



Reducing Aluminum Dust Explosion Hazards: Case Study of Dust Inerting in a Buffing Operation

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Abstract

Metal powders or dusts can represent significant dust explosion hazards in industry, due to their relatively low ignition energy and high explosivity. As demonstrated by the 2003 dust explosion at Hayes Lemmerz, facilities that process bulk metals are at risk due to dust generated during machining and finishing operations. Previous studies have shown that aluminum dust explosions are more difficult to suppress with flame retardants or inerting agents than dust explosions fueled by other materials such as coal.¹ In this paper, an inerting method is discussed to reduce the dust explosion hazard of dust created in an aluminum buffing operation as the dust is generated. This reduces the dust explosion hazard throughout the buffing process and within the dust collector systems.

A manufacturer of extruded aluminum products used buffing lines to create a polished finish on their materials. The facility sought to make the dust produced by the buffing operation less hazardous, so that it would not require classified electrical equipment^{2,3} In order to achieve this, varying levels of flame retardant were added to the buffing compound and buffing wheels used in the process. A series of buffing trials were performed, and material collected in dust collectors underwent a battery of tests to determine the ignition sensitivity and explosion severity of the material. With sufficient flame retardant added to both the buffing wheels and buffing compound, even the fine fraction of dried dust had an ignition sensitivity and explosion severity that were sufficiently low to remove the requirement for electrical classification.^{2,3}

In this paper, measurements of the minimum ignition energy, dust cloud ignition temperature, minimum explosible concentration, rate of pressure rise, and pressure rise are shown as a function of flame retardant addition. In addition, other metal processing operations are discussed, where flame retardant addition may also be used to minimize the hazard of dust created by the process.

[1] A.G. Dastidar, P.R. Amyotte, J. Going, and K. Chatrathi, “Flammability Limits of Dusts: Minimum Inerting Concentrations”, *Process Safety Progress*, Vol. 18, No. 1, 1999.

[2] NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, National Fire Protection Association, Quincy , MA .

[3] National Materials Advisory Board, *Classification of Combustible Dusts in Accordance with the National Electrical Code*, NMAB 353-3, (1980)