

Safety Corner

How to prevent dust explosion?

Under a surface-controlled combustion, the latent heat energy of a solid combustible material is released gradually due to the limited surface area in contact with oxygen. When the same mass of the material is grounded to fine powder, the total surface area of all particles exposed to the air is vastly larger when compared to the material's original solid form. When the powder is mixed with air to form a dust cloud in the presence of an ignition source, the material will release its heat energy and gaseous reaction products within a very short time, causing a rapid increase in air pressure. Such a phenomenon is called a dust explosion.

Many combustible materials such as coal, sawdust and magnesium are known to be able to generate a dust explosion. However, many materials that are generally considered to be incombustible, such as grain, flour, sugar, powdered milk and pollen, and even powdered metals such as aluminium, titanium and iron, can form explosive dust cloud under permissible conditions.

The main principles in designing against dust explosion in powder processing facility are:

- Containment – use storage vessels and processing devices with high compressive strength
- Relief – install pressure relief valve to release air pressure
- Inhibition – inject inert gases such as nitrogen to reduce the oxygen content in the system
- Suppression – use sensors to detect initial shock waves and launch explosion suppression agent (e.g., sodium bicarbonate) to avoid initial fire turning into a full blast
- Isolation – install explosion-proof panel and doors to isolate potential hazardous area from the rest of a facility.

Apart from engineering design, relevant facility management shall also actively:

- Implement a dust inspection, testing, housekeeping and control program
- Use proper dust collection and ventilation strategy
- Regularly inspect for dust residues in open and hidden areas
- Apply cleaning methods that do not generate dust clouds where ignition sources are present
- Control smoking, open flames and sparks, including mechanical sparks and friction

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