Dust explosion hazards in the automotive sector: the case of brake pads manufacturing

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The automotive industry includes companies and organisations involved in designing, developing, manufacturing, marketing, and selling motor vehicles. Its turnover is among the highest globally (behind the healthcare and ICT sectors). This industrial sector comprises several production processes identified by a particular production chain involving different raw materials and industrial equipment.
The production of brake pads is an essential part of the automotive industry: valued up to 3.8 billion dollars in 2021. In recent years, the search for new sustainable materials as "friction" components of brake pads has been increasing due to environmental problems. Asbestos-based materials are no longer usable due to health problems resulting from the dispersion of fibres during use and production.
The production of brake pads is affected by chemical risk, linked to the characteristics of the raw material and risks of fire and explosion that could also be associated with flammable and combustible substances. The risk of dust explosion is present in the global industrial automotive industry; many of the most severe explosion episodes have occurred in automotive manufacturing plants, including the explosion of aluminium powder in a wheel polishing factory in China (Li et al., 2016).
Brake pads are made from polymeric materials (mainly resins), metal materials and powder additives. These materials determine an explosion risk as they have relatively severe explosion parameters (LEL from 60 g/m3). 75% of the materials studied in this paper were found to be flammable. Materials with higher content of metallic Iron and polymeric resins (mainly phenol-formaldehyde) are more reactive.
This paper will provide an overview of the dust explosion risk present in the brake pad manufacturing industry to identify high-risk processes and materials and provide guidance to fire engineers and safety professionals on the potential severity of events and the likely mitigation strategy.
Keywords: *Automotive industry, dust mixture explosion, metallic dust, ignition sensitivity, polymeric dust*

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