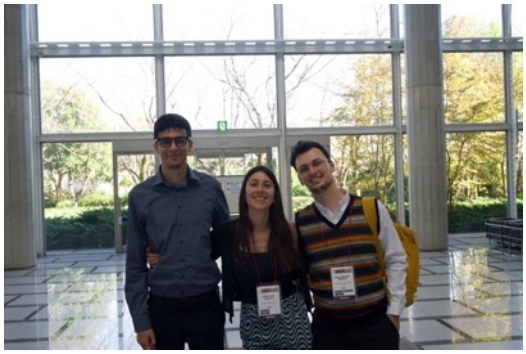
Hello friends of Hazelab! Welcome to another update of our recent activities on research and engineering. For more news follow us on twitter @ImperialHazelab, visit our website, publications, or watch our video.

IAFSS 2023

One of the main events of the year for Hazelab was the IAFSS symposium in Tsukuba, Japan, that **Nikolaos Kalogeropoulos, Francesca Lugaresi, Harry Mitchell** and **Prof. Guillermo Rein** attended and met a large number of fellow fire scientists! Nikolaos presented his work on wildfire trigger boundaries, Francesca presented on mechanical failure of facades, and Harry presented his findings on smouldering fires in mass timber. We met a lot of collaborators and fellow IAFSS members, and were joined by Tommy, Francesca's son and the newest associate member of Hazelab!

Hazelab had an amazing time in Japan with colleagues and friends from across the world (and singing Karaoke with some of them!). We can't wait to see you all again in La Rochelle in 2026!

Graduating and arriving students



We are pleased to congratulate **Dr. Harry Mitchell** and **Dr. Francesca Lugaresi** on completing their PhD studies in fire science and engineering!

Harry's thesis, titled "Flaming and smouldering hazards in large timber compartments", studies flame spread, smouldering, and firebrands in large mass timber compartment experiments (CodeRed). Francesca's thesis, titled "Computational Study of Failure of Curtain Wall Facade Systems Exposed to Fire", models the numerical thermal and mechanical response of facade systems subjected to fire. Harry was examined by Dr. Erica Fischer (university of Oregon), and Francesca was examined by Dr. Matina Manes (University of Liverpool). Harry has started a postdoc in Hazelab on wildfires, and Francesca has joined as a postdoc the research group of Dr. Francesco Restuccia at Kings College to study battery fires. Best of luck, Dr. Mitchell and Dr. Lugaresi!!

We are especially thrilled to welcome two PhD students with outstanding backgrounds and a strong interest in fire research, **Alexander Castagna** and **Annabelle Hospital**. Alex starts his PhD studies on timber fires and wants to help engineers design a safer building, funded by Arup and EPSRC. Meanwhile, Annabelle is a part-time PhD student who is also working at CERIB (The Concrete Industry Study and Research Centre) in France, will be investigating smouldering in tall timber structures for her studies. Welcome to Hazelab, Alex and Annabelle!

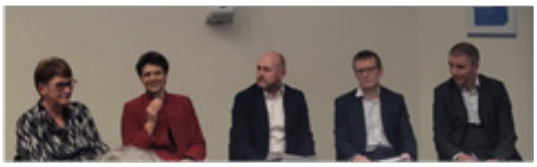
Dimitra Tarasi joined as a visiting student for two months from the Technical University of Crete, Greece. She is developing global climate simulations including peat fires and worked with Hazelab on experiments and field trips to collect peat samples during her visit. We also had **Ignacio Alonso Calderon Espinoza**, a visiting student from the Pontificia Universidad Católica de Chile, visit us, during which he presented his research on the timber compartments fires.

Conferences and Outreach

It has been a busy time for Hazelab outreach! In March, Hazelab presented posters of our research on mass timber, wildfires, and batteries at the Department Research Showcase. We then presented our research at an evening celebration of the UK's association to the Horizon Europe research scheme, meeting delegates from several research bodies and governments.

More recently, Hazelab, in collaboration with the SFPE UK Chapter and Greater London Student Chapter, hosted over 200 attendees from the fire engineering community for an evening seminar and panel discussion with Imperial alumna and Chair of the Independent Review of Building Regulations, **Dame Judith Hackitt**! Throughout the evening, Dame Hackitt and other panel members had a thought-provoking discussion with the audience on the future of building regulations and design in the UK.

Nick, Carlos and Guillermo attended the Hazards Forum's special event on wildfires as an emerging issue for the UK. The Hazards Forum discusses all aspects of hazards to life, property, and the environment of the UK. UK experts gathered to exchange lectures and discussions, including Guillermo giving a talk on wildfire dynamics, prompting discussions on future UK wildfire strategies.



Hazelab **(Nick, Carlos, and Afi**, with the help of Immy and Dimitra!) led a field trip to the Flow Country in Scotland, where we were welcomed by Prof. Roxane Andersen, an expert in peatland ecology, and together we sourced peat and vegetation samples for experiments. The samples will be used in peat fire experiments in the lab. We also attended the Flow Country research conference. It was fascinating how researchers have been using the Flow Country as a living laboratory to understand the effect humans and climate change are having on the natural environment. The trip was funded by Leverhulme Centre for Wildfires.

Hazelab is part of an EU Horizons project consortia called SEMEDFIRE, comprising of Imperial College London, European University of Cyprus, University of Wagningen, Pau Costa Foundation and Niemes Metropole. The

project goal is to provide the foundation needed for the European University of Cyprus to develop tools and strategies to confront wildfires in Cyprus. Hazelab delivered a course on fire science to a diverse audience of stakeholders such as Cypriot Fire Brigade, Forestry Department, Ministry of Environment, UN Civil Defence, UK British Bases, fire engineers and researchers. A lecture was given by **Guillermo** on wildfire behaviour, building on his current collaboration with UK Met Office where he is providing a foundation for wildfire stakeholders in the UK. Nick presented his work on current models of wildfire hazards, and his PhD work that combines operational fire spread models and community evacuation modelling to inform decision makers of the different scenarios they may be confronted with should a wildfire ignite. **Carlos** created laboratory video content that reinforced the lessons taught by Guillermo and Nick, which were then scaled to live demos for the course participants with support of the Cypriot Fire Brigade. These were inspired by the current fire operator training of UK Forestry Commision and we would like to thank Rob Gazzard for his support.

Awards
We are happy to announce that **Nick** has been awarded one of the SFPE student grant awards! Nick has been funded to explore the use of AI as a tool to predict wildfire spread and use it along with trigger boundaries to generate evacuation plans. Results are promising, with Google's new EPD-ConvLSTM model showing promise, cutting simulation time significantly and allowing for fast iterative probabilistic simulations.

Nick also received the Sheldon Tieszen award for best student-led papers in the IAFSS symposium! His paper on stochastic trigger boundaries introduces the k-PERIL algorithm and shows how trigger boundaries can be used to keep communities safe from wildfires by comparing required and available evacuation times, depending on wildfire spread.

Carlos was awarded a grant by the Leverhulme Centre for Wildfires to support him in leading the previously mentioned field trip to Flow Country in Scotland to collect peat and vegetation samples.

Afi was awarded a grant to develop a collaboration between Imperial College and NTU in Singapore, in which she will be developing and recording a series of informative videos on peatland fires!

Harry was awarded a grant acceleration grant by the Imperial Institute for Molecular Science and Engineering to support him in writing a grant on battery fires.

Signed Harry Mitchell, Nikolaos Kalogeroplous, Afi Mulyasih, and Carlos Walker-Ravena. Edited by Guillermo Rein

International Master of Science in Fire Safety Engineering and Ghent University

9th IMFSE Fire Safety Engineering Day at Lund University
On Thursday 15 February 2024 the 9th IMFSE Fire Safety Engineering Day was held in which approximately 75 attendees participated. The central theme this year was "The importance of Data in Fire Safety Engineering" and it included several presentations on this topic by some of our contributors and an interesting panel discussion. This event was a great way for our 1st and 2nd year students to learn about this important topic and to network.

New IMFSE Contributor: FSRI
Recently IMFSE welcomed UL's Fire Safety Research Institute (FSRI) as one of the IMFSE contributing companies. The financial contribution of the IMFSE contributing companies makes it possible to offer full and partial scholarships. You can find more information about all our contributors on https://imfse.be/contributors.

IAFSS symposium: keynote lecture by IMFSE program director Eulàlia Planas

Prof Eulàlia Planas – IMFSE program director at UPC – delivered a keynote lecture at the IAFSS Symposium at Tsukuba (Japan), titled "Fires at the wildland industrial interface. Is there an emerging problem?". She introduced the topic of potential accidents that can occur when a wildfire affects an industry and how preparations need to be made, as it can become a problem due to climate change.

Signed: Silke Van Parys

Linnaeus University

Växjö Wood Building Award 2023

The Växjö Wood Building Award was established to strengthen the Växjö municipality's wood construction strategy and manifest Växjö as a leader in wood construction. The prize is to be awarded to one or more actors in academia, industry or the public sector for a particularly good performance in construction, engineering, technical innovation or related initiatives with a focus on wood construction and good architecture. In 2023 it was awarded to a research project for the first time.

The motivation 2023 reads:
Birgit Östman received the prize for her many years of research, which largely consists of showing the fire properties of wood materials and putting them in relation to other building materials for the same use. Many of the wooden buildings we have in Växjö today would probably not exist if the knowledge of wood and fire had not been developed. Research results that Birgit Östman has been responsible for are used in Sweden, Europe and even the rest of the world.

Swedish Wood Building Prize 2024

The Swedish Wood Prize is one of Sweden's most attractive architectural prizes and is awarded every four years to a new building erected in Sweden that possesses special architectural qualities. It can be a building, a bridge or a facility where wood has been used in a way that makes the most of the potential of wood and at the same time reflects or develops the Swedish architectural tradition and the times we live in. Behind the Swedish Wood Award is Swedish Wood association.

The winner of the Swedish Wood Award 2024 is Sara Kulturhus in Skellefteå – a landmark that has received international attention for its innovative power that has advanced the positions of wood construction. The name is after the author Sara Lidman from the north of Sweden. With its 20 floors, Sara Kulturhus is one of the world's tallest wooden buildings. it is located right in the heart of Skellefteå and is a natural meeting place that combines the city's rich wood tradition with modern engineering. More info at www.sarakulturhus.se/en.

New versions of Eurocodes for structural fire performance in 2025

New versions of the Eurocodes for structural performance of buildings will soon be published.
The Eurocodes are European standards for calculating the structural performance of building components and structures, the present versions are from 2004. The Eurocodes consist of ten parts for different structural materials such as concrete, steel and timber. Each of the material codes contains two parts, one for general building design and one for fire design. The present Eurocodes were published in 2004 and new versions have been developed since then based on extensive research. Sweden has been especially active in the fire design of timber structures. Draft versions of the Eurocodes are now out for formal vote and the new versions are expected to be published in 2025.

Signed Birgit Östman

University of Liverpool

A new fire safety engineering research group has been established at the University of Liverpool (UK) by Dr Martina Manes, who joined the Department of Civil and Environmental Engineering in 2021. The group is gradually growing including a new academic, Dr Xu Dai starting in May 2024, and two new PhD students starting

in the same year. Currently, several research projects have been developed covering fire risk, investigation of international fire incidents, structural fire safety and travelling fires.

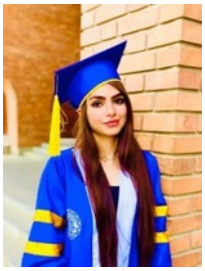
Academics

Dr Martina Manes is a Lecturer in Civil Engineering at the University of Liverpool. Her research includes the investigation of international fire statistics, evaluation of fire risk assessment and optimization of fire resilience. She is a professionally qualified civil engineer in Italy and her research outcomes updated the BS PD 7974-7:2003 fire safety data with current fire statistics of England and the USA. She also participated in the EU FireStat project funded by the European Commission. Experience with interdisciplinary teams of experts was built on collaborations between academia and industry, participation in technical steering groups for MHCLG research, consultancy for the NFCC, DLUHC, and private companies, and studies with experts in engineering and social sciences. In 2023, she received the Faculty Learning, Teaching and Student Experience Award of the University of Liverpool for outstanding teaching.

Dr Xu Dai is a Lecturer in Structural Engineering at the University of Liverpool. His research is centred on structural fire engineering to mitigate worldwide loss due to structural failure under real fires via coupling structural engineering and fire engineering. He was a senior lecturer and programme lead of the Fire Safety Engineer (BEng) degree apprenticeship at Birmingham City University (2022-2024). Prior to this role, he was also a foreign guest researcher at the National Fire Research Laboratory, NIST (2019-2021), and post-doc at the University of Edinburgh (2017-2019) after obtaining his PhD at the same institution. Starting from September 2024, he will take the award from the Royal Academy of Engineering (RAEng) in the UK, as a RAEng/Leverhulme Trust Research Fellow for one year.

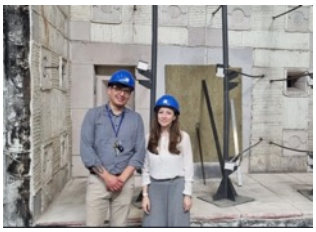
PhD students

Hongxin Zhuang started a Dual PhD scholarship in February 2024 that will be developed between the University of Liverpool (UK) and NTHU (Taiwan) under the supervision of Dr Martina Manes, Prof Eric Lin, and Dr Xu Dai. The PhD research is focused on assessing the comprehensive cost of fire incidents in buildings and developing a model for estimating the financial impacts of fire protection measures. The research aims to provide a deeper understanding of the economic consequences of fire incidents and create strategies for mitigating financial losses through effective fire protection measures.



Morvarid Koohkhezri will start her PhD in the summer of 2024 at the University of Liverpool under the supervision of Dr Xu Dai, Dr Martina Manes, and Dr Charlie Hopkin (Director, Ashton Fire), and also in collaboration with the academics at the University of Edinburgh. Her PhD is partially funded by Ashton Fire and the University of Liverpool. Her research is focused on improving the fire safety design of open car parks in the UK, especially after the accident of the London Luton Airport Car Park Fire in October 2023.

Research projects



Thanks to the 2024 funding from the **Zavod za gradbeništvo Slovenije - Slovenian National Building and Civil Engineering Institute**, Dr Martina Manes visited Frissbe (ZAG) in Slovenia to work on a research project led by Dr Ulises Rojas-Alva with colleagues at ZAG focused on the creation of a framework for the fire impact estimation on the environmental and sustainable requirements and comprehensive optimisation in the built environment.

Invited presentations and outreach activities

2023 Guest Lecture IMFSE Ghent

Dr Martina Manes gave a presentation on the complexity of fire safety engineering and resilience. Understanding the relationships between resilience, its categories, dimensions, and capacities is essential to applying a holistic approach to the fire safety problem in buildings.

2023 Invited presentation Hazelab – Imperial College

Dr Martina was invited to the Hazelab at Imperial College London to present the EU FireStat Project and the applications of data-driven approaches in fire safety.

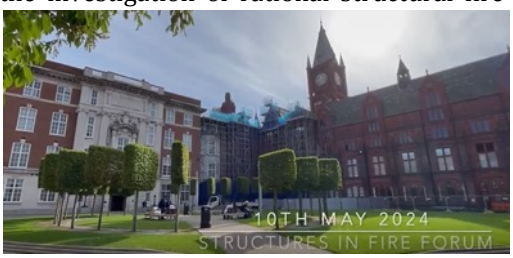
2023 Fire Science Show Podcast - Enhancing Fire Safety Through Data: EU FireStat Project
Wojciech Węgrzyński invited Dr Martina Manes and Dr Mohamad El Houssami to participate in one of his episodes to present the EU FireStat project. During the discussion, the importance of mapping international fire statistics was highlighted to increase awareness of fire incident data in terms of variables, terminology, collection methodology and quality as well as their applications and international role.

Summer projects

2023 NFPA Student Project Initiative on Cooking Practices and Fires
Jack Salem and Alex Smith (MEng students in Civil Engineering) under the supervision of Dr Martina Manes worked on the NFPA Student Project Initiative in the Summer of 2023 on research focused on "Cooking Practices and Fires in the USA". As part of this initiative, students were accepted for the presentation and poster session at the 2024 NFPA Conference & Expo (Orlando, Florida, USA) and the final report of the project was published on the NFPA website.

Events

2024 Structures in Fire Forum
The next Structures in Fire Forum (STiFF) will be held on the 10th of May 2024 at the University of Liverpool. After careful consideration, the agenda has accepted 10 presentations, on topics from fire safety for retrofit projects to steel container structures, concrete tunnels, steel bridges in fire, timber and steel connections, and connectors in fires. More than 80 participants have registered for the forum. STiFF is a discussion group for international researchers, specialists and design professionals interested in the behaviour of all types of structures under the influence of fire. The topics discussed in the forum also include the investigation of rational structural fire engineering design methods and guidance, the impact of fire consequences on building performance, design code developments, issues, and best practice. The forum is based in the United Kingdom and welcomes members and fire safety engineers from all over the world. Finally, many thanks to the University of Liverpool, Efectis, OFR Consultants, AkzoNobel, Trigon Fire Safety, and The Concrete Centre, who are sponsors of this forum. Useful links: Structures in Fire Forum and Video of the Event



Awards

2024/25 RAEng/Leverhulme Trust Research Fellowship
Dr Xu Dai will take the award from the Royal Academy of Engineering (RAEng) in the UK from September 2024 as a RAEng/Leverhulme Trust Research Fellow for one year. The research will focus on travelling fires.

