PhD Opportunities in fire modelling and safety technologies

The global economy has entered a major transition phase, with renewable energy and decarbonisation taking place and increasing electrification across all sectors. Emerging electrification technologies present additional unforeseen fire risks. The ARC Fire Training Centre for Flame Retardants and Safety Technologies at UNSW is training Australia’s next generation of industry-focused researchers and engineers to develop innovative fire safety technologies on key themes such as electric vehicles, battery storage systems, hydrogen, mining, and smart buildings. Successful applications will join a thriving research group working on flame retardants, fire modelling and safety. Applicants may also have an opportunity to spend a period of their research at the laboratories of our collaborating organisations from Australia, Hong Kong, China, UK and USA.

Topics of Research:

**High-fidelity computational approaches for fire-retardant materials**

This topic focuses on developing advanced computational models to study the flammability properties, thermal degradation, and combustion characteristics of fire retardant materials. The multi-scale modelling approach includes (1) Atomic-scale models using molecular dynamics (MD) simulation to provide insight into the mechanisms of the pyrolysis process from a molecular level; (2) Macro-scale simulation with large eddy simulation (LES) based computational fluid dynamics (CFD) models to effectively characterise the char layer formation, material surface regression and emitting combustion gas volatiles in reduced-scale experimental settings.

**Lithium-ion batteries (LIB) thermal management and fire mitigation system**

With the emerging electrification across different industry sectors, there is an increasing focus on the critical aspect of containing and isolating lithium-ion battery fires. This project aims to investigate the fundamental behaviours and root causes of LIB by fires by developing novel diagnostics techniques to monitor LIB electrochemical conditions. This includes an end-user predictive model for LIB fire that fully couples the electrochemical and flame propagation behaviours and innovative monitoring and fire protection system to reduce the fire risks of LIB systems.

**Advancing fire testing standards for smart infrastructure and assets**

This project aims to develop performance-based design solutions to streamline fire testing methods of different scales to improve designs of systems or structures with renewable energy systems. Such methods will provide better categorising or classifying risks of fire and toxicity due to the implementation and utilisation of energy storage systems and building-integrated photovoltaics. These new fire tests and models will lead to new standards to safeguard the fire safety of structures and battery storage systems of different configurations subject to different fire settings.

For more information on the wide variety of our research projects, partnerships and international collaborators, please kindly visit our Centre website at https://fire.edu.au/

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