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Particle size emissions from PVC electrical cable fires

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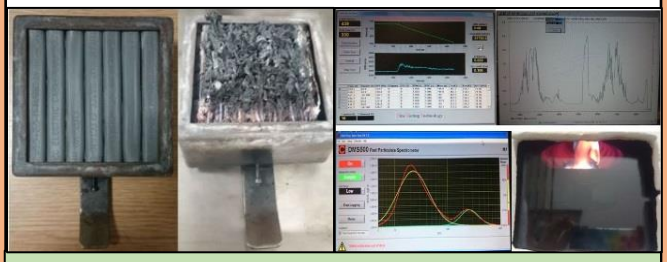
Introduction

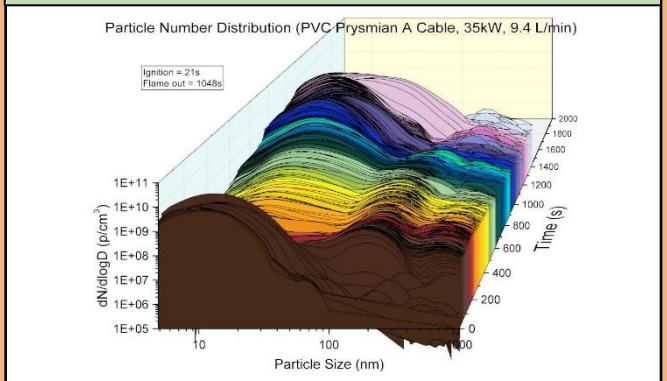
PVC (Polyvinyl chloride) based electrical cable has high electrical strength and strong insulation resistance to flame, moisture and abrasion. However, PVC materials may produce highly toxic smoke when burned and can also form the toxic gas HCl. Previous studies mostly involve the measurement of toxic species from fires [1-14] but only a limited number of studies have focused on the ultra-fine particulate emissions [15-17] and none at all is found to focus on the electrical cable fires. There is also increasing concern over the health implications of exposure to nanoparticles in fires, both by fire fighters and by people exposed to fire smoke inhalation [18,19]. There is currently no requirement to measure particulate emissions in cable fire tests.

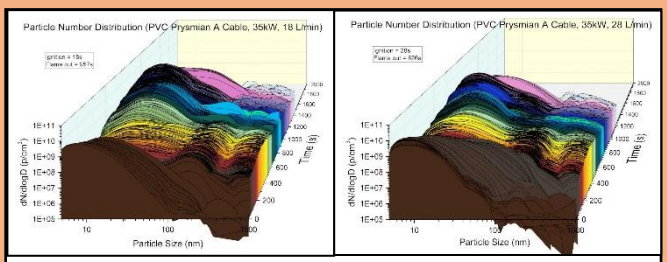
Methods

The present work investigated toxic species and particulates from the burning of PVC Prysmian A (BS6004 6242Y) cables in the Cone Calorimeter. Each test involves the combustion of a 100mm^2 test specimen at a constant irradiation level (35 kW/m^2) and has been repeated at different initial air flow rates (9.4, 18 and 28 L/min). Composition of toxic gases from the cable fires were measured using the FTIR analyser and the particulate size distribution was determined using the Cambustion DMS500.

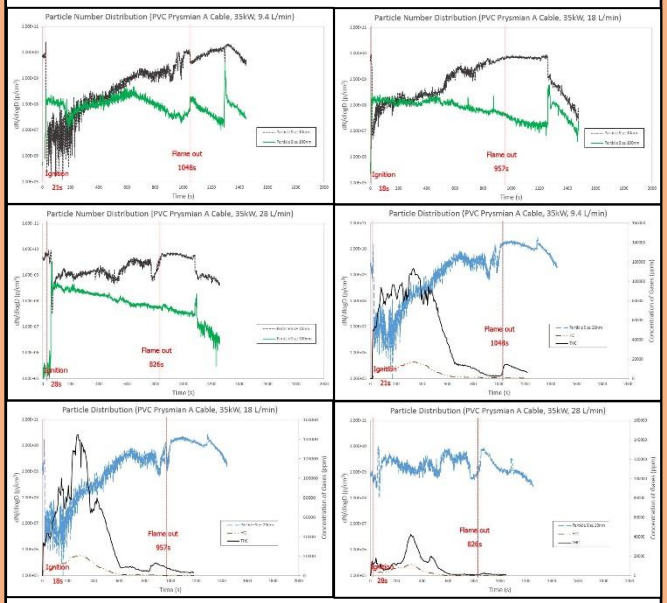


Results and Discussion





There are two peaks observed which the first peak represents 10nm particles (nucleation mode) and the second peak represents 100nm particles (cumulative mode).



The number of 10nm particles increased from the start to the end of the fire. These fine particles are a health hazard and penetrate into the lungs and into the blood stream. The number of larger particles (100nm) decreased during the fire which was unexpected, as agglomeration of fine particles to form larger particles is expected. The fine particles could be HCl and future work will use a thermal denuder to determine this.

Conclusions

Fine particles are a toxic hazards in fires and must be measured for all materials used in fires and regulations need to be changed to make this compulsory. Particles below 100nm are a health hazard and the results from the present study show that these dominate the number of particles in PVC electrical cable fires.

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