2023 UK SFPE Research Project
Dr Martina Manes was the Recipient of the UK Society of Fire Protection Engineers Research Project 2023 Award Runner-Up for the EU FireStat project

2023 Faculty Learning, Teaching and Student Experience Award of the University of Liverpool
The University of Liverpool recognised the importance of excellence in learning and teaching in providing a high-quality experience for its students and awarded Dr Martina Manes with the Faculty Learning, Teaching and Student Experience (LTSE) Awards for outstanding teaching.

Signed: Martina Manes

University of Lorraine

Twitter: LEMTA (@Labo_Lemta) / LEMTA-OS Feux (@FeuxOs)
Web site: https://lemta.univ-lorraine.fr

Work in progress. The group is involved in several major projects: on façade fires (ANR FIREWALL+ project), on confined fires in buildings with the CSTB, on fires in tunnels with SGP (Grand Paris Express project) and on WUI-type fires with Efectis in particular. Fundamental work on spraying is also underway (a project with Naval Group and laboratory studies on spray/wall interactions). We are of course continuing our research about radiative transfer and its impact on fire propagation, using our spectral devices to provide a detailed characterization of the involved phenomena. We provide below a series of highlights and recent realizations by the group.

Highlights:

A Study of the cooling of a metal plate at high temperature by water spraying. This was the topic of a study conducted in our group by Laurine Cappon. There are many questions about the validity of models used for the impact between a spray and a surface, especially considering the cooling of the surface. Yet this is a major problem for the protection of walls and structures or for firefighting simulation using sprays. Laurine conducted and analyzed an extensive series of experiments with steel plates at high temperature cooled down by sprays. A special care was devoted to the spray characterization, the temperature measurement and the identification of the heat transfer coefficient and the critical heat fluxes. Data will be shared for a dissemination toward researchers interested by this particular spray application.

An extensive test campaign on wood charring. The aim of this work was to analyze the charring process for different experimental settings and wood species, most importantly varying heat fluxes. The robustness lies in the large number of cone calorimeter experiments, as the char characteristics of 1077 samples were measured. The results show promising relationships between the char depth (combination of missing and remaining char thicknesses) and the cumulative exposure, which represents the energy accumulated by the sample, for a single or a double exposure and regardless of the other experimental conditions.

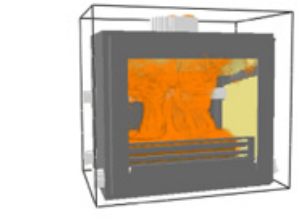
Towards a new international collaboration with the Faculty of Engineering and Science, Universidad Adolfo Ibanez, Chile. Fruitful exchanges are underway with Pedro Reszka's group. Initial discussions with data analysis and the submission of an initial article to the next ESFSS symposium in Barcelona are laying the foundations for cooperation on wood degradation and combustion, in the context of various applications ranging from construction to forest fires. Direct sharing of data and expertise is planned for the coming period.

The french research network dedicated to fire (RésoFeux) met in Nancy - 7-8 December 2023. The 33rd RésoFeux Group meeting was organized by our group. It brought together 55 participants (from universities and companies), with sessions presenting the fire research underway in French laboratories. A round table discussion was also held on the use of virtual reality in the field of fire sciences. The days ended with a visit to LEMTA's experimental facilities dedicated to fire (PROMETHEI platform).

PhD defenses:

Two of our students have just defended their theses, which led to a better understanding and modeling of the pyrolysis and degradation of different types of wood using multi-scale approaches. Particular attention was paid to fine measurement techniques and coupled models involving home-made degradation models and FDS simulations.

On 6 December 2023, Hassan Flity successfully defended his doctoral thesis entitled "Modelling the degradation and combustion of wood" within a collaboration between LEMTA and CSTB. Hassan conducted a very extensive study on wood at the cone calorimeter scale, using advanced metrology (infrared thermography, thermocouples embedded in the wood according to the technique developed by our group) and a customized cone calorimeter (sliding double cone, inert atmosphere chamber). Eight different types of wood have been studied, from balsa, which is very light, to ipe, which is very dense, and tests were performed at 6 different heat fluxes from 15 to 75 kW/m^2, in order to make the study as general and reliable as possible. Numerically, the heat transfer was solved in 3D, and special attention was paid to the determination of boundary conditions using an inert material whose thermal properties are well known. The numerous in-depth thermograms were inverted to obtain wood properties that were unknown and difficult to obtain directly (such as the equivalent conductivity of wood/char at high temperature). Part of the work was presented at the recent ISFSS in Tsukuba and several papers are in preparation.



On 20 December 2023, Mariam Abdo successfully defended her doctoral thesis entitled "Modelling the combustion of wood logs in wood stoves" within a collaboration between our group and LERMAB, a laboratory specialized on wood. The aim of the thesis was to model the combustion of wood in domestic heating appliances, from the pyrolysis of the wood under the effect of heat to the evacuation of the smoke. The study was first carried out using a multi-scale approach, from the material scale (ATG) to the material scale (calorimeter cone). A global multi-reaction kinetic model of wood pyrolysis was developed and then integrated into a heat transfer model (1D) to simulate the pyrolysis of a thermally thick wood sample exposed to a heat flux from a cone calorimeter. The second part involved an analysis of coal oxidation with tests carried out on two thermobalances and with the derivation of an oxidation model. This was coupled with a homogeneous-phase combustion model of the gases produced by pyrolysis. In the end, the package implemented in FDS provides a complete simulation of the combustion of a log in a fireplace. The combustion optimisation work must now be continued.

Arrival: Modibo Dembele has just joined our group for his master training period. He is now studying the flame propagation on hedges, within a more general collaboration on Wildland Urban Interface fires with Efectis company.

Signed: Pascal Boulet

Luleå University of Technology

Newly finished project: Inhibit fire with molecules from nature

Anna-Carin Larsson, Biplab Roy, Josefine Enman, Rhoda Afriyie Mensah, Luleå University of Technology, and Ragni Fjellgaard Mikalsen, and Edvard Aamodt, Rise Fire Research, Norway, have just finished our project "Inhibit Fire with Molecules from Nature – Application on Textiles", funded by Brandforsk, The Swedish Fire Research Foundation.

The aim of the project was to develop new environmentally friendly, and safe flame retardants (FR) from bio-based resources, for applications on textiles. The idea was to combine a few naturally occurring non-toxic molecules to find an efficient FR, which can remove all components of the fire tetrahedron. Cotton (C) and polyester (P) was thus treated with the phosphate rich acid phytic acid (PA) in combination with one of the nitrogen-rich purines adenine (A) and theophylline (TP). By investigating various physicochemical properties, it could be concluded that treatment of textiles with the phytic acid-purine formulation significantly affected their fire behaviour. The purines diluted the combustible gases by forming non-combustible gases during ignition, phytic acid markedly enhanced fire resistance by reducing heat and smoke release and slowing fire growth. Also, PA formed an intumescent char layer on the surface of the fabric, creating an effective thermal insulation. The oxygen and other combustible gases and heat were excellently blocked by the char residue and the intumescent char layer, by using a phytic acid-purine flame retardant. The synergistic effect of combining both additives offers a balanced approach, potentially improving the fire safety of cotton and polyester based materials, and the results from this study highlight the importance of selecting appropriate additives for enhancing the fire safety profiles in textile applications.

C_TP_PA

C_AD_PA

P

P_AD_PA

Figure shows residues after cone calorimeter experiments. From left to right: Cotton treated with TP and PA, Cotton treated with AD and PA, Polyester untreated, and Polyester treated with AD and PA. For untreated cotton no residue was remaining.

The chemistry day

On February 22, Luleå University of Technology invited high school students studying years two and three on university preparatory science and technology programs to the annual event “The Chemistry Day”. During the day, they met companies, researchers and students and performed practical experiments such as burning tests on untreated fabric and fabric treated with an environmentally friendly flame retardant developed at Luleå University of Technology. They were also introduced to the theory behind flame retardants and the connection to the research being conducted at Luleå University of Technology to develop environmentally friendly and safe flame retardants from natural, bio-based compounds. It was a successful event, and the students were very interested and happy with the day.

New colleague: Andrea Correa

Andrea Correa is the newest PhD in fire sciences at Luleå University of Technology. Andrea is originally from Ecuador. She is a physicist and did her master's studies in Computational Fluid Mechanics with a focus on microfluidics. She was part of the LAGO (Latin America Giant Observatory) project where she analyzed the amount of cosmic rays reaching the Earth's surface using Cherenkov water detectors. Andrea also has extensive teaching experience, specifically in Newtonian mechanics. Andrea will perform research on hydrogen safety, more specifically on radiative heat transfer from hydrogen jet flames. The work is performed within the project H2SIPP (Hydrogen Safety and Improved Permit Processes), which is a part of the Nordic Hydrogen Valleys as Energy Hubs. Our research on hydrogen safety is a subset of the hydrogen research and knowledge initiative, CH2ESS (Centre for Hydrogen Energy Systems Sweden). A very warm welcome, Andrea!

Signed: Michael Försth

Lund University

Education

In January the students at the International Master Program in Fire Safety Engineering (IMFSE) arrived in Lund. The students in the 2023 cohort have a busy semester in front of them with courses in Advanced Fire Dynamics, Human Behaviour in Fires, CFD and Risk Assessment.

The PhD course in tunnel fire dynamics was held from October 2023 to January 2024 at the division. Approximately a dozen students participated in the course and every student did a final project that was presented during a final seminar in January 2024. The course was arranged by Prof. Haukur Ingason together with several other lecturers form the division and RISE Research Institutes of Sweden.

On the February 15th the division hosted the 9th IMFSE Fire Safety Engineering Day. This event offered a unique opportunity to our IMFSE students to meet with the organizations supporting the IMFSE programme. The topic of the day was "The importance of data in Fire Safety Engineering" and included presentations and a panel debate on this topic moderated by Associate Professor Enrico Ronchi. The event also gave the opportunity to celebrate the recent evaluation received by the EU for the IMFSE education, as we got the highest score ever for our education, being a success story among the International joint master programmes funded by the EU.

The Swedish Master Program in Fire Safety Engineering received almost 100 first choice applicants (470 total) to the program starting after the summer 2024. This is almost two persons applying as their first choice to each available student position.

Research

On September 8th, 2023, the Swedish government announced an effort to strengthen research and education in electrification and batteries. Lund University has decided to focus a substantial part of this, 2.3 M€, on battery safety research – including 500 k€ in a testing facility. As a part of this, the division of fire safety engineering will, during the year, recruit two PhD-students in battery safety research to strengthen the ongoing research on safe energy carriers, which has until now focused mostly on hydrogen safety. The research will be performed with close collaboration with recruitments at other divisions within the same effort. The project leader on fire safety is Associate Professor Marcus Runefors.

The division is leading the development of a new research facility located in Campus Helsingborg (part of Lund University). The new lab will host a wide range of state-of-the-art Virtual Reality and driving simulator equipment for research in the safety area, including Human Behaviour in building fires and wildfires. This is part of a multi-disciplinary project in collaboration with the Faculty of Medicine and Transport and Roads Division. at Lund University For any information, you can contact the project leader Dr Enrico Ronchi at enrico.ronchi@brand.lth.se.

Positions and personnel
Thushadh Wijesekere, a gratuate from the IMFSE program, joined the division as PhD student in April 2024. Thushadh will work with hydrogen safety, and he is supervised by Marcus Runefors.

Awards
The Division of Fire Safety Engineering was well represented at the International Symposium of Fire Safety Science in Tsukuba, Japan. Several papers and posters were presented by people associated with the division. There were also awards presented to our colleagues Margaret McNamee (Forum award), Arthur Rohaert for the best student paper and Konrad Wilkens for the best photo.

More information
More information about the Division, is available on www.brand.lth.se. Our website is continuously updated with news.

Signed: Nils Johansson

University of Maryland

UMD Awarded NSF Grant to Study Structure Losses in Maui Wildfire
The wind-driven blazes that ravaged the Hawaiian island of Maui in 2023 killed 100 people, making it the third-deadliest U.S. wildfire. After the embers died down, a UMD researcher looked at images and data depicting the $4-6 billion in damage and wondered about the landscape that remained. “Why didn’t some of these buildings burn, when most of the surrounding structures were completely destroyed?” asked Shuna Ni. Now, funded by a grant from the National Science Foundation, Ni will study the few buildings that survived an inferno that current wildfire modeling software predicts should have leveled everything in its path. The one-year study could help boost such modeling capabilities while leading to new protective technologies for structures. Along with Arnaud Trouvé and Stanislav Stoliarov, Ni will build a database to carry out an enhanced simulation of the fire as it swept over two Lahaina buildings: one damaged, and one left intact. They will look at details such as the buildings’ architecture and construction, age and condition, the nearby vegetation distribution, heat exposure during the fire and other factors to build more accurate prediction models. Their goal is to develop models that capture individual structure losses at the wildland-urban interface that would unleash a wealth of information on conventional fire risk assessment techniques, ultimately developing better solutions to protect neighborhoods in affected areas.

UMD Research Recognized at IAFSS


Stanislav Stoliarov was a plenary speaker at the 14th IAFSS in Tsukuba, Japan. He presented scientific efforts that could unveil the mechanisms driving pyrolysis. The study of fire behavior and growth has been the focus of Stoliarov’s research. A paper by Stoliarov and his advisees Jacques De Beer and Emily Dietz on structural materials’ reactions to firebrands was also presented. Arnaud Trouvé presented a paper titled “Evaluation of Angular Resolution Requirements in the Finite-Volume-Method-Solution of the Radiative Transfer Equation.” Parham Dehghani received the IAFSS Best Thesis Award for the Americas for his thesis “Burning Emulations of Condensed Phase Fuels Aboard the International Space Station.” He was advised by Peter Sunderland and James Quintiere. At the IAFSS Trouvé is a trustee and vice-chair of the Executive Committee and Shuna Ni is on the Membership Advisory Council.

UMD Enters XPRIZE Wildfire Competition
A multidisciplinary research collaboration led by the FPE Department is working on new ways to detect, localize and suppress wildfires through its participation in the XPRIZE Wildfire international competition. The team is called “Crossfire” and is led by Arnaud Trouvé. It aims to improve wildfire mitigation tools via rapid and autonomous technologies as part of the competition’s $5M autonomous wildfire response track. The challenge is to develop a system that locates and suppresses a wildfire in an area spanning 1000 km^2 with challenging wind and terrain conditions in under 10 minutes. The multidisciplinary team brings together researchers from FPE,

including 9 undergraduate students advised by Stanislav Stoliarov and Fernando Raffan-Montoya; researchers from the departments of Aerospace Engineering, Mechanical Engineering, and Geographical Sciences; the UAS Research and Operations Center; the Maryland Autonomous Technologies Research Innovation and eXploration Lab; and managers from xFoundry@UMD. "Crossfire" will also collaborate with researchers from Georgia Tech.

Gemstone Team Wins 'Do Good' Showcase Prize to Build Wildfire Drone

The Gemstone Honors Program team advised by Fernando Raffan-Montoya won the 2023 'Do Good' Showcase, receiving an award that will support the development of a drone prototype that could advance wildfire research. The undergraduate research team, named "Supa'Hot," received a $500 award in support of the development of an unmanned aerial vehicle that could be used to collect data of the burning pieces of airborne wood or vegetation lifted by wildfires, known as embers. The prototype could help researchers develop modeling systems to better understand how wildfires spread by characterizing ember size, count and flight path–further advancing the study of fire behavior.

UMD Calls for Safer Holidays with Christmas Tree Fire Demonstrations

The FPE Department held its annual Christmas Tree Fire Safety Demonstration. Isaac Leventon, a research scientist at NIST, conducted a series of live fire experiments demonstrating the burning behavior of well-hydrated Balsam Fir trees in comparison to unhealthy, dried out ones. Each year, Leventon seeks to educate the public about the hundreds of fire incidents that result in structural losses and civilian casualties. The tests demonstrated the impact of moisture content on ignition, fire growth rate, and peak fire size, emphasizing how these accidents can be prevented by following the safety measures recommended by the NFPA. A second round of experiments engaged over 200 fire safety scholars, students, and engineers across 24 nations in a competition to predict the burning behavior of the trees. This year marks its 10th anniversary.

"Milke Way" Retirement Party for James Milke

In a reception dinner in Bethesda, students, alumni and friends of the FPE Department reunited to commemorate the retirement of James Milke, who has been associated with the department since obtaining a B.S. degree in 1976, followed by an M.S. degree in 1981, and who was department chair from 2011 – 2023. Several of his former students gave remarks and expressed gratitude for his profound and meaningful impact on their personal and professional lives. For many, like Rosalie Hrybyk, he was present in important milestones such as her graduation and her wedding. Remarks were also given by Dean Samuel Graham and Arnaud Trouvé. The dinner was also a fundraising event for the Dr. James A. Milke Scholarship for undergraduate students.

