iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** VII **Month of publication:** July 2020

DOI: https://doi.org/10.22214/ijraset.2020.30719

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue VII July 2020- Available at www.ijraset.com

Research on Dust Explosion

Harshith Gaur
Student, B.Tech(Fire Technology and Safety), IES IPS Academy, Indore

I. INTRODUCTION

In 1785 we have witnessed first dust explosion in an Italian flour meal from which the term dust explosion was introduced. After that many dust explosion was witnessed by us. A dust explosion is type of cloud that is formed by small particles having size from 1 micrometer to 100 micrometer the particles of dust may be of grain, flour, starch, sugar, powder milk, cocoa, coffee, metal such as aluminum, titanium etc. The dust explosion can only occur in a confined space. So, that it can create so, much pressure that it can explode in the form of fire ball and effect health of human and property. According to the fact every year cases of dust explosion is increasing. In 2019 due to dust explosion 87% of the fatalities occurred and the world faces a loss of $1,000,000. On may28, 2019 a grain factory in Punjab, India faces an explosion in which 1 person got died and about 9 got injured. In 2019 similar case was held in Anzeyem, Belgium in which 1 got died and 3 got injured this explosion was occurred on January25, 2019. On January5, 2019 in Clinton, lowa (USA) in this case on firefighter got died and one firefighter got injured due to dust explosion in grain silo. In global incident data it is seen that about 65% of dust explosion has occurred due to food and wood products. Dust explosion can easily be occur by electrostatic discharge, friction, electrical arcing, hot surface, fire or self-ignition.

II. DUST CHEMICAL COMPOSITION

Chemical composition of dust should be determined whether it is combustible or not. Some of the dusts are non-combustible as some particles of it do not react with oxygen and some of the dust are combustible having slow burning and reacts with oxygen. For example Grain will not burn. As different types of dust have different composition like sand has a composition of si and o_2 which together formulates sio_2. Dust of rocks is mostly made up of graphite and some minerals like phosphorus and silicon. So, basically dust has a composition of carbon, hydrogen, oxygen, nitrogen, silicon, phosphorus and some minor minerals.

III. BULK DENSITY OF DUST

It is a measure of the mass of dust per unit of volume (g/m^3). You can use it to adjust the layer depth criteria for housekeeping. A bulk density of a dust depends upon factors such as particle size, shape and chemical content of dust. Combination of these particles with a measured volume of dust in space and the measured volume gives an idea of total amount of combustible dust in workplace.

IV. DEFLAGRATION INDEX (K_{ST})

To measure explosibility of dust cloud K_{st} value is needed. It is a universal value which is used to characterized and compared with explosive severity of a dust cloud. It is expressed in terms of bar-m/s. To design the equipment which is use to protect or prevent workers and workplace these value is used. By changing the particle size, dust cloud concentration, particle agglomeration deflagration index (K_{st}) changes. It is seen that as the particle size decreases the deflagration index increases. K_{st} values for combustible dust typically have a value between 0 and 300 bar-m/sec. Combustible dust having deflagration index value greater than zero can be subject to dust deflagration.

V. MECHANISM

Generally a dust explosion occurs when the particles of dust which is small in size gets dispersed in air. So, that the concentration of dust into air increases its explosive range. The five elements that should require making the explosive pentagon are combustible dust, oxidant, ignition source or heat, confinement and mixing. If one element is not present in the pentagon then the explosion will not occur. The confined space is also important so, that the dust cloud can create a pressure which is much higher than the pressure required to explode. You can also see the dust explosion in an open space if the rate of reaction is so fast that the pressure builds in dust cloud so that reaction gets released at the boundary of cloud faster. When the oxidation of fuel dust increases rapidly then the temperature and pressure of fuel dust will also increases rapidly. You can term this explosion as deflagration or a detonation. Both deflagration and detonation have different property as in deflagration the speed of flame propagation is slower than a speed of sound and in case of detonation the speed of flame propagation is faster than speed of sound. Dust explosion always starts with primary explosion and the secondary explosion gets generated from primary explosion by entering dust deposits and layers.

©IJRASET: All Rights are Reserved

A. Prevention

To reduce chances of dust explosion and reduce chances of hazard so that you can protect the property and health of workers by giving proper training to workers about how to handle dust safely and use of respiratory protective equipment and many more methods.

B. Eliminate Dust

Chance of explosion of dust can be removed by eliminating dust or by adding some non-combustible dust. Handling of dust is also a good method that can be used to transfer the dust from workplace should be construct in such manner that it do not get leak by any damage happened to the box and cleaning of workplace regularly is also a good method to eliminate dust.

C. Use of gas

To reduce the percentage of oxygen in confined space can also reduce the chance of explosion. Adding different gases such as nitrogen and carbon dioxide. Adding of these gases should be done by a person who have good experience and have proper knowledge of adding proper amount of gases. If you limit the oxygen than oxygen in fire triangle gets absent due to which ignition may not occur. It should keep in mind that with adding inert gases the temperature should be increased.

VI. CONCLUSION

