**Abstract**

The increasing use of Electric Vehicles (EVs) is leading to a higher proportion of EVs in car parks. In this study, a comprehensive analysis of EV fire risks is conducted, and the adequacy of the existing building regulations for car parks in the UK is evaluated in light of EV fire risks.

A thorough literature review is undertaken to explore the fire risks associated with EVs. An assessment of the likelihood of fire ignition in EVs and conventional vehicles is performed in this work, which reveals that the likelihood of fire ignition is higher for an EV. A radiation analysis is conducted for both vehicle types, indicating that the distance between EVs in car parks should be increased. A novel approach to predict and compare the total energy release (THR) from fires of both vehicle types is implemented in this work. This analysis shows that the THR from an EV fire could be up to 40% higher than an equivalent Internal Combustion Engine Vehicle (ICEV) variant. The fire spread analysis of both vehicle types is conducted utilising the existing fire test results and employing the point source fire model, which unveils that the fire spread occurs much faster for an EV. The combination of faster fire spread and a higher energy release per vehicle would have a greater impact on the car park structure and pose a greater threat to firefighters.

The analysis undertaken in this study suggests that the existing building regulations for car parks pertaining to structural fire resistance, ventilation, and suppression systems should be revised to address the risks associated with EV fires. Further assessment is required to evaluate the adequacy of current regulations pertaining to the charging of EVs in car parks to mitigate the heightened fire risk during charging.