Signed: Peter Sunderland

NIST Fire Research Division

A Photoacoustic Technique for Measuring Soot Deposition on Surfaces

NIST has investigated the feasibility of a non-invasive soot deposition measurement technique to help fire investigators to quantify burn patterns in a fire scene. The tool relies on the photoacoustic effect of soot, which generates an acoustic response when exposed to a pulsed light source. Soot was deposited on drywall and metal substrates mounted above a propene burner, and the mass deposited was measured gravimetrically. The soot coated substrates were perturbed with a camera flash, and the photoacoustic response of the soot was measured by a microphone in the form of the peak sound pressure. The results showed a log-based correlation between the acoustic response and the measured soot mass load, a correlation that was dependent on the flash intensity. Notably, the photoacoustic response of soot deposited on both drywall and metal substrates was the same within the experimental uncertainties. The results were presented at the Eastern States Section of the Combustion Institute Meeting on March 10-13, 2024, and the work was featured in a NIST Taking Measure blog (https://www.nist.gov/blogs/taking-measure/sound-soot-how-strange-noise-can-keep-us-safer-fires).

Full-Scale Fire Growth Experiments for Fire Model Validation

In collaboration with the Nuclear Regulatory Commission (NRC), the Flammability Reduction Group (FRG) recently completed a series of 90 full-scale fire experiments to quantify the impact of material composition on full-scale burning and fire growth behavior (NIST Technical Note 2282). Samples were selected to provide a wide range of material compositions (i.e., chemistries) and burning behaviors: physical deformation (e.g, swelling, charring collapse, dripping, and/or melt flow), heavy or light soot formation, and varied ignitability and fire growth rate. In total, 18 unique combustible solids were tested including: natural and synthetic polymers, copolymers, fiberglass-reinforced composite materials, porous polymer foams, and electrical cables. Measurement data obtained in these tests include: spatially-resolved flame to surface heat transfer and flame heat transfer mechanism (radiation vs. total), time-resolved heat release rate, combustion products yields (CO, CO2, and soot), and radiative heat flux at a distance.

Collectively, these experiments offer a comprehensive set of validation data for computational fluid dynamics (CFD) simulations of large-scale fire growth due to flame spread over the surface of combustible solids in a parallel panel configuration. Measurement data is available online on the NIST Fire Calorimetry Database. This dataset is also incorporated in the NIST Material Flammability Database, which is an ongoing project designed to support fire model development by maintaining: experimental measurements for model calibration; automated analysis tools for material property calibration; archived, version-controlled material property sets; and unique experimental datasets to validate model predictions of ignitability, burning rate, flame structure/heat feedback, and fire growth rate at multiple scales.

Signed: Isaac Leventon

Université de Poitiers

PhD defence of Rita Nohra, "Modelling of the reaction to fire of materials in sub-ventilated atmosphere. Application to the PMMA"

Rita defended her PhD on March 15 before a jury composed of Bart Merci from Ghent University, Anthony Collin from université de Lorraine (the 2 reviewers), Gaelle Fontaine from Polytechnique Lille and Yannick Pizzo from Aix-Marseille université. Rita's supervisors were damien Marquis from LNE, Benjamin Batiot and Thomas Rogaume from université de Poitiers.

Abstract of her PhD: In the field of fire safety, the ignition and combustion of polymeric materials are closely linked to the ambient conditions, particularly the oxygen concentration. In the initial stages, the fire displays characteristics similar to a well-ventilated situation, but as the fire develops and the combustible materials burn, the availability of oxygen decreases. The fire moves into a state of under-oxygenation characterised by complex and unstable behaviour of the gaseous phase. Oxygen depletion also affects heat and mass transfer within the material under study, affecting its thermal decomposition and combustion, as well as the kinetics and nature of the gaseous products.

Experimental studies aimed at characterising the influence of the under-oxygenation on the reaction to fire of solid materials are still very limited in the literature, and numerical models are often not validated for such atmospheres.

In this context, the present work aims to characterise the thermal decomposition and the combustion of polymeric materials in contaminated environments, focusing on poly(methyl)methacrylate (PMMA). A controlled atmosphere calorimeter cone (CACC) was instrumented to characterise the influence of oxygen concentration on thermal decomposition and combustion processes: mass loss, temperature fields, heat flux, gas composition. During the experimental study, oxygen concentrations ranging from 10% to 21% were studied, for 3 different heat flows.

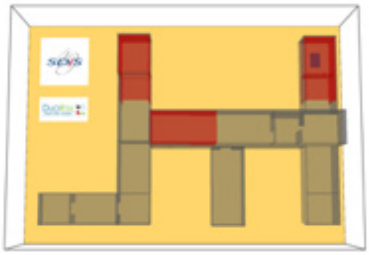
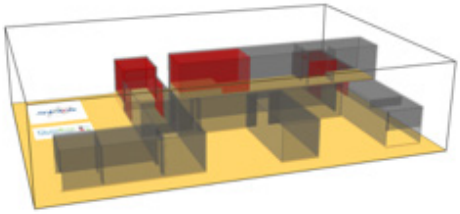
The experimental results highlight the significant influence of oxygen concentration and external heat flux on heat and mass transfer as well as on PMMA combustion. Mass loss, heat release rate and temperatures show linear progression with oxygen concentration up to a certain value where the behaviour becomes chaotic and unpredictable. A dimensionless parameter representing the oxygen concentration was introduced, allowing suitable correlations to be found for the various parameters studied.

Evaluation of the thermal conditions that can be encountered in a project of fire training facility consisting of shipping

Simon Roblin and Fabien Hermouet, PhD of Poitiers University and CEOs of DuoRisk, had the opportunity to work with the firefighting services of Maine et Loire (France) to evaluate the thermal conditions that can be encountered in a project of fire training facility consisting of shipping containers. This work follows the different studies and collaborations that have been led since 2012, by Poitiers and Nancy Universities, with various fire department like Vendée.

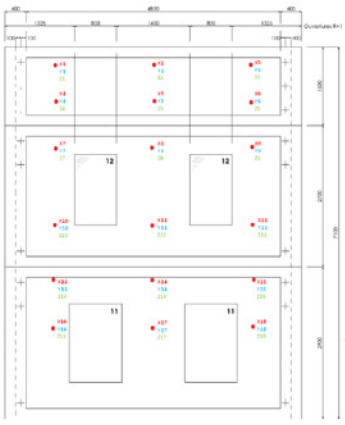
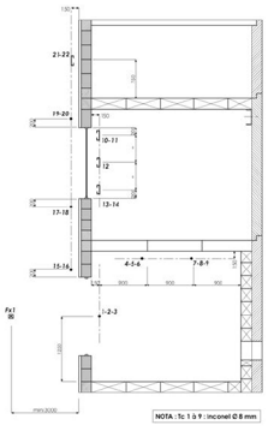
In this context, the fire department of Maine et Loire, asked DuoRisk to lead a numerical study to ensure that the project of the new facility responds to different objectives in terms of pedagogy, safety, operability and durability. Moreover, the environmental impact of smoke was evaluated by experimental studies (led in Pprime laboratories and on the project location) and by a numerical approach (with the use of a Gaussian model). This approach led to the use of toxicological indicators like AEGL.

Fire scenarios were conducted using two types of sources (four European wood pallets corresponding to 100 kg and 190 kg of chipboard). Numerical simulation was led with three fire locations in the facility (red areas in the figures below). For each location and each fire source, temperature, heat flux, smoke density were evaluated. To help the fire service in his choice of materials, a few insulation solutions were tested too.


"Fire REsistaNce of External Thermal Insulation Composite Systems - FRENETICS" Project. A large scale campaigns

The French national program "Fire REsistaNce of External Thermal Insulation Composite Systems - FRENETICS" involved Institut Pprime, Efectis, UMET (Lille) and CORIA (Rouen). The work focused on two main systems, one ETICS and one HPL. Whereas UMET has characterized the fire behavior of those materials at small scale (TGA, cone calorimeter, small radiant panel), Pprime has worked at medium scale (0,5*0,5m² and 1*1m²).
A campaign has been conducted at large scale into Efectis platform located in "les Avenieres". Three LEPIR-2 tests have been done and one BS8414. During those large-scale tests, a specific and detailed scientific instrumentation was used: thermocouples, fluxmeters, IR cameras, etc.


The results obtained are now used to validate the results obtained at smaller scale with those new real scale data.

A new Master in Fire Safety Engineering

Université de POITIERS offers at the beginning of the academic year 2024-2025 a new master's degree dedicated to the training of future fire risk prevention and management in all types of structures and organization.

The two years of this new training, will allow training students to become Fire Safety Manager, Risk Manager, Foreman, Fire Safety Expert, Engineer in fire safety...
The lessons concern in particular :

- Risk management
- Fire Hazard Fundamentals
- Methods of risk analysis
- Risk assessment methods
- Fire science and modelling
- Type of fires
- Fire risk study
- Resilience to major risks

Signed: Thomas Rogaume

Universitat Politècnica de Catalunya

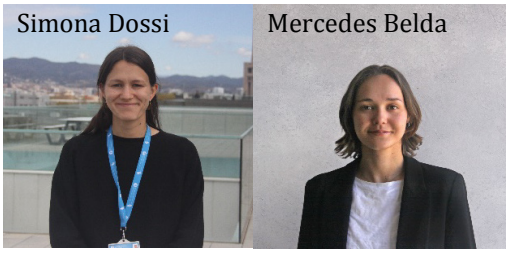
CERTEC (Centre for Technological Risk Studies) has been selected to become part of the UPC Specific Centre for Hydrogen Research (CER-H2), which consists of 10 research groups, and offers training and R&D capabilities for companies to explore innovation in the hydrogen sector. CERTEC will contribute by supporting and leading hydrogen fire safety research advances.

The CERTEC team is part of the Technical Commission for the management of the problem of fire spread along building facades appointed by the Government of the region of Catalonia in March 2024, after the façade fire in Valencia (Spain) in February 2024. The objective of the Commission is to prevent the occurrence of similar accidents in Catalonia.

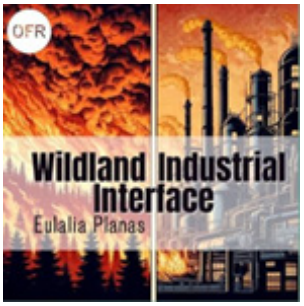
People updates

After a successful completion of his MSCA fellowship, **Dr. Ronan Paugam** has been awarded the position of Lecturer at UPC in December 2023, due to officially commence the next academic semester, Autumn 2024. Dr. Paugam will continue his IMFSE Wildfire Behaviour course, focusing on wildfire spread simulations. Additionally, he will be leading and expanding his projects related to the simulation of radiative transfer in open propagating fires, wildfire plume formation and predictive simulations, using remote sensing images from prescribed fire experiments.

Dr. Pascale Vacca was awarded second place of *VI Premios Internacionales de Incendios Forestales 2023,* a prestigious national award for excellence in wildfire research for her PhD thesis titled *Fire risk analysis framework at the wildland-urban interface*, supervised by Prof. Elsa Pastor and Prof. Eulàlia Planas. Dr. Vacca was awarded by Junta de Comunidades de Castilla-La Mancha and Pau Costa Foundation.



Dr. Pascale Vacca started as Assistant Professor and post-doc researcher. In October 2023 **Dr. Simona Dossi** joined as a post-doc researcher after obtaining her PhD from Imperial College London, and **Mercedes Belda** as a researcher; Mercedes will start her PhD as part of the PROSAFE Marie Skłodowska-Curie Actions Doctoral Network in June 2024.



Listen to our very own Prof. Eulalia Planas interviewed by Prof. Wojciech Węgrzyński in a recent **Fire Science Show podcast** episode on Wildfire Industrial Interface (WII) and Risk Assessment. The episode introduces the risks of wildfire exposure to industrial installations, and the necessary considerations to reduce this important, and always more pressing, fire safety issue.

Academic updates

CERTEC organised the first **Wildland-Industrial Interface (WII) Workshop** at UPC campus in Bacelona, on wildfire risk and impact to industrial facilities. Members from la Generalitat de Catalunya, firefighters, QRA consultants, and industry representatives all joined and participated in valuable lectures and discussions addressing wildfire exposure characterisation, technical barrier vulnerabilities and more. Our collaborators from

Università di Bologna, Dr. Giordano Scarponi and Dr. Federica Ricci, collaborated in the organisation and presentation of the workshop, and shared their expertise on Natech industrial accidents and assessments. A second workshop session is scheduled to be help in Bologna in June 2023.

CERTEC Team and IMFSE Students, Nov.r 2023

We are happy to be approaching the end of the first successful academic year as Full Partner University of the International **Master of Science in Fire Safety Engineering (IMFSE)**. CERTEC offered courses on wildfires and WUI fires including Wildland Fire Behaviour and Modelling, Risk and Vulnerability at the WUI, and Advanced Fire Safety Engineering. Six students are currently finishing their Master Thesis research at CERTEC.

Projects updates

Vulnerable Elements and Risk Assessment – VERA project, started on January 2024 and will end in December 2025. It is a project financed under the EU Civil Protection Mechanism, coordinated by Meteogrid SL and done in collaboration with Universitat Politècnica de Catalunya (Dr. Alba Àgueda), ADAI (Dr. Miguel Almeida), Universidade de Aveiro (Dra. Ana Miranda), VOST Portugal (Mr. Jorge Gomes), Entente pour la Fôret Méditerranéenne (Dr. Frédérique Giroud) and Departament d'Interior Generalitat de Catalunya (Ms. Núria Gasulla). VERA project aims at improving cross-border risk management mechanisms, with an improved multi-risk approach, extending the capabilities of the platform developed in the previous VESPRA project by taking advantage of existing data from European services (Copernicus, Galileo or JRC) and extending the analysis to Spanish-Portuguese and Spanish-French (Catalonia-France) bordering pilot cases. In addition, its operation and usefulness will be applied in real demonstrations carried out in-situ.

European Program for Wildfire-Prepared Communities – FIREPRIME project, started January 2024 and will end on December 2025. It is a project financed under the EU Civil Protection Mechanism, coordinated by UPC, Prof. Elsa Pastor acting as P.I. of the consortium. The technical team at CERTEC is led by Prof. Pascale Vacca. The work is done in collaboration with Universitat Oberta de Catalunya (Prof. Israel Rodríguez), Pau Costa Foundation (Mr. Guillem Canaleta), Universitaet Fuer Bodenkultur Wien (Dr. Maria Papathoma-Köhle), RISE Research Institutes of Sweden (Dr. Johan Sjostrom). The main objective of FIREPRIME is to establish the foundations of an EU-wide program that promotes a culture of fire resilience among WUI communities, with the focus on civil protection. FIREPRIME will design at pilot level the program architecture and governance, and will develop and implement a comprehensive toolkit of resources that includes a smartphone app, guidelines, checklists, and educational materials aimed at enhancing wildfire resilience in three critical targets: households, communities, and infrastructure.

Signed: Eulàlia Planas

University of Queensland

UQFire welcomes new PhD Students

Zeinab Darabi commenced her doctoral studies at the University of Queensland, building upon her background in chemical engineering. Her current research focuses on developing effective chemical treatments for CCA-treated wood to mitigate the risk of sustained smouldering. The primary objective of Zeinab's research is to identify cost-effective, non-leachable, and safe smouldering inhibitors, to formulate an emulsion or solution of CCA and fire-retardant agent that can treat wood in a single step to have both durability and fire retardancy. Outside of her studies, Zeinab enjoys activities like playing ping-pong, cooking and photography.

Haiyang Fang is a new PhD student exploring *High Performance Numerical Fire Simulation with FDS*. Prior to joining the PhD programme, Haiyang completed his master's degree in civil engineering also at UQ where he worked on evaluating the effects of material nonlinearity on the fundamental behaviour of structures in fire. His current research aims to systematically assess and improve the scalability of FDS simulations on heterogenous compute architectures and across multiple compute nodes.

Satorupa Karmakar is a PhD student in University of Queensland-Indian Institute of Technology Delhi Joint Academy of Research. She is currently working under the supervision of Dr. Upasna Sharma (IIT-D) and Dr. David Lange (UQ). Satorupa's research focuses on examining community resilience to fire in informal settlements. She has conducted field visits in the informal settlements (Jhuggi Jhonpdi clusters) in Delhi to assess community and individual perception to fire, fire management practice and prevention measures. The final part of the project is funded by SFPE Student Grant and attempts to understand the impact of policies towards fire management through a cross-country study in India and Australia. In Australia, the primary focus of Satorupa is to conduct stakeholder workshops including experts from various organisations throughout Australia.

Anish Banerjee is also a PhD student in University of Queensland-Indian Institute of Technology Delhi Joint Academy of Research. His PhD topic delves into the resilience of densely built urban areas when subjected to loss of compartmentation or building-to-building fire spread in both isolated and multi-hazard fire scenarios. He is currently at UQ investigating the constitutive properties of stressed concrete under fire exposure using a novel testing apparatus and methodology accompanied by rigorous numerical simulation.

