Editorial

Special Issue on Lithium Battery Fire Safety

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Lithium batteries are currently the predominant power source [1] for portable electronic devices, electric vehicles and energy storage in general. However, fire safety issues are a bottleneck hindering large-scale application of this technology [2]. Fire safety of Lithium batteries has been a research topic since 1990s. This topic has gained increasing importance in recent years following the occurrence of many fire accidents. Lithium battery fire is a complex phenomenon, which involves multiple physical and chemical processes inside and outside the battery enclosure. Protection against these fires is an unsolved problem associated with thermal runaway, propagation, a chemistry not based on external oxygen, and flaming combustion.

The idea of this special issue stems from an exchange of knowledge and relevant experience among experts in the field of fire safety at the 1st International Symposium on Lithium Battery Fire Safety (ISLBFS) held on July 18–20 in 2019 in Hefei, China. The plenary speakers emphasized the importance of lithium battery fire safety and noted the progress made in this field. The following areas related to lithium battery safety are considered to warrant investigations: (1) Thermal runaway mechanism, (2) Fire dynamics, (3) Explosive behaviour, (4) Gas generation, (5) Fire suppression, (6) Thermal management, (7) Safer materials and designs, and (8) Fire safety assessment.

The special issue on Lithium Battery Fire Safety includes 16 original papers and 1 review with multidisciplinary contributions from different aspects of lithium battery fire and fire protection engineering. Three papers are focused on thermal runaway mechanism, different causes to trigger are studied. Liu et al. [3] investigated the thermal runaway mechanism of 18650 lithium ion batteries and the related hazards at different pressure, which provided guidance for the safety of battery transportation in civil aviation. Wang et al. [4] studied the oven heating caused thermal runaway in adiabatic rate calorimeter. Huang et al. [5] committed to ther-

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mal runaway behaviour of lithium-ion phosphate battery during mechanical penetration. Three papers [6–8] studied the thermal runaway propagation characteristics of battery pack based on the thermal runaway mechanism. And Wang et al. [9] reviewed a series of relevant literatures and proposed an instrument that can be used to analyse the thermal runaway behaviour at different pressure. Another four papers worked on the fire and explosion behaviour. Kong et al. [10] describes the use of non-destructive computed tomography (CT) to analyse cylindrical Li-ion battery samples that underwent thermal runaway and exploded. Hu [11] and He [12] numerically and experimentally studied the self-heating ignition behaviour of a box of cells during storage, respectively. The full-scale thermal runaway test was conducted on real lithium-ion battery pack by Li et al. [13]. Based on the combustion behaviour, they found that water cannot directly act on the cells due to the shielding of the pack's cover in the fire extinguish stage, which greatly limited its cooling effect. Finally, in order to prevent fire and explosion events, six papers focused on thermal management [14, 15] and fire suppression [16, 17], as well as non-flammable electrolyte [18] and half-cell dynamic heat generation [19], respectively.

Overall, the papers in this special issue provide us with a comprehensive but not yet exhaustive picture of the recent research on lithium battery fire safety. All papers include applications in the field and should be of interest to both academics and practitioners.

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