SUMMARY

Fire Safety for Batteries in Residential Buildings.

The introduction of batteries into the home introduces new risks of fire and toxic gases. A thorough understanding of these risks through experimental studies and simulations is necessary to develop effective measures and design rules. This project hopes to establish comprehensive design guidelines for safer use of battery modules in homes, which in turn can improve life safety and reduce fire risks.

Purpose and goal

The goal is to provide guidelines and propose design rules for building fire protection for smaller lithium-ion battery modules, which are used in electric scooters and e-bikes, and are charged and stored in regular homes. Thermal runaway and spread within the module can cause very rapid fire growth leading to fully developed fires in a short time, potentially blocking escape routes through fire and spreading toxic gases that can further limit evacuation.

Methods

In this work, we present an overview of current literature, conducted experiments, and models used to support the guidelines we propose on how to handle current risks with batteries from e-bikes and electric scooters. The data we have gathered from the experiments indicate that fire growth is faster than expected in the models used today.the internet. Site visits were also carried out at several selected objects during the autumn of 2023.

Results

The experiments show typical heat release rates (HRR) from open fire tests combined with emissions of toxic and flammable gases from cells and modules. These experiments indicate how quickly and intensely a fire can develop. Alongside the open experiments, studies were conducted with an ARC calorimeter where the conditions for when individual cells enter thermal runaway can be determined. The measured HRR values were then used in simulations of a module to investigate the effect of certain cells ejecting their contents during thermal runaway. This provided a more comprehensive picture of the spread process within the module.

The collected information from literature, experiments, and modelling were used to propose a design fire. Although, the fully developed fire is not more severe than a typical room fire on a longer time scale, the risk of very rapid fire growth must be managed. Additionally, the very rapid process can cause a deflagration that destroys the fire resistance in a building.

Although the recommendations we provide are general and can be used in more scenarios than in the design of new construction, it is necessary to spread information about current risks to the public. The identified risks are reduced by being attentive to batteries and where battery modules are charged, as well as monitoring the health of the batteries, which includes but is not limited to observing if they have been damaged in any way or become unusually warm during use or charging.

RESEARCH GROUP

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FINANCED BY BRANDFORSK

Brandforsk's activities are made possible by support from various organisations in the community. www.brandforsk.se

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