Recent Graduates

One outstanding PhD student specialised in fire research graduated from UQ in 2024. UQFire extends their warmest congratulations to Dr. Julian Mendez.

Characterisation of the fire dynamics in Ventilated Facades

The research utilised bench scale characterisation to extract material flammability properties, as well as medium-scale testing rigs to investigate factors like cavity width, ventilation, and fire intensity's influence on flame dynamics and heat transfer to facade linings. Findings revealed the dominance of radiative heat transfer at the fire base and highlighted the importance of considering interactions between materials and geometry in facade design for fire performance. Furthermore, critical elements for fire growth in ventilated facades were identified and a theoretical framework to explain complex fire dynamics was developed, offering insights into material and system properties necessary for assessing facade assembly performance under various conditions.

UQFire around the world

12th IAFSS Symposium

Staff and students, past and present, from UQ fire were at IAFSS in Japan, enjoying all of the delights of Tsukuba. Yifei Lin presented on applications of Causal Networks in Fire Safety Engineering, Wenxuan Wu presented on self-sustained smouldering of CCA treated timber, Zhiruoyu Wang presented on the response of structural diagrids to fire, Julian Mendez presented on fire dynamics in ventilated cavities. It was also great to see so many graduates and former colleagues presenting work that they did at UQ, and to listen to some of the fantastic work that they've continued to do since they left. A particular highlight was Carmen Gorska and Juan Hidalgo taking home the Philip Thomas Medal of Excellence for their paper presented at the 11th Symposium and co-authored with Jose Torero.

Tsukuba turned out to be an excellent experience for everyone, it was fantastic to see the IAFSS community together again and we look forward to seeing everyone again soon!

Two UQFire Students Win the SFPE Student Research Grant

Joshua Madden was awarded for his project "Phenomena Governing the Fire Dynamics in Open-Plan Timber Compartments." His proposed research project aims to develop engineering models for open-plan timber compartments in mass timber buildings, addressing the unique fire safety challenges they present compared to traditional concrete or steel structures.

Satroupa Karmakar was awarded for her project "Understanding the Impact of Policies Designed to Mitigate Fire Risk in Informal Housing". In her research project, she aims to elicit stakeholder perspectives on formation of

informal housing and policy improvements needed for reducing the risk of fire and to improve response to fire in informal settlements.

UQ Students Present in ASFE in Nanning, China
UQFire PhD students Joshua Madden and Zhiruoyu Wang presented at the Applications of Structural Fire Engineering Conference held in Nanning China.

Zhiruoyu presented his work on high-rise diagrid structures under fire scenarios with an optimized modelling methodology. This research aims to establish a methodology to assess the fire resilience of diagrid structures, while addressing considerations of cost and structural efficiency.

Josh presented his paper titled "Coupling Fire and Mass Timber Structures: a Challenge Fire Safety Designer Must Address". This paper highlights the critical need for a holistic approach to fire safety in mass timber buildings, illustrating the practical application of a proposed performance-based design methodology, and also highlighting the limitations with existing research.

ARC Advance Timber Hub
The ARC Research Hub to Advance Timber for Australia's Future Built Environment aims to develop the resources, enablers, and drivers to advance sustainable timber, as a natural resource, to be the material of choice, leading towards a net zero future for Australia's built environment.
The Hub has brought together interdisciplinary experts from broader disciplines from industry, government, and academia with expertise in understanding innovative technology solutions, national transformative benefits, and the processes of change. This expertise across the full value chain aims to enable an advanced manufacturing transformation of Australia's timber and construction industries that unlocks substantial industry and social value.

As part of the Hub, UQ Fire is leading several research projects and activities on the fire performance of timber. To learn more about the Hub please visit: https://www.advance-timber-hub.org/

See you at the 2024 SiF Conference in Coimbra!
Our students Zhiruoyu Wang, Joshua Madden, Akshay Baheti and Stavros Spyridakis will be presenting their work in SiF2024!

Signed: Anwar Orabi

SFPE Foundation

In March 2024, the SFPE Foundation published a new research report. *The Integration of Building Information Modeling with Fire Protection Systems, Software, and Workflows* is the culmination of a yearlong research study by Stephen B. Roth, PE, who set out to investigate BIM software tools and schemas available to fire protection engineers. Through interviewing over 40 stakeholders, Roth learned that improvements could be made to software, data, and interoperability to enhance the design experience and expand BIM adoption amongst FPEs. Roth's recommendations include that equipment manufacturers design more usable Autodesk Revit families and that updates be made to the IFC (Industry Foundation Classes) schema for better interoperability. The report also explores the future of BIM in fire engineering, which includes adoption of AI tools and digital twins of physical buildings for smarter firefighting.

Accompanying the report is a supplementary User Guide that includes expectations and recommendations on overcoming some of the workflow bottlenecks that occur when fire engineers are using FE-related software tools. Readers who wish to focus on the practical application of the research should check out the User Guide first. The report and guide are available at: https://www.sfpe.org/foundation/foundationresearch/fundedresearch
The SFPE Foundation is also funding three new projects whose reports will be available in 2025. These projects are intended to meet research needs identified as priorities for the field by the Grand Challenges Initiative Working Groups.

- **Environmental and Health Impacts of Thermal Runaway Events in Outdoor Lithium-Ion Battery Energy Storage System Installations:** Battery Energy Storage Systems (BESS) installations are

becoming more common due to the world's push for more renewable energy systems in the face of climate change, but no one has yet thoroughly investigated the impacts of li-ion BESS fires. Such fires are rare but, when they occur, are intense and difficult to suppress. The SFPE Foundation is funding research on the environmental and health impacts of thermal runaway in lithium-ion (Li-ion) batteries in outdoor BESS installations. Jamie McAllister (PhD, PE) of FireTox LLC is the principal investigator, with Brendan McCarrick (PE) and Zelda Zhao also on the project team. The project aims to better understand the health and environmental aspects of li-ion BESS fires, such as products of combustion, factors that influence propagation, and firefighting tactics. The project team will use this information to model li-ion BESS fire plume dispersion. They will then use the models to develop a risk analysis of the health and environmental impacts of such fires.

- **Fire Testing of Resilient and Sustainable Building Materials:** The construction industry uses a diverse range of new materials intended to lower carbon emissions of buildings, such as green façades, hempcrete, and building-integrated photovoltaic (PV) systems. While these materials improve the sustainability of the built environment, they may also elevate fire risk and compromise a building's performance in the event of a fire. The SFPE Foundation is funding research into fire testing of resilient and sustainable building materials, including PV panels. The project team includes principal investigator Prof. Richard Walls (PhD, MSc, BScEng, GDE, BTh, PrEng), Dr. Natalia Flores-Quiroz (PhD, MSc, BScEng), Yohannes Shewalul (MS, BS) of Stellenbosch University, Carlo Kuhn of Ignis Testing, and a to-be-hired postdoctoral researcher. The project's objectives are to identify the sustainable building materials used in construction, the fire testing methods used for those materials, and potential fire risks that are not addressed in existing testing methods with further experimental fire testing.
- **The Interface Between Digital Buildings and Fire Service Operations:** Smart Firefighting represents a transformative approach to fire safety, leveraging large amounts of information to enhance the efficiency, effectiveness, and safety of firefighting operations, enabling first responders to make more informed decisions, predict fire behaviors, and reduce risks for both themselves and the communities they protect. While much research has been done to develop and apply the Smart Firefighting framework, more research is needed on the packaging and communication of the immense amount of data that flows from Smart Firefighting systems. The SFPE Foundation is funding research into the interface between digital buildings and fire service operations. Dr. Nils Johansson of Lund University will serve as project leader. He is accompanied by Dr. Enrico Ronchi of Lund University and Dr. Kate Kapalo of the International Public Safety Data Institute. The primary goal of this research project is to study the flow of digital information from smart buildings to the fire service and how it can be optimized. A specific interest is the integration of data from tools for Smart Firefighting and incident commanders.

Learn more at https://www.sfpe.org/foundation/foundationresearch/foundationresearch-ongoing

Additionally, the SFPE Foundation received a FEMA Fire Prevention & Safety Grant to create an expanded WUI Virtual Handbook with updated and new content, a template for risk assessment based on best practices, and a robust suite of supporting materials to help fire service personnel communicate with property owners and community leaders about fire risks and parcel-level and community-level mitigation strategies to reduce wildland-urban interface (WUI) fire losses. Three project teams were selected for this project. Darlene Rini, PE, is leading the Engineering Technical Consultant team from Jensen Hughes. Hubert Biteau, PhD, PE, CFEI, is leading the Engineering Risk Consultant Team from Code Red Consultants, LLC. And third, Daniel Price, PE, and Bill M. West are leading the Web Design & Creative Consultant Team from Engineered Fire Systems, Inc. and Bareknuckle Branding, respectively. The updated handbook will be made available in late 2025.

Do you have students in search of research funding? We can virtually speak to your students about SFPE funding opportunities for students. To arrange a presentation, please contact Amanda Tarbet at atarbet@sfpefoundation.org

Signed: Amanda Tarbet

University of Sheffield

Recent completions

Congratulations to **Yifan Li** who defended his PhD thesis entitled "The Mechanism and Mitigation of Fire-induced Spalling of Concrete with Recycled Tyre fibres". The project investigated how sustainable fibres from recycled tyre fibres could still help mitigate the risk of spalling. In particular, it focused on how these fibres influence moisture transport and how the physical introduction of thermocouples can modify the pore structure and affect results. Yifan was supervised by Prof. Kypros Pilakoutas and Dr Shan-Shan Huang.

New arrivals

Welcome to new PhD student, **Babar Ali**, under the supervision of Dr Shan-Shan Huang and Dr Giacomo Torelli. His PhD project is entitled "*Investigating Fire Spalling Behavior of Low Carbon Ultra-High Performance Concrete (UHPC) Utilizing Sustainable Materials and Fibres*". The project aims to investigate how eco-friendly binders like fly ash, GGBS, and alkali-activated materials, alongside sustainable fibres such as recycled tyre waste and plant-based fibres can be used to mitigate spalling risks while improving environmental sustainability. It will include developing mixes and testing them for spalling, and then conducting comprehensive LCA (life cycle assessments) to identify suitable sustainable mixes. Babar graduated with a Civil Engineering degree in BZU Multan in 2017, and has since completed a Masters, and worked as Engineer, Lecturer and Research Associate.

Babar has also written a little about himself outside of work:
"When I'm not immersed in work, you'll find me enjoying my hobbies. Whether it's collecting leather goods (seriously, everyone I know has a wallet from me), navigating the pitfalls of online shopping, or brewing a perfect cup of chai, I'm all in. And when it comes to cooking, I love experimenting with fusion dishes inspired by Afghan, Pakistani, and Chinese cuisines. Plus, I'm not too bad at pool tables and snooker, and I adore spending time outdoors – trekking, camping, and just soaking in the beauty of the mountains."

Dissemination

The group is happy to announce that a number of papers have been accepted at SiF (Structures in Fire). These include:

1. **Apostolopoulos, P.**, Torelli, G., Guadagnini, M., Huang, S-S. & Dal Pont, S. *Numerical and Experimental Investigations of Heat-Induced Spalling in Concrete*.
2. **Jeebodh, A.**, Davison, J.B., McLaggan, M.S., Burgess, I.W. & Huang, S-S. *Lateral-torsional buckling of steel-timber hybrid structures in fire.*
3. **Selvaranjan, K.**, Torelli, G., Provis, J.P. & Guadagnini, M. *Apparatus for assessing the load-induced thermal strain of concrete under uni-axial compression at elevated temperature*.

Be sure to check out the presenters at Coimbra in June!

Other papers:

1. Liu, Y., Huang, S-S., Burgess, I.W. & Peng, B. Optimization of Failure Modes of a Ductile Connection Under Fire Conditions. *Fire Technology*. 2024 Mar 31:1-23. https://doi.org/10.1007/s10694-024-01571-3
2. Mendez, J.E., McLaggan, M.S. & Lange, D. Upward flame spread behaviour of cladding materials on a medium-scale ventilated façade experimental setup with a single combustible wall. *Fire Safety Journal*. 2024 Jan 1;142:104020. https://doi.org/10.1016/j.firesaf.2023.104020
3. Mendez, J.E., Ingolfsson, S., Hidalgo, J.P., Lange, D. & McLaggan, M.S. Upward flame spread behavior of cladding materials on a medium-scale ventilated façade. *Fire Safety of Façades (FSF)*, Lund, Sweden, 10—12 June 2024.

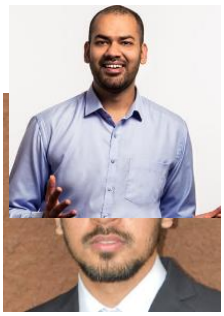
Shan-Shan Huang has also been co-author of the following recommendations as part of RILEM Technical Committee 256-SPF: Spalling of concrete due to fire: testing and modelling.

1. Recommendation of RILEM TC 256-SPF on fire spalling assessment during standardised fire resistance tests: complementary guidance and requirements
2. Recommendation of RILEM TC 256-SPF on the method of testing concrete spalling due to fire: material screening test

Topic focus: Hybrid steel-timber in fire

The structural fire engineering group has been running projects for a number of years on hybrid steel-timber structures in fire. These combine the (relatively) known behaviour of steel beams and columns and combines them with potentially low carbon CLT (cross laminated timber). We currently have two major projects ongoing:

1. **Dr Ankit Agrawal (Sheffield/DBI)**. Focused on the thermal performance of these hybrid systems, combining both numerical and experimental campaigns. A number of constructions will be investigated while varying various parameters in order to understand how the thermal performance changes. Ankit has been using AI combined with validated numerical modelling to understand the relative importance of each factor. This is decoupled from the mechanical response. You can see a mini-website that we will keep updated here. *Joint with DBI and Stora Enso and funded by the Danish Innovation Fund.*



2. **Aatish Jeebodh (Sheffield)**. Focused on the mechanical response of hybrid steel-timber systems in fire. Aatish has the SiF paper mentioned above, and is expecting another journal paper to be published soon (already submitted). He has been investigating the effect of lateral restraint and the lateral torsional buckling behaviour of steel beams supporting CLT floors in fire. *Funded by an EPSRC CASE award with OFR Consultants.*

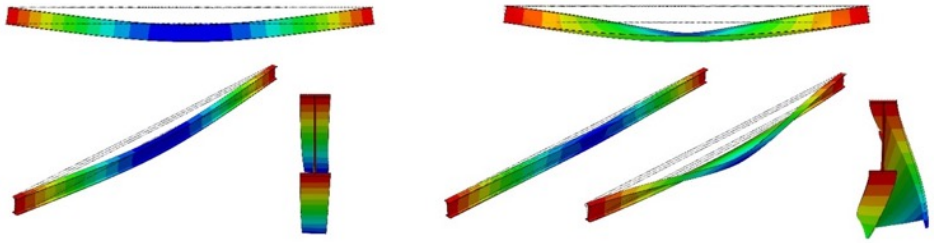


Figure – Aatish's work on lateral torsional buckling of steel beams supporting CLT in fire.

We have a number of publications upcoming in this area, so keep an eye out for them!

Signed: Martyn McLaggan

The Slovenian National Building and Civil Engineering Institute

SFPE Engineering Solutions Symposium: Advancing Fire Safety and Sustainability

On 29th and 30th November, 2023, the SFPE Engineering Solutions Symposium for Fire Safety and Sustainable Building Design took place in Ljubljana, Slovenia, arranged by the Society of Fire Protection Engineers (SFPE) in collaboration with the FRISSBE team from ZAG (photo credit: Tamara Želimorski, ZAG).

With over 100 attendees from more than 20 countries, the two-day symposium delved into diverse topics intertwining sustainability and fire safety engineering. Esteemed speakers, representing academia and industry, shared insights and best practices, thus catalyzing engaging discussions on pertinent issues.
Prof. Grunde Jomaas, FRISSBE's ERA chair holder, shared the project's objectives, while senior researchers Andrea Lucherini and Ulises Rojas-Alva unveiled ongoing research initiatives. Their presentations spanned a spectrum of themes, including the integration of fire safety and sustainability, advancements in biobased products and mass timber buildings, fire safety of photovoltaic (PV) systems, the fire performance of façade systems, and lithium-ion battery fire safety.

Following the symposium, on December 1st, attendees were invited to a visit to the ZAG Fire Laboratory in Logatec (photos). There, they witnessed a live fire resistance test of a loaded cross-laminated timber (CLT) wall element, sponsored by Stora Enso. Andrea Lucherini gave a presentation entitled "Fire engineering and research needs in future timber buildings", showcasing the importance of research in ensuring the fire safety of timber.

More photos and information about the SFPE Symposium and the lab event can be found on ZAG's website.

