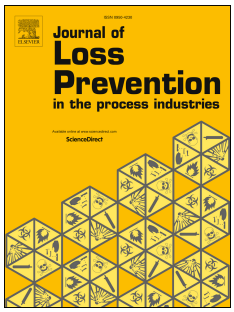
Accepted Manuscript



Effect of shock strength on dust entrainment behind a moving shock wave

Amira Y. Chowdhury, H. Greg Johnston, Brandon Marks, M. Sam Mannan, Eric L. Petersen

PII: S0950-4230(15)00058-3

DOI: 10.1016/j.jlp.2015.02.012

Reference: JLPP 2935

To appear in: *Journal of Loss Prevention in the Process Industries*

Received Date: 16 September 2014

Revised Date: 18 February 2015

Accepted Date: 19 February 2015

Please cite this article as: Chowdhury, A.Y., Johnston, H.G., Marks, B., Mannan, M.S., Petersen, E.L., Effect of shock strength on dust entrainment behind a moving shock wave, *Journal of Loss Prevention in the Process Industries* (2015), doi: 10.1016/j.jlp.2015.02.012.

Effect of Shock Strength on Dust Entrainment Behind a Moving Shock Wave

Amira Y. Chowdhury [a], H. Greg Johnston[b], Brandon Marks [b],

M. Sam Mannan [a] and Eric L. Petersen [b]

[a] Mary Kay O'Connor Process Safety Center, Texas A&M University, College Station, Texas 77843-3122, USA

[b] Department of Mechanical Engineering, Texas A&M University, College Station, Texas 77843-3123 USA

E-mail: *epetersen@tamu.edu*

Abstract

Secondary dust explosion is a serious industrial issue because it occurs under conditions corresponding to an increased quantity and concentration of dispersed, combustible dust when compared with the primary explosion. The problems of lifting and dispersion of a dust layer behind a propagating shock wave must therefore be understood to ensure safety regarding secondary dust explosion hazards. Using a new shock-tube facility for studying shock propagation over dust layers, limestone dust was subjected to Mach numbers ranging from 1.10 to 1.60. A shadowgraph technique was applied by using a high-speed camera (15,000 fps) for visualization of the dust-layer height change behind the moving shock wave. Also, the effect of dust-layer thickness on the entrainment process was observed by performing tests with two different layer depths, namely 3.2- and 12.7-mm thicknesses. New correlations were developed between the shock strength and the dust entrainment height as a function of time for each layer depth. In general, the results herein are in agreement with trends found in previous work, where there is a linear relationship between dust growth rate and shock Mach number at early times after shock passage. Also, new data were collected for image analyses over longer periods,