An example of an active day in ZAG's Fire Laboratory

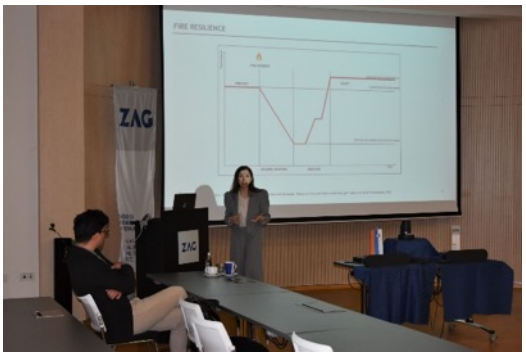
On a day at the end of January 2024, the Slovenian Fire Protection Association (SZPV) arranged an event in ZAG's Fire Laboratory in Logatec (photo). The full-day seminar, given by Milan Hajduković, focused on the fire properties of construction products and Milan provided crucial insights into passive and active fire protection systems, emphasizing the importance of understanding and verifying the fire resistance of building materials.
Participants, including fire safety designers, engineers, architects, manufacturers, and inspectors, gained valuable knowledge on product certification, installation requirements, and real-life fire scenarios where effective building materials halted fire progression. Obviously, a lab tour was also given (by ZAG's fire laboratory team), and this enabled a close connection between theory and practice.

In addition to the seminar, internal meetings at ZAG facilitated interdisciplinary discussions among employees. Andrea Lucherini (FRISSBE), Urška Blumauer (ZAG's Fire Laboratory), Mirjam Bajt Leban (ZAG's Department for Materials), and Andrej Anžlin (ZAG's Department for Structures) explored collaboration opportunities related to the assessment of post-fire performance of steel structures (photo).

Furthermore, Prof. Grunde Jomaas and Ulises Rojas-Alva led a productive meeting with partners from InnoRenew CoE to discuss progress and optimization strategies for the WoDeFi project, focusing on wood-modification methods for enhanced fire safety (see also next section). These gatherings underscore ZAG's commitment to advancing fire research and fostering collaboration within the field.

Fostering Research Exchange: Martina Manes Shares Career Insights at ZAG

Assistant Prof. Martina Manes (University of Liverpool) visited the FRISSBE Department at ZAG thanks to the RSF pillar funding from ARIS (Slovenian Research and Innovation Agency) for hosting researchers. Martina is also involved in a ZAG funded project entitled FIEERCE (a Framework for the Fire Impact Estimation on the Environmental Sustainable Requirements and Comprehensive Optimisation in the Built Environment) where her expertise related to fire statistics is highly relevant. On the 5th of April, she gave a seminar (photo) on her career development and challenges for a young researcher. During the week of visit, she was also introduced to the activities in the lab (photo). Another project visit will take place in November.



Research Focus

The fire researchers at ZAG have secured public funding from ARIS (Slovenian Research and Innovation Agency) for various projects. These projects, which range from battery safety to material behaviour of wood and façade systems, contribute to the overall research strategy of the FRISSBE project and the various research topics (Materials, Experimental methods, and emissions & toxicity).

Ulises Rojas-Alva, as the lead in a consortium between FRISSBE-ZAG (leading partner) and KI (The National Institute of Chemistry in Slovenia), was awarded funding from ARIS for the acquisition of an Acceleratory Rate Calorimetry (ARC). Before the end of the summer, the ARC will be installed and will be fully operational and ready to perform thermal stability studies (adiabatic, ramping, isothermal, isoperibolic calorimetry, and step isothermal control modes) for LIB (Li-Ion Battery) cells and other alternative battery technologies. In addition, the ARC can do abuse tests (thermal, overcharging, nail penetration) and heat capacity measurements.

InnoRenew CoE (lead partner) and the FRISSBE department at ZAG was awarded funding from ARIS for a project entitled "Innovative engineering wood products made from Thermo-hydro-mechanical densified wood with enhanced physical, mechanical and fire performance " or WoDeFi. The overall goal of the project is to apply wood thermo-hydro-mechanical (THM) densification to low-value wood species to develop high-performance engineered timber products (EWPs) with enhanced mechanical properties and fire behaviour.

Lastly, the FRISSBE department was also awarded another ARIS project with focus on façade fire safety. The proposed research project will carry out an extensive experimental study that combines large-scale and mid-scale experiments to identify the sensitivity to failure of ETICS systems in a fire scenario. The aim is to determine the critical parameters that can define (possibly as precursors) the failure mode of a building envelope system at large-scale and mid-scale, and the influence flame retardants in the insulation layer have on the failure mode. The parameters to be measured are time-dependent concentrations of toxic gases, heat release rate (HRR), smoke volume, mass loss, temperature, and radiant heat flux density.

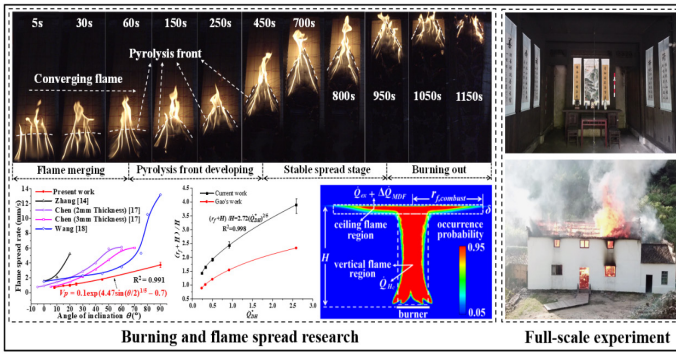
Further information
Follow FRISSBE on LinkedIn for updates and job postings: https://www.linkedin.com/company/frissbe
News stories and research updates are posted on the FRISSBE website: https://www.frissbe.eu/

The FRISSBE project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 952395. (https://cordis.europa.eu/project/id/952395)

Signed: Grunde Jomaas

State Key Laboratory of Fire Science (SKLFS), University of Science and Technology of China

The National Key R&D Program of China "Fire Spreading Mechanisms and Key Technologies for Fire Risk Assessment and Forewarning of Heritage Buildings", led by Prof. Jie Ji of SKLFS with the execution period from October 2020 to September 2023, has yielded significant achievements. Through many burning experiments conducted on typical fire sources, the project has revealed the characteristics of different fire sources and key fire-spreading paths within heritage buildings. A series of kinetic models have been established to elucidate wood ignition and the burning behavior of the typical wood and wooden components in heritage buildings. Mathematical models of flame spread on the usual wooden components' surfaces have been developed. The project has successfully established anti-interference image-based fire detection technologies and a comprehensive evaluation method to assess the anti-interference performance of fire detectors. The project has established a dynamic fire risk assessment method that accounts for variable indicator weights and scores for heritage buildings. Additionally, a comprehensive fire prevention and control platform has been developed by integrating key technologies produced by the project. The developed technologies have been applied to the Potala Palace in Tibet, the ancient village of Hongcun in Anhui, and Baiyun Temple in Beijing and Puning Temple in Hebei Province.



Burning and flame spread research and the full-scale fire experiment of wooden structure buildings.

A Scientific and Technological Training Course "Design and Evaluation Methods of Fire Safety Engineering Materials" for Developing Countries in "the Belt and Road" successfully held.

From December 3 to 16 2023, a scientific and technological training course "Design and Evaluation Methods of Fire Safety Engineering Materials" for developing countries in "the Belt and Road", funded by the Bureau of International Cooperation, Chinese Academy of Sciences (CAS) and hosted by SKLFS, was successfully held. In total, 34 researchers in fire safety engineering materials and related research fields from 15 countries along "the Belt and Road", including Russia, Iran, Kazakhstan, Belarus, Egypt, Thailand, Bangladesh, Ghana, and Afghanistan, participated in the two-week training course.

The training courses are composed of four parts: (1) the theoretical foundation of technical methods, including the basic principles of fire safety engineering material design and its application in lithium batteries, fiber-reinforced composite materials, and biodegradable polymer materials; (2) the evaluation methods of fire safety engineering materials, which involve the on-site understanding of commonly used instruments and their operating procedures; (3) visiting research institutions and enterprises in the field of fire safety engineering materials, including the SKLFS, the Advanced Technology Research Institute of the USTC, the Hefei Public Safety Research Institute of Tsinghua University, and Huitong New Materials Co., Ltd.; and (4) brainstorming, where each trainee combines their actual situation to explore collaborative research and prospects in the field of fire safety engineering materials.

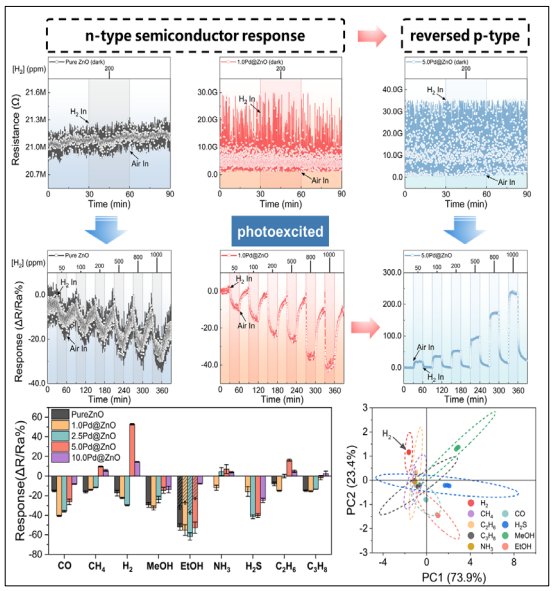
This course invited several renowned experts to give academic lectures, including Prof. Manfred Döring from the Fraunhofer Institute for Structural Durability and System Reliability in Germany, Prof. Baljinder Kandola from the University of Bolton in the UK, Prof. Richard K. K. Yuen from City University of Hong Kong in China, Prof. Fei Bin and Assoc. Prof. Anthony Chun Yin Yuen from Hong Kong Polytechnic University in China, Prof. Jixin Zhu, Prof. Bin Yu, Assoc. Prof. Weiyi Xing, Assoc. Prof. Bibo Wang, Assoc. Prof. Xin Wang, Assoc. Prof. Weizhao Hu and Assoc. Prof. Yongchun Kan from the SKLFS.

Progress in the development of high-selectivity room temperature MOS-type flammable gas sensors

In recent years, amidst the escalating global energy crisis and the imperative push towards carbon peaking and neutrality, emerging application scenarios such as fuel cells, electrochemical energy storage, and hydrogen-methane fuel technologies have put forward more diverse needs and higher standards for the detection of flammable gases, especially hydrogen. Due to its high stability, reliable repeatability, and structure miniaturization advantages, the metal oxide semiconductor (MOS) gas sensor has become one of the most promising sensing technologies for environmental monitoring and flammable gas detection. Nevertheless, such sensors typically require operating temperatures ranging from 300 to 500 ℃ to perform their sensing functions. Such high operating temperature poses the potential risk of high-temperature ignition in the flammable gas environment and greatly increases the system's power consumption. In addition, MOS-based sensors currently exhibit high cross-sensitivity, which means they have similar response characteristics to the same type of gas molecule (such as H2, CH4, CO, and other flammable gases). Therefore, developing gas sensing technology with high selectivity at room temperature is of great significance for enhancing security measures and early risk detection in the energy sector.

Recently, Professor Jinhua Sun and Dr. Peiyu Duan from the State Key Laboratory of Fire Science proposed an ultra-efficient room temperature gas discrimination scheme based on photoexcited Pd@MOF-derived porous nanocomposites, enabling accurate identification of hydrogen at room temperature through a monolithic sensor. A new phenomenon of room-temperature hydrogen response transition behavior was discovered, and the microscopic mechanism of the high-selectivity hydrogen response at room temperature under photoexcitation was clarified. The associated work was entitled “Ultra-effective room temperature gas discrimination based on monolithic Pd@MOF-derived porous nanocomposites: An exclusive scheme with photoexcitation” and was published as the cover article in the ***Journal of Materials Chemistry A*** (the top journal of Energy and Materials Science, Impact factor=11.9).

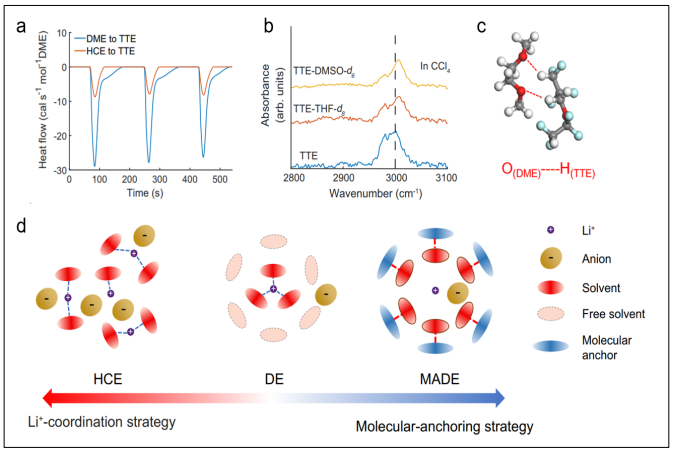
To solve the problem posed by the high operating temperature and limited selectivity of MOS-based sensors, a novel approach has been proposed. This strategy integrates the benefits of porous microstructures in materials with photoexcitation techniques. The photoexcited rectification effect significantly reduced the baseline resistance (Ra) of the nanocomposites and effectively eliminated the electrical signal noises in the prepared sensors. It was discovered that with an increase in Pd content, the response behavior of the material to hydrogen changed from typical n-type to p-type semiconductor sensing characteristics. Due to the porous properties of Pd@MOF-derived nanocomposites and the special adsorption mechanism of Pd nanoclusters on H2 molecules, the monolithic sensor's unique response and high-selectivity to hydrogen was realized at room temperature. H2 was found to be completely independent of other flammable gases through pattern recognition, which means that the high-selectivity recognition of hydrogen can be achieved merely based on the original electrical response behavior, thereby expanding the application potential of this research. This work provides a solid experimental foundation and theoretical basis for regulating porous materials and designing novel photoexcited high-selectivity room temperature gas sensors.



The unique response behavior and high-selectivity to hydrogen of the sensor at room temperature

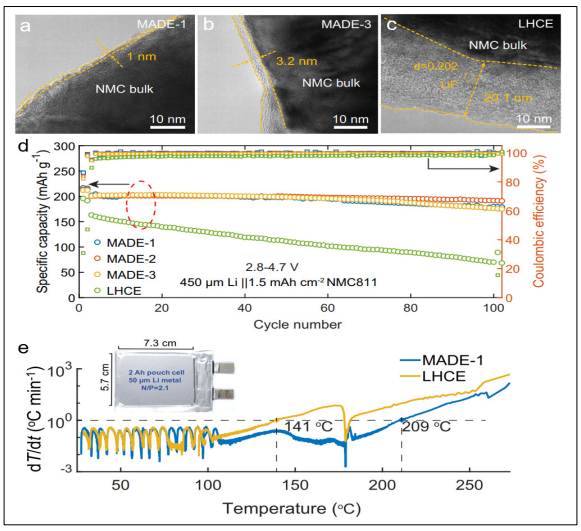
Progress in New Electrolyte Design for High-Voltage and High-Safety Lithium Metal Batteries

Recently, a team from SKLFS has discovered a new electrolyte design that utilizes intermolecular hydrogen bonding interactions to significantly enhance the electrochemical stability of electrolytes and effectively suppress the thermal runaway process in Li metal batteries. The related findings, entitled "Molecular anchoring of free solvents for high-voltage and high-safety Lithium metal batteries," have been published in ***Nature Communications***. Prof. Xiaodi Ren and Prof. Qingsong Wang are the corresponding authors, and PhD student Zhuangzhuang Cui is the first author of the paper.



Hydrogen bonding interactions and molecular anchoring electrolyte design strategies. a Heat flow curves with DME or HCE added into TTE. b Comparison of C-H vibration signals of TTE before and after mixing with THF-d8 and DMSO-d6 in CCl4. c Schematic diagram of MADE and HCE/LHCE design strategy (DE, LiFSI-9DME in molar ratio).

Due to their extremely high energy density, Li metal batteries are considered strong contenders for next-generation battery technology, but they face significant issues in electrolyte stability and safety. While widely used in Li-ion batteries, traditional carbonate-based electrolytes struggle to accommodate the reactive Li metal anode. In contrast, ether-based electrolytes demonstrate better compatibility with Li metal, yet their inferior antioxidative capacity limits their application in high-voltage cathodes. While raising the electrolyte concentration can enhance the electrochemical stability of ethers, it introduces challenges such as increased



Electrochemical performance, surface interface, and safety study of Li metal batteries a-c HR-TEM images of the cathodes after 50 cycles in MADE−1 (a), MADE-3 (b), and LHCE (c). d Cycling performance of Li||NMC811 cells using MADE-1, MADE-2, MADE-3 and LHCE. The temperature dependence (dT/dt) of the Li||NMC811 pouch cells with the MADE−1 and LHCE during the thermal runaway process.

costs and compromised low-temperature performance. More significantly, a high concentration of anions poses safety risks such as thermal runaway.

To tackle the challenges outlined above, the authors propose a novel molecular anchoring strategy, which holds promise for addressing both the high-voltage and safety concerns of ether-based electrolytes. They introduce fluorinated ethers (e.g., TTE) with polar C-H moieties into a low-concentration electrolyte of dimethoxyethane (DME). It was found that molecular "anchoring" between DME and TTE occurs via hydrogen bonding, effectively reducing the electron cloud density around the oxygen atoms in the ether molecule. This significantly enhances the oxidation stability of the solvent.

The 3rd International Conference on Loss Prevention, Process Safety, and Thermal Analysis in Chemical and Coal Industries held

SKLFS hosted the 3rd International Conference on Loss Prevention, Process Safety, and Thermal Analysis in Chemical and Coal Industries (LPPSTA) on March 29 – 31, 2024. This conference was organized by the University of Science and Technology of China, Yunlin University of Science and Technology, Nanjing Tech University, and Xi'an University of Science and Technology, and jointly hosted by 17 institutions. The conference was a success in terms of the quality of the papers and posters presented. Nearly 300 representatives from 5 countries gathered to discuss the industry's process safety and state-of-the-art thermal analysis research.

At the conference, 103 oral presentations and 37 posters were presented in the fields of Chemical Process Safety, New Energy Fire Safety, Coal Fire Disaster Prevention and Control, Mine Ventilation and Gas Control, Fire Science and Technology, Urban Public Safety, Disaster Emergency Response, and Security and Emergency Management. The selected papers are recommended for peer review by the Safety Science, Journal of Loss Prevention in the Process Industries, and Journal of Thermal Analysis and Calorimetry.

The China National Symposium on Combustion 2023 successfully held in Hefei

The China National Symposium on Combustion 2023 was successfully held on October 12-15, 2023, in Hefei, Anhui. The symposium is organized by the Chinese Society of Engineering Thermophysics (CSET), hosted by SKLFS, and supported by the National Natural Science Foundation of China (NSFC). More than 1,700 delegates from more than 100 universities, institutions, and industry enterprises attended the two conferences on-site.

During the symposium, Prof. Marcus Aldén from Lund University, Prof. Jianhua Yan from Zhejiang University, Prof. Jai-ick Yoh from Seoul National University, Prof. Bin Yang from Tsinghua University, Prof. Yuji Suzuki from the University of Tokyo, and Prof. Jie Ji from USTC, were invited to deliver plenary lectures. Twelve parallel topics of combustion research were set up. In total, 12 topical reviews and 307 oral presentations were presented, and 406 posters and 46 popular science works were shown. In addition, a series of activities, including the industrial forum, the female scholars salon, the youth scholars salon, and the academic visit, were also held during the symposium.

The China National Symposium on Combustion has been held annually for many years and has become the most well-known academic conference in the Chinese combustion community. The Program Committee of the Symposium 2023 is jointly chaired by Prof. Zuohua Huang, Prof. Zhihua Wang, and Prof. Yixiang Shi. Prof. Gequn Shu and Prof. Naian Liu served as the chairman and executive chairman of the local organization committee, respectively. This symposium brought together more than 1,700 well-known experts and scholars at home and abroad to exchange innovative research progress in the field of combustion in the past year.

The 4th Workshop on Pedestrian Traffic and Evacuation Dynamics (2023) successfully held

The 4th Workshop on Pedestrian Traffic and Evacuation Dynamics (2023) was held in Hefei, Anhui, during October 27-29, 2023. The conference was hosted by SKLFS, and co-sponsored by the National & Local Joint Engineering Research Center of Thermal Safety Technology and the Working Committee for Personnel Safety of China Association for Public Safety. More than 110 representatives from over 30 universities and institutions, including the University of Science and Technology of China, University of Tokyo, Tsinghua University, Tongji University, Beijing Jiaotong University, Beihang University, Wuhan University of Technology, Southwest Jiaotong University, and Shanghai University of Technology, gathered in Hefei to exchange ideas on new theories, methods, technologies, and trends in the study on pedestrian and evacuation dynamics. Dr. Claudio Feliciani from the University of Tokyo, Dr. Xiaobing Yang from the Academy of Military Sciences, Professor Tieqiao Tang from Beihang University, and Professor Xiaolei Wang from Tongji University were invited to deliver their research speeches. Twenty-one experts and scholars gave oral presentations. The attendees discussed the opportunities and challenges faced in the field of pedestrians and evacuation in the future.

Eight Researchers from SKLFS Selected to Elsevier's List of Highly Cited Chinese Researchers in 2023

Elsevier published the list of 2023's "Highly Cited Chinese Researchers" on March 27, 2024. Eight researchers from SKLFS appear in the list (names listed alphabetically): Longhua Hu, Yuan Hu, Jie Ji, Jinhua Sun, Weiguo Song, and Qingsong Wang for the Safety Science and Engineering subject list, Professor Lei Song for Material Science and Engineering, and Xin Wang for Chemistry.

This list employs Scopus, the globally recognized citation and indexing database, as the source of statistics for Chinese intellectuals' scientific research achievements. It also uses the technique of the Shanghai Soft Science Education Information Consulting Co., Ltd. By 2024, it is the tenth release and has sparked widespread concern among media and researchers. Elsevier offers data support and technological implementation for the list.
The list of "Highly Cited Chinese Researchers" by Elsevier is not only dedicated to systematically displaying the current talent distribution in China's scientific research field but also accurately portrays the composition and academic influence of dominant disciplines across various institutions and universities, as well as the top talents in key technology research areas. Data source: Scopus database, Highly Cited Chinese Researchers Micro. Website link: https://www.elsevier.com/zh-cn

Professor Jie Ji's research group published a popular science comic book

In January 2024, the research group of Prof. Jie Ji at SKLFS published a popular science comic book, "*The Adventure of Fiery Sprite: Exploring the Mystery of Fire and the Wisdom of Ancient Chinese Fire Protection*". This book is inspired by Prof. Jie Ji's National Key R&D Program project of China, "Fire Spreading Mechanisms and Key Technologies for Fire Risk Assessment and Forewarning of Heritage Buildings", to convey scientific research findings on fires in heritage buildings to the public.

The book took two years to craft the story and draw the cartoon. By combining stories and knowledge, the book presents readers with several highlighted moments of fire prevention in ancient China. The protagonist, a fiery sprite, travels to Chang'an City in the Tang Dynasty, Hangzhou City managed by the famous poet Dongpo Su in the Song Dynasty, the Forbidden City in the Qing Dynasty, and the present SKLFS. Through four adventure stories, this book aims to popularize unique fire behaviors and share the fire prevention wisdom of China from different historical periods. It includes over 100 knowledge points and historical allusions, covering topics such as firefighting measures, fire prevention strategies, building structures, and the latest scientific research findings in fire science.

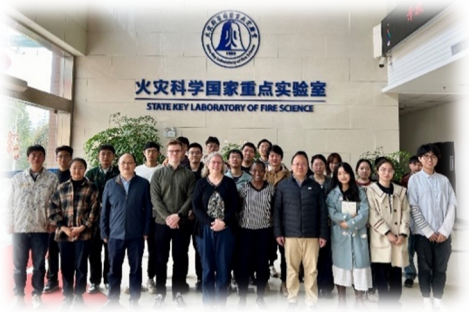
The book has been recognized and recommended by well-known scholars, including Prof. Weicheng Fan (founder of SKLFS), Prof. Xinhe Bao (President of the University of Science and Technology of China), Prof. Laibin Zhang (former President of China University of Petroleum (Beijing)), and Jixiang Shan (former Director of the Palace Museum). On March 10, 2024, the team held a book

launch and a science popularization lecture, attracting more than 300 people offline and more than 10,000 online.

Dr. Xiepeng Sun Receives IAFSS Best Thesis Award

Dr. Xiepeng Sun at SKLFS has been honored with the IAFSS Best Thesis Award "Excellence in Research" (Region Asia Pacific). His Ph.D dissertation is entitled "Experimental and Theoretical Study on the Ejected Facade Flame Behavior from Compartment Fires under Different Ventilation Conditions" under the joint supervision of Prof. Longhua Hu (USTC) and Prof Bart Merci (Ghent University). He also delivered a presentation, "Experimental study of ejected fire plume from an opening under facing wind passing through the roof," at the 14th International Symposium on Fire Safety Science. Dr. Sun earned a B. S. (China University of Mining and Technology, 2012.09-2016.06) and Ph. D (University of Science and Technology of China, 2016.09-2021.06). He worked as a Postdoctoral Researcher at SKLFS after graduation (2021.07-2023.06). He is currently an Associate Professor at SKLFS.

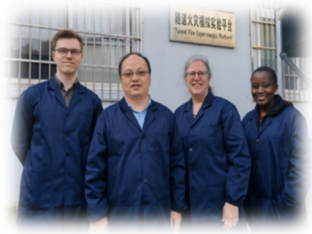
Professor Margaret McNamee from Lund University visited SKLFS in March 2024



Margaret McNamee, a Professor of Fire Safety Engineering at Lund University in Sweden, and two Ph.D. students from the same university visited SKLFS under the support of NSFC-STINT collaboration project by Professor Fei Tang and Professor Longhua Hu.

During the seminar, five Ph.D. students from Lund University and USTC presented their current research on flame spread, fire test, celling jet fire, fire emissions, and tunnel fire, inspiring a wide range of discussions among numerous students. After the presentations, Professor Margaret McNamee and Professor Longhua Hu discussed and proposed steps to deepen cooperation.

After the seminar, Margaret's team discussed with Professor Longhua Hu's group the experimental setup for fire toxicity, flame characteristics, and smoke control of new energy vehicles in a longitudinal ventilation tunnel, which are the main research topics of NSFC-STINT collaboration project.



On March 29th, Prof. Margaret McNamee delivered an insightful lecture titled "Projects in Support of Sustainable Fire Safety" at SKLFS. Prof. Margaret McNamee underscored the critical importance of fostering a sustainable environment and delved into strategies for advancing sustainable fire safety practices. Through three compelling examples, the lecture elucidated key areas of focus: navigating challenges associated with phase-change materials, promoting the reuse of products and materials to meet fire safety standards, and implementing a decision support framework for sustainable fire-resistant buildings (SAFR-BE). Professor McNamee emphasized the pressing need for more concerted efforts in systematic, interdisciplinary collaboration to effectively address the multifaceted challenges posed by sustainable fire safety on a global scale.

Prof. Congling Shi was awarded China National Outstanding Engineer

On January 19, 2024, Prof. Congling Shi, a doctoral graduate of SKLFS, was awarded the title of inaugural "National Outstanding Engineer". The National Engineer Award is a recognition activity carried out in the name of the Central Committee of the Communist Party of China and the State Council, and it is the highest honor in the engineering field in China.

Professor Congling Shi entered the Department of Thermal Science and Energy Engineering at the University of Science and Technology of China in 1996. He obtained his doctoral degree from SKLFS in 2005. Later, he joined the China Academy of Safety Science and Technology and has mainly engaged in scientific research and technical applications

in metro safety, fire safety, etc. He has made outstanding contributions in areas such as metro fire safety, passenger evacuation safety, metro safety assessment, etc., which has led to the publication of over 130 SCI papers in respected journals such as TUST, JHM, and IJHMT, as well as the authorization of more than 140 patents and the drafting of 20 national, industry and local standards. He invented the full-scale testing technology, equipment, and standards for metro disaster prevention systems, innovated the fire modeling and smoke extraction system of complex structure metro, formulated subway safety evacuation standards, developed metro safety assessment & testing technology and standards, which have been widely used in over 85% of metro lines in China and promoted the innovation of metro safety technology.

In addition, he was awarded the China Youth Science and Technology Award in 2016. In 2020, he was awarded the "National Advanced Worker" honor by the Central Committee of the Communist Party of China and the State Council. Furthermore, he has won the Beijing Science and Technology Award First Prize, the China Patent Excellence Award, and the China Standard Innovation Contribution Award.

Signed: Naian Liu

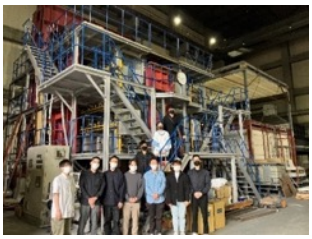
Tokyo University of Science

Fire Research and Education at

TUS's Center for Fire Science and Technology was founded in 1981 and has been serving as a leading fire research institute in Japan since then. As of March 2024, 17 faculty members within TUS and 14 visiting professors from worldwide belong to the Center. IAFSS's Kunio Kawagoe Gold Medal was named after Prof. Kawagoe, a founding member of the Center.

The left picture below shows the Center's Fire Research and Test Laboratory. It has a floor area of 1,900 m^2 with a ceiling height of 18 m. The Laboratory has a full-scale fire test hall of 40 × 26 m^2, equipped with, e.g., a calorimetry hood of 5 × 5 m^2 (the middle picture), a large-scale structural fire resistance furnace for walls, a multi-purpose full-scale furnace (the right picture), and a room corner testing unit. These are utilized not only for state-of-the-art fire research but also for conducting performance appraisal services.





The Center has four research units: (1) fire dynamics, (2) evacuation and human behaviors, (3) fire resistance for structural members and materials for disaster prevention, and (4) firefighting, fire prevention, and industry fires. Their representative research topics include efficient and continuous smoke control, wheelchair helpers' ways to pass through a fire door, FEM analysis of fire behavior of fire-protected steel columns, and the environmental impacts of fire suppressants. The Center publishes the International Journal for Fire Science Technology, a peer-reviewed journal whose information can be found at https://gcoe.tus-fire.com/en_journal/.

TUS's Department of Global Fire Science and Technology offers master's and doctoral degree programs. Most classes are taught in English, and Japanese language proficiency is not required for obtaining a master's or doctoral degree. Approximately 1/3 of the Department's graduate students are international students, primarily from Asian and Pacific regions. Our faculty members include (from left to right) Profs. Ritsu Dobashi, Ichiro Hagiwara, Shiro Ichimura, Kazunori Kuwana, Ken Matsuyama, Masayuki Mizuno, Yoshifumi Ohmiya, and Shinya Yanagita.

Those who are interested in the Center's research activities or our graduate programs, please contact Prof. Ken Matsuyama, the Center's Director, at kmatsu@rs.tus.ac.jp or Prof. Kazunori Kuwana, the Department Head, at kuwana@rs.tus.ac.jp.

FORUM

In 2012, the Center took the initiative to establish the FORUM on Advanced Fire Education/Research in Asia. The 9th FORUM was held from 23rd to 24th Nov. 2023 in Hanoi, Vietnam. TUS members (4 professors and 11 graduate students) participated in the seminar and visited HUCE (Hanoi University of Civil Engineering) and UFPF (University of Fire Prevention and Fighting).

At the seminar on the first day at HUCE, TUS's Center for Fire Science and Technology introduced research project planning. It proposed promoting collaborative research to address recent challenges in fire damage mitigation. Additionally, speakers from Vietnam highlighted issues such as deficiencies in hotel fire prevention measures and standards, challenges posed by large-scale fires resulting in fatalities in high-rise apartments, and challenges with firefighting equipment in rack-type warehouses. Discussions also covered topics like handling of existing inadequate buildings associated with revisions to the Building Standards Law and retroactive applications with amendments to the Fire Service Act in Japan, as well as comparing installation standards for sprinklers in rack-type warehouses between Vietnam and Japan. Furthermore, poster presentations by graduate students were conducted, fostering lively exchanges of ideas.

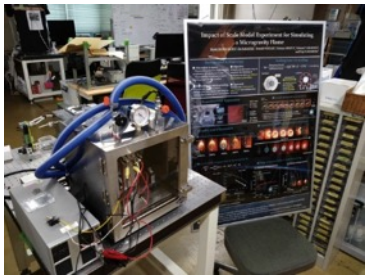
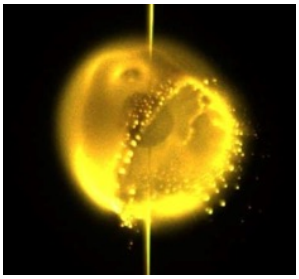
During the meeting at UFPF on the second day, we had discussions regarding the layout of mini-apartments with no fire compartmentation between the stairs and motorcycle parking on the first floor, fire safety measures in accommodations known as Sleep Boxes, and fire prevention measures in large-scale rack-type warehouses. UFPF introduced firefighting equipment.

Signed: Kazunori Kuwana

Toyohashi University of Technology

The fire safety group ECELAB (Energy Conversion Engineering Laboratory) located at Toyohashi University of Technology (TUT), Japan, is experiencing continued growth. The current members of ECELAB include Professor Yuji Nakamura, Associate Professor Tsuneyoshi Matsuoka, Associate Professor Sekishita Nobumasa, Assistant Professor Takuya Yamazaki, three postdoctoral researchers, a secretary, and over 20 students. We are delighted to announce the transition of our Assistant Professor, Takuya Yamazaki, who will embark on an exciting new journey as an Associate Professor at Hirosaki University, Japan, from April 2023. Also one of postdoc (Dr Sun) was returned to Hong Kong Poly U from April 2023. Thank you for your wonderful contributions and wish a luck for your new position!

Prof. Yuji Nakamura devoted himself to the study of scale-modeling-based combustion research to establish a better and safer energy system, and is currently mainly devoted to fundamental research on combustion under microgravity conditions. Experiments are conducted in a drop tower (as shown in the picture) to evaluate fire safety in future space missions, also contributes to the selection of materials and designs for spacesuits, cabins, and habitats. This work is supported by Adaptable and Seamless Technology Transfer Program through Target-driven R&D (A-STEP) from Japan Science and Technology Agency (JST) Grant Number JPMJTR22RA and JSPS Kakenhi (#20H02397).


Experimental hardware for the drop tower experiment (left), burning polymer under microgravity environment (center), mg-test teams at COSMOTORRE (right)

Congratulations to Prof. Yuji Nakamura on being appointed Vice-Chair of the Membership Advisory Council and Symposium Planning Committee for the International Association for Fire Safety Science (IAFSS). His work on suppression of flame flickering under normal gravity and atmospheric pressure has been prominently featured in the American Physical Society and the New Scientist magazine. The Japanese web media "Rikerabo" conducted an interview about this work, and the interview content is scheduled to be released soon! Anticipate with eagerness!

Since the ECELAB started several collaborative research projects, from 2022, three postdocs joined: Dr. Daiki Matsugi (Japan), Dr. Yue Zhang (China), and Dr. Peiyi Sun (China).


Dr Daiki Matsugi


Dr Zhang Yue


Dr Peiyi Sun

Dr. Daiki Matsugi's research centers around fundamental studies on burning characteristics of a porous combustible soaked in a liquid oxidizer and “inverse” droplet combustion of liquid oxidizer in a gaseous fuel atmosphere (https://doi.org/10.1016/j.combustflame.2023.112782). Also, he conducts in-depth research on combustion in microgravity environments. His research outcomes have already garnered recognition through peer reviews. Congratulations to Dr. Daiki Matsugi for winning the Incentive Award at the 35th JASMAC (Japan Society for Microgravity Application)!

Dr. Yue Zhang was selected as JSPS Foreign Special Researcher. Her research focuses on fire dynamics, with current interests in flame structure and fundamental burning characteristics of polymer. Dr. Zhang's work enriches the foundational knowledge of flame research and will be instrumental in developing more effective

firefighting techniques and ensuring the safety of both responders and the public. Recent work on flame spreading over partially wetted specimen has been published to CNF; congratulation!

Dr. Sun employed simulation software like FDS and Fluent to create models for multi-scale fire scenarios. Her research not only facilitated the visualization and comprehension of fire-related concepts but also simulated potential accidents or possible situations, enabling the evaluation of safety protocols and emergency response strategies. This is projected work supported by private company (PI. Prof. Nakamura).

One new postdoc will join our team in the year 2024. Once launched, we will update the member.

ECELAB is a place full of challenges and opportunities. With a wide range of research interests and a dedicated research team, it will always be the most robust support during your research career. We extend a warm welcome to doctoral students and postdocs with experience in combustion and fire dynamics to join us in our pursuit of exciting and meaningful research. If you are interested in our lab, please leave your contact information. Thanks!

The continued communicating views, news, and achievements in ECELAB blog https://ece.me.tut.ac.jp/wp/.

Signed: Yuji Nakamura

Waseda Univerisity

Waseda University has two laboratories concerned with fire disaster prevention: the Tomonori Sano Laboratory in the School of Human Sciences and the Tomoyo Hokibara Laboratory in the School of Creative Science and Engineering.

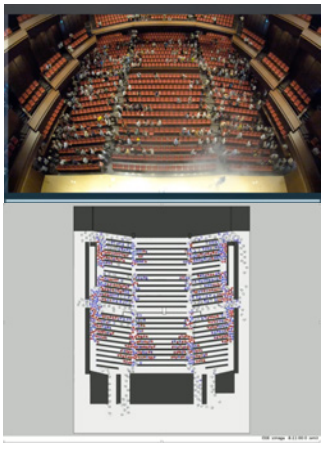
Tomonori Sano Laboratory, School of Human Sciences, Waseda University

The Faculty of Human Sciences at Waseda University is interdisciplinary, and the Tomonori Sano Laboratory researches architectural disaster prevention and planning. Established in 2005, the laboratory comprises Professor Tomonori Sano, eight invited researchers, three masters, and 19 undergraduate students. (http://sanolab.jp)

The following three of the laboratory's evacuation studies are introduced.

Evacuation training survey research

- Evacuation training concert study in a theatre

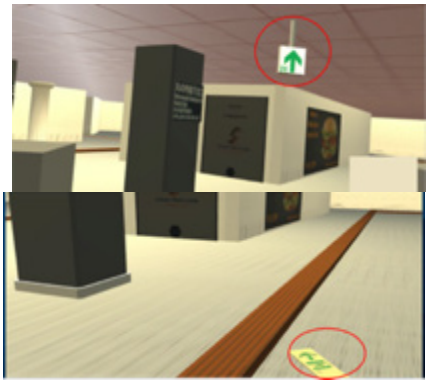


A concert hall with a capacity of 2,000 people is continuously used for evacuation training concerts by recruiting members of the public. Evacuation behavior was filmed by a video camera installed near the ceiling, and the walking trajectories of each of the approximately 600 participants were analyzed. The participants themselves selected the six evacuation exits themselves, and it was confirmed that most participants used the nearest exit and that they did not use the vertical passageway very often, often moving to the wall before heading for the exit. Based on these results, the evacuation behaviour was reproduced, and the mechanism analysed using the evacuation simulation described below. The research is being conducted together with invited researchers Dr. Yugo Hatakeyama, Dr. Mineko Imanishi, and Dr.Tai Satoh.

Imanishi, M., & Sano, T. (2019). Route Choice and Flow Rate in Theatre Evacuation Drills: Analysis of Walking Trajectory Dataset. Fire Technology, 55(2), 569-593. https://doi.org/10.1007/s10694-018-0783-2

Evacuation guide light research

Research on evacuation guidance by guide lights using VR

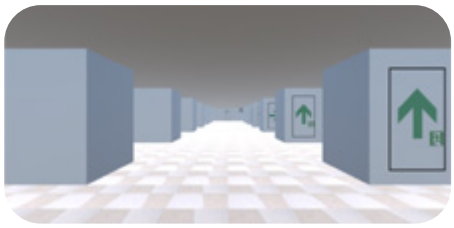


The station space was reproduced by VR and the differences in the guidance effects of suspended guide lights, floor guide lights and four-sided guide lights were investigated. It was found that the upper arrow marks guidance lights could be mistaken depending on the viewing angle and that the four-sided guidance lights complimented the mistakes.

Research with Jun Kubota and Dr. Enrico Ronchi, Lund University, presented at IAFSS 2023 Jun Kubota, Tomonori Sano, Enrico Ronchi The

impact of people-signage interaction on way- finding evacuation behaviour, Fire Safety Journal, Volume 142, January 2024, https://doi.org/10.1016/j.firesaf.2023.104023

A study on evacuation guidance using digital billboards with VRs.
This is a study on the use of digital billboards, which can display videos used for advertising in everyday life, as evacuation guidance lights during emergencies. The research is being conducted together with invited researcher Dr. Kosuke Fujii.



SANO Tomonori, FUJIWARA Ryuta, SASAKI Atsushi, Effects of placement conditions of digital signage displaying, dynamic evacuation guidance on the ease of Summaries of technical papers of annual meeting, Architectual Institute of Japan, 2022.09 (in Japanese).

Tomoyo Hokibara Laboratory, Faculty of Creative Science and Engineering, Waseda University
A new disaster prevention laboratory was launched in 2021 at the Department of Architecture, Faculty of Creative Science and Engineering, Waseda University.
The current main members are **Assistant Professor Tomoyo Hokibara** and 19 students. (https://www.hokibara.arch.waseda.ac.jp/)

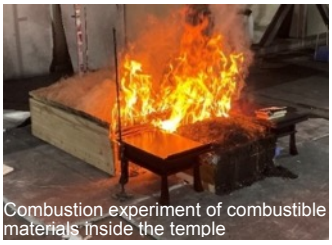
It has been over three years since the laboratory was established as Professor Yuji Hasemi's successor. It has been over three years since the laboratory was established, and we are currently pursuing three main research themes.

① Fire-resistant wooden construction
Large-scale, medium- and high-rise wooden buildings have been attracting worldwide attention in recent years from the perspective of decarbonization and forest resource utilization. For wood structural members, physical properties such as tree species and moisture content greatly affect fireproofing performance.


Heating experiment of a full-sized wooden structural beam

Assistant Prof. Hokibara has been working to quantitatively clarify the relationship between wood combustion and self-extinguishment, and to develop wood fire-resistant materials that reliably achieve self-extinguishment. In addition, it was announced that the product achieved both high fire resistance and minimal cross-section[available here].Some of these studies were also presented at **WCTE2023(Norway,Oslo)** under the title "Effect of the sacrificial layer thickness and the barrier layer type on self-extinguishing for wooden fireproof-structural elements ".

② Fire safety and preservation of historic buildings
In the wake of the fires at Shuri Castle and Notre-Dame Cathedral in Paris in 2019, surveys and reviews of disaster prevention measures for wooden cultural heritage buildings are underway. Our laboratory investigates the actual situation of combustible materials and management systems at small-scale cultural property temples and shrines, where it is difficult to maintain and manage firefighting equipment compared to famous temples and shrines and large-scale cultural property buildings. By understanding the heat generation characteristics of combustible materials unique to temples and the extinguishment deadline after a fire is detected, we are considering the possibility of quickly extinguishing the fire before it loses its value as a cultural property.


Combustion experiment of combustible materials inside the temple

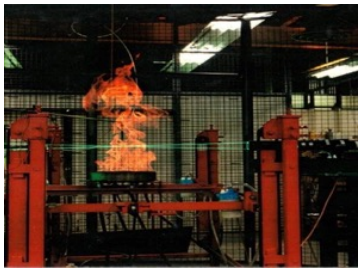
③ Sophistication of disaster-vulnerable people and evacuation systems
In recent years, due to the diversification of society and rapid aging of the population, there are a variety of people who are vulnerable to disasters due to their mobility, hearing, language, etc. Therefore, with the aim of building an evacuation system that accommodates disaster-vulnerable populations, which are expected to become even more diverse in the future, we are working to understand the following behavioral characteristics and consider them through simulation. These results were presented at **IAFSS2023(Tsukuba, Japan)** under the title "Crowd simulation including evacuees using wheelchairs and beds".

Signed: *Tomonori SANO*

University of Waterloo

Acetone Pool Fire Analysis

Work is underway by MASc. student Ayaan Lakhani to continue analyzing acetone pool fire data previously collected by Professor Elizabeth Weckman. 53.3 kW acetone pool fires were established in a 30.5 cm diameter modified overflow pan burner. Temperature and two components of velocity data were collected with fine wire Pt-Pt-10% Rh 75–100 micron diameter thermocouples and LDV (forward scatter), respectively. The fire was moved radially through a measurement volume with data collected at 2 cm intervals at a rate of 125 Hz. Building upon the work presented during the MaCFP poster session held at the 14th IAFSS Symposium, Ayaan will be presenting additional results at the Combustion Institute – Canadian Section conference taking place in May. Results in Figure 1 and 2 show contour plots of buoyant production of turbulence and turbulent kinetic energy estimated from the data.



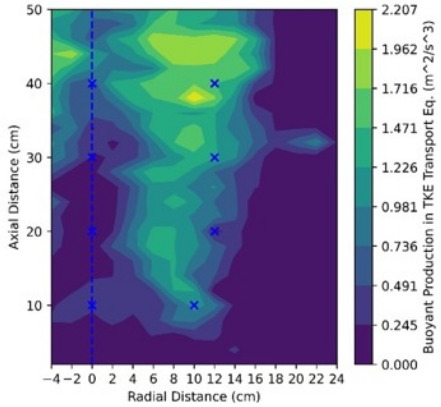


Figure 1.

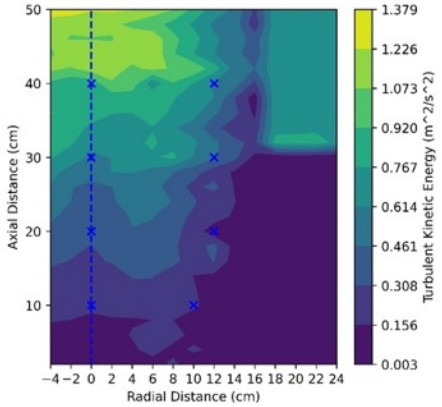
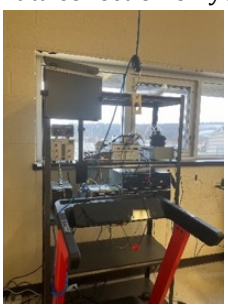


Figure 2.

Human Response to Fire Exposure

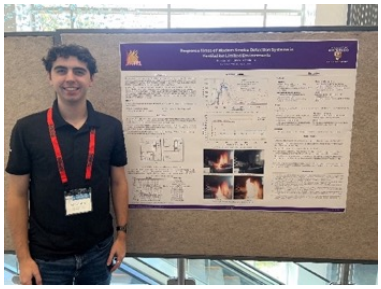
Data collection on young, healthy adult participants is wrapping up in the newly established human exposure lab led by PhD student Bronwyn Forrest. Physiological measurements pertaining to cardiopulmonary function (e.g. heart rate, ventilation rate, breathing frequency) are collected along with measurements of gait parameters (measured with inertial measurement units worn bilaterally on the ankles) and cognitive performance (assessed with a cognitive task 'played' throughout the protocols). Egress protocols begin with participants sitting, then transition to walking at a slow, easy pace on a treadmill. Part way through the protocol they carry a 9 kg sandbag (20 lbs) while continuing to walk on the treadmill to simulate egress with belongings and/or another occupant requiring assistance. An egress protocol is performed in room air (20.93% oxygen and 0.04% carbon dioxide) as a control condition. The remaining protocols involve manipulating inspired gases based on measured concentrations of accumulated gases determined using a 'breathing' mechanical ventilator during large-scale ventilation-limited furniture fires conducted at the UW Fire Research Facility. Other protocols involve hypoxic conditions (decreasing inspired oxygen down to 14%) and hypercapnic conditions (increasing inspired carbon dioxide to 7%), in isolation and tandem, with and without two low levels of carbon monoxide saturation (COHb 4% and 7%). Results confirm physiological responses to these types of hypoxic and hypercapnic exposures, while revealing interesting implications of this exposure on cognitive response and changes to gait. Results of this first stage of testing will be published later this year. In other work, we collaborated with researchers in Health Sciences to extract new data on older adult walking speeds, recently published in Fire Technology DOI: https://doi.org/10.1007/s10694-024-01574-0



Suppression Studies

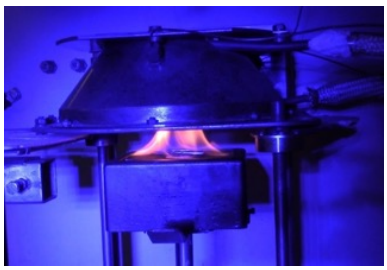
Research associate Braden Southern is conducting a multi-phase project investigating the potential for use of a new, clean suppression and boundary cooling agent as a replacement for AFFFs (aqueous film forming foams) in naval applications. Pictured here is a heptane fire burning in the medium-scale compartment under the large furniture calorimeter hood. The fire imparts 40-60 kW/m^2 heat flux to a large steel plate installed at the back of the compartment. Type K thermocouples are welded to the plate to track temperature changes over 10-minute duration of the pool fire with and without application of suppression agents. Gas concentrations are measured via the cone calorimeter as well as custom-made electrochemical gas sensor boxes and Novatech emissions system. Work will be extended in future to investigate the use of the suppression agents for battery, and potentially other, fires as well.

Under-ventilated Fire Characterization



Analysis of data from our multi-year studies into characterization of ventilation limited residential fires continues with graduation of MASc student, Alex DiPaola, who analyzed four fires under differing ventilation conditions and recent completion of a PhD thesis focused on comparison of the environment across different fuel types. Undergraduate student Keon Senez, shown here, proudly presented his portion of the work on "Response times of Modern Smoke Detection Systems in Ventilation Limited Environments" at the SFPE23 Annual Conference and Expo in Washington DC in October. Future work includes further analysis of the data and modeling of the 13 large-scale fire tests conducted in this series.

Mass Timber Alliance



MASc student Jan Dabrowski is doing research under a 7-million-dollar NSERC Alliance Grant 'Next-generation Wood Construction' involving universities and industry from across Canada. Working in close collaboration with York University, Waterloo researchers are conducting critical research related to fire safety design for mass timber structures. Jan's research involves a series of smaller-scale mass timber fire performance characterization tests and larger experiments examining fire spread in compartments under different ventilation conditions. Results will aid in understanding the mechanisms of degradation found in structural systems exposed to fire.

Activities and Events

It has been a busy time at UW Fire Research. In addition to our ongoing courses in the Fire Safety Program, in late August we co-hosted the SFPE Engineering Solutions Symposium on Mass Timber with an outstanding panel of experts who shared their knowledge and best practices in fire safety design. The Symposium brought together fire protection and structural engineers, designers, architects, academics, code officials and first responders to discuss challenges and issues in design of mass timber structures. The Eastern Canadian SFPE chapter held a student poster session at which MASc Jan Dabrowski presented his work on "Preliminary Review of Existing Risk-based Framework and Performance Parameters for Fire Safety Design of Mass Timber Buildings".

In October, Professor Weckman and several students headed to the 14th IAFSS Symposium in Japan to present on the podium [published in Fire Safety Journal https://doi.org/10.1016/j.firesaf.2023.103963], along with seven student posters on topics ranging from pool fires and fire modelling through gas sensing instrumentation and ventilation limited fire behaviour. PhD student Bronwyn Forrest and her co-authors were awarded the best poster award for their research on "Physiological Response to Fire Exposure".

Recently, students presented results at CWCRN update workshops and the lab hosted over 50 local emergency responders for lectures and demonstrations of incident response drones.

Signed: Beth Weckman

Worcester Polytechnic Institute

New Incoming Members

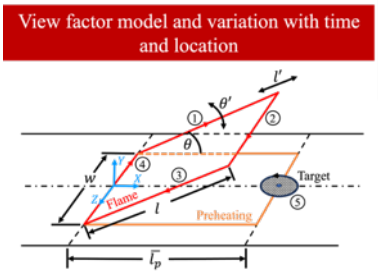
Raphael Ogabi is a post-doctoral research fellow working with Prof. Albert Simeoni in the Department of Fire Protection Engineering at Worcester Polytechnic Institute. Dr. Raphael obtained his Ph.D. in field of Energetic at INSA Centre Val de Loire in France. His Ph.D. research was focused on studying the fire behavior of synthetic and bio-sourced composite materials impacted by heat flux density on a medium and large scale. His current research focuses on quantifying the reliability of fire pattern indicators obtained during fire investigations. The project is funded by the National Institute of Justice (NIJ), USA.

Current Research:

Quantifying firebrand generation from Forest fuels (NIST project)

This work focuses on investigating the generation of firebrands and the conditions influencing their distribution. Repeated lab-scale experiments (6 trials) with the same operating conditions have been conducted. The data reveals significant variability in the number of firebrands generated among the different trials. Further, a consistent auto-similar behavior across the transitions from ignition to fully engulfed, and finally to smoldering states has been observed. The results were presented at the Spring Technical meeting, Eastern States section of the combustion institute under the title: "Quantifying firebrand generation from Douglas Fir: An intermediate-scale wind tunnel analysis with probabilistic modeling for wildfire spread prediction."

Influence of wind on the mean and fluctuating behavior of spreading and stationary fires.



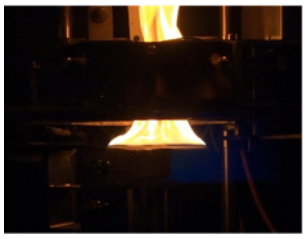
This work explores the fluctuating nature of flame spread over vegetative fuel under wind-aided conditions. An image analysis algorithm is used to quantify the instantaneous rate of spread, flame impingement at the fuel surface, and flame geometry of the spreading flame. These instantaneous measurements are decomposed into mean and fluctuating components and allow for a quantification of the fluctuating behavior. Moreover, instantaneous geometry is used to evaluate the variation in view factor at the fuel surface, which controls the radiative heating of the unburnt fuel. A simplified energy balance model is developed to quantify the effects of variation in radiative (flame geometry) and convective (flame impingement) heating. The existence of the variability in flame geometry and spread rate is validated in the fire spread experiments, but the cause of the variability in flame geometry is still not well understood. For this purpose, stationary experiments using a sand burner are conducted to emulate the fire dynamics of vegetative fires. The effects of porous media are established using steel wool with the same Leaf Area Index (LAI), and the presence of smoldering behind the fire front is generated using a hot plate. These experiments are still in progress and are showing promising results in capturing the vegetative fire behavior.

The Effect of Fuel Characteristics and Fire Dynamics on Emissions, Dispersion, and Air Quality Impacts

This research investigates the intricate relationship between fuel characteristics, fire dynamics, and emissions during prescribed burns, with a focus on mitigating environmental impacts and improving human health. A field campaign was conducted in January 2024, in collaboration with the U.S. Environmental Protection Agency, to study this coupled effect in pine-needle beds. A series of burner tests were carried out in a laboratory-scale wind tunnel to study the critical aspects of fire behavior and its relation to emissions. The mass loss rate per unit area (MLRPUA) was measured in a specified region of the bed to quantify the flaming and smoldering zones. Attempts are now being made to correlate the data with the visual images of the flaming and smoldering zones in this region and further use the correlation to estimate the MLRPUA over the entire test bed.

A Multiscale Study of the Coupling Between Flow, Fire and Vegetation – Influence of Vegetation Distribution and Flow on Fire Behavior and Plume Development for Risk Mitigation in Prescribed Burns (SERDP grant RC20-C3-1362)

(i) Fuel characterization and model validation studies of canola oil-diesel fires



Fuel characterization studies for a mixture of canola-oil and diesel blends were conducted in a cone calorimeter. These tests aimed to measure various fire properties of the fuel mixture, including the effective heat of combustion, CO, and soot yield which are the essential inputs required for numerical simulations of fire and buoyant plumes from these fuels. The numerical model in FDS is currently being validated with the lab-scale measurements of plumes from this fuel. Further, the model will also be validated with our field-scale measurements in the flame and plume zones. The preliminary results of the fuel characterization studies and model validation studies were presented at the Spring Technical meeting, Eastern States section of the combustion institute under the title "*Measurements of burning behavior and fire properties of diesel, canola oil, and diesel/canola oil blends using the Cone Calorimeter*", and "*Experimental and numerical investigation of canola oil-diesel pool fire"*.

(ii) A novel drag measurement setup

Studying the impact of vegetation on smoke transport during wildfires and prescribed burns requires meticulous measurements, particularly involving the assessment of drag forces. A novel drag measurement setup with strain gauges is built and employed to quantify the drag force using systematic wind tunnel experiments with ornamental vegetation. The experiments are currently in progress and show promising results for correlating the drag imparted by the vegetation with wind.

Effect of inert Gas Discharge on Wood Crib Fires in Reduced-Scale and Full-Scale Experiments

After completing 80 inert gas extinguishing experiments in full-scale 100 m^3 enclosure, the enclosure, test article, and discharge system was reduced to 1/3 of the full-scale. Several preliminary tests indicate that a 33 m^3 enclosure can reproduce the flow of agent and entrained air within the compartment and the scaled discharge system can extinguish a wood crib test article at the same agent concentration as the full scale. The objective now is to characterize the flow of agent and entrained air within the enclosure and to conduct an in-depth study of test article extinguishment for the 60- and 120-second discharge periods and perform nonstandard suppression tests to further study extinguishment. These nonstandard tests will utilize extreme conditions such as shorter or longer discharge periods and various other test articles (much larger or multiple test articles) to find the extinguishing limit for the standardized test methodology. Additionally, studies to understand the wood crib's burning rate under various oxygen concentrations and flows through the crib through a B-number approach will be continued. The results of the full-scale experiments will be presented at the Combustion Institute's 40th International Symposium on Combustion.

Battery Electric Vehicle (BEV) Fire Project

The primary goal of this work is to test and evaluate the response of an electric vehicle to external ignition sources in outdoor conditions. In collaboration with the Boston Fire Department and UL's Fire Safety Research Institute, our experiment involved the instrumentation, ignition, initiation of thermal runaway, and subsequent suppression of a 2020 model BEV. The primary objectives of the test are to gather data on fire behavior, combustion products development, and firefighter suppression activities, and to make recommendations for subsequent BEV testing.

The insights gained from the current test highlight the multifaceted threats posed by an electric vehicle fire, the complexities in accurately measuring the temperature and incident heat fluxes under outdoor conditions. Furthermore, the findings also stress the importance of refining instrumentation protocols for more precise assessment of fire characteristics and battery pack thermal runaway in electric vehicle fires. Measuring the vehicle's mass loss rate to estimate the total heat release rate from the vehicle fire and optimizing the thermocouple arrangements might offer practical solutions. Additionally, fire suppression operations pose another layer of complexity to characterize fire behavior.

The next phase of this project includes laboratory testing of instrumented battery electric vehicles (BEVs), without implementing fire suppression measures midway through testing. Additionally, it involves developing a numerical model using Fire Dynamics Simulator (FDS). The experimental measurements will include the vehicle's mass loss rate, temperature distribution within the vehicle, and the total/radiative heat flux of the flame. These

measurements will serve as the input/validation source for the numerical investigation of the battery electric vehicle.

Hurstwic Viking Research Project

A team of 7 WPI Fire Protection Engineering Ph.D. students have been working with Hurstwic, a local Viking age combat reenactment and historical society, to study the common Viking-age battle tactic fire of burning turf longhouses. Historical sources state that in certain Viking cultures, and particularly in Iceland, a campfire placed in front of the door was often used to burn out the defending turf house occupants. Major goals included understanding how long the area behind the door stays tenable, where a defending Viking would negotiate with the attacking side, and to learn how modern firefighting resources could suppress fires of current reconstructed and historical turf longhouses on display. The first stage of the project included instrumenting and igniting a replica of the door and the entryway with a turf roof to study the tenability and fire spread of this critical infrastructure. We look forward to continuing this research in Iceland at the Eldhátíð (Icelandic Fire Festival) this summer with partners at Hurstwic, the National Museum of Iceland, and the Icelandic local district's Fire Department.

Signed: Albert Simeoni

CONFERENCES AND MEETINGS

Call for papers

13th Asia-Oceania Symposium on Fire Science and Technology (AOFST): 21– 25. Oct 2024, Daegu, Korea Rep

he Organizing Committee of the 13th Asia-Oceania Symposium on Fire Science and Technology (AOSFST 2024) invites you to submit your research papers to the symposium. The reaserach areas of interest are:

- Material Flammability, Toxicity, and Related Testing Method (including fire retardants, small- and large-scale testing)
- Fire Spread (including pyrolysis modeling, smoldering, ignition, and fire spread on solids)
- Enclosure Fire Dynamics (including tunnel fires, compartment fires, and spill plumes)
- Flame Dynamics (including fire induced flow, pool fires, flame heat transfer, and liquid fire spread)
- Fire Suppression (including sprinklers, water mist, aerosols, and gaseous agents)
- Structures in Fire (including structural responses to fires, e.g., steel, concrete, timber, etc.)
- Wildland Fires and Other Large Outdoor Fires (including WUI, urban fires, informal settlement fires)
- Evacuation and Human Behavior (in building, wildland/WUI, and other outdoor fires)
- Fire Risk Analysis and Fire Safety Design (including performance-based design, fire detection, smoke control, and fire codes and standards)
- Emerging Issues and Special Applications (including explosions, industrial fires, fire forensics, AI and data driven models, environmental impacts of fire, sustainability, battery safety)

Find deadlines and submission details on the webpage: https://www.aosfst2024.com/

Upcoming Conferences and Meetings

Fire Safety of Facades

The *4th International Symposium on fire safety of facades will be* be arranged by RISE and Lund University on June 10-12, 2024. The event will take place on the Lund University campus in the same building as the Division of Fire Safety Engineering. Fire Safety Engineering has been an active research and educational topic for more than 50 years at Lund University. Read more here: https://www.ri.se/en/fsf

Nordic Fire & Safety Days

The Nordic Fire & Safety Days is the meeting point for the Fire and Safety community in the Nordic countries. NFSD is an event carried out by the Nordic universities and research institutes dealing with risk and fire safety.

The days put focus on risk and fire research in the Nordic countries. Contributions from other countries are more than welcome. The conference language is English. NFSD conferences provide great opportunities to tie bands between fire industry, municipalities, research institutes and universities. At the Nordic Fire & Safety Days you will have the opportunity to get information on different aspects within fire research.

We are looking forward to seeing you in June 2024!

4th European Symposium on Fire Safety Science (ESFSS 2024) - Barcelona (Spain) 9th - 11th October 2024

Following the conference held in Nancy (2018), the European Symposium on Fire Safety Science, will be the fourth edition of a series of symposia organized triennially in Europe, with the participation of the International Association of Fire Safety Science (IAFSS). Due to the COVID19 situation, the 2021 edition did not taken place. The aim is to gather researchers from and beyond Europe to have exchanges and discussions about fire safety science.

The program will have oral and poster sessions for the presentation of fully peer-reviewed papers over the three days, including invited lectures from world's top fire science researchers. The main topics of the seminar will be:

- Material behaviour in fire
- Fire dynamics, structure in fire
- Wildland fires /Wildland-urban fires
- Fire detection and suppression

- Evacuation and human behaviour
- Miscellaneous

Full papers submissions closed on 1st April 2024 but there will be a special poster session for work-in progress research. The 1 page abstract submission deadline for this special session will be 10th June 2024.
We sincerely welcome you to attend the symposium to discuss ideas and share knowledge. You can get more information about the symposium visiting the webpage: https://esfss2024.com/. The 4th European Symposium on Fire Safety Science will be hosted by the Centre for Technological Risk Studies (CERTEC), a research group affiliated to the Universitat Politècnica de Catalunya (UPC) in Barcelona.

Reports from Conferences

Notes from the Compartment fire workshop IAFSS2023, Tsukuba Japan

The compartment fire workshop took place on the 21st of October 2023. The workshop was divided into the following three themes (with short breaks in-between).

1. Modelling of compartment fires and its applicability to fire safety engineering
2. Experimental challenges in compartment fire research
3. Emerging hazards and it influence on compartment fire dynamics

Each theme was introduced with a 10-15 talk by an invited speaker, the talks were followed by a discussion amongst all the participants at the workshop. The discussions were facilitated by the workshop co-chairs and the discussions were guided with the help of questions through the survey tool Menti. The participants answers could be displayed directly during the workshop with the help of Menti and this made it possible to get the views of all in the audience and to discuss the results. A total of 51 individuals participated in the Menti survey.

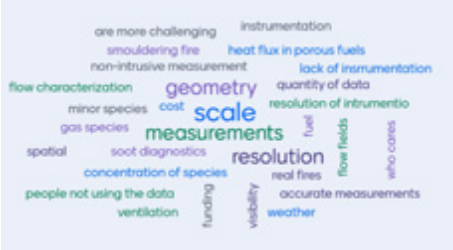
Theme 1: Modelling of compartment fires and its applicability to fire safety engineering
The theme was introduced with a short talk by Simo Hostikka, Aalto University, Finland. Prof. Hostikka focused on the modelling of fire spread in his talk. Two of the questions discussed in this theme is presented below with the Menti response presented in the figure to the right.

What are the present key challenges when modelling compartment fires?

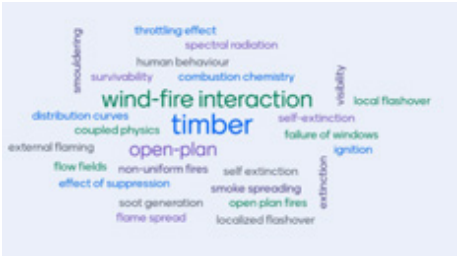
In terms of modelling of compartment fires. Where should efforts be directed in the education of graduate students and early career researchers?

Theme 2: Experimental challenges in compartment fire research
The theme was introduced by Ian Pop, DBI, Denmark. Dr Pope presented open questions related to large-scale compartment fire with a focus on timber buildings. Two of the questions discussed in this theme is presented below with the Menti response presented in the figure to the right.

What are the present key challenges in compartment fire experiments?



What are phenomena that require urgent research attention?



Theme 3: Emerging hazards and it influence on compartment fire dynamics
The theme was introduced by Andrea Lucherini, FRISBEE, Slovenia. Dr Lucherini a range of emerging challenges for compartment fires (batteries, green facades, timber buildings etc.). One of the questions discussed in this theme is presented below with the Menti response presented in the figure to the right.

What emerging hazards in the filed require urgent research attention?

Conclusions
The discussions focused on the questions that came out of the Menti survey, mainly regarding the most common answers in the word clouds but also around some that got less attention. Some general points that were mentioned during the workshop were the connection between experiments and modelling and that it is important to have in mind how an experiment later can be modeled when designing the experiment. Another area that was discussed at several instances was uncertainties, in terms of measurements, inputs to models, simplification in models etc.

The use of the Menti survey is believed to have helped to create an atmosphere at the workshop that encouraged for discussion. Everyone in the room had a good possibility to participate with the help of Menti which resulted in a good interaction in the workshop.

Signed: Nils Johansson, Lund University, and Vinny Gupta, University of Sydney, co-chairs at the compartment fire workshop.

CALL FOR CONTRIBUTIONS

To continue succeeding with this newsletter, it is important that we receive contributions from the IAFSS membership at large. Please consider submitting articles, letters to the editor, images, news, announcements or job openings related to fire safety science of IAFSS members. These could be collected from your department, institution, country or region. Please send your contributions to the Co-Editors (Nils Johansson, nils.johansson@brand.lth.se or Xinyan Huang, xy.huang@polyu.edu.hk.

Letters to the Editor are most welcome, anytime, in response to newsletter content or any other topic related to the IAFSS.

Deadline for contributing to the next regular Issue (No. 52) will be communicated later.

http://www.iafss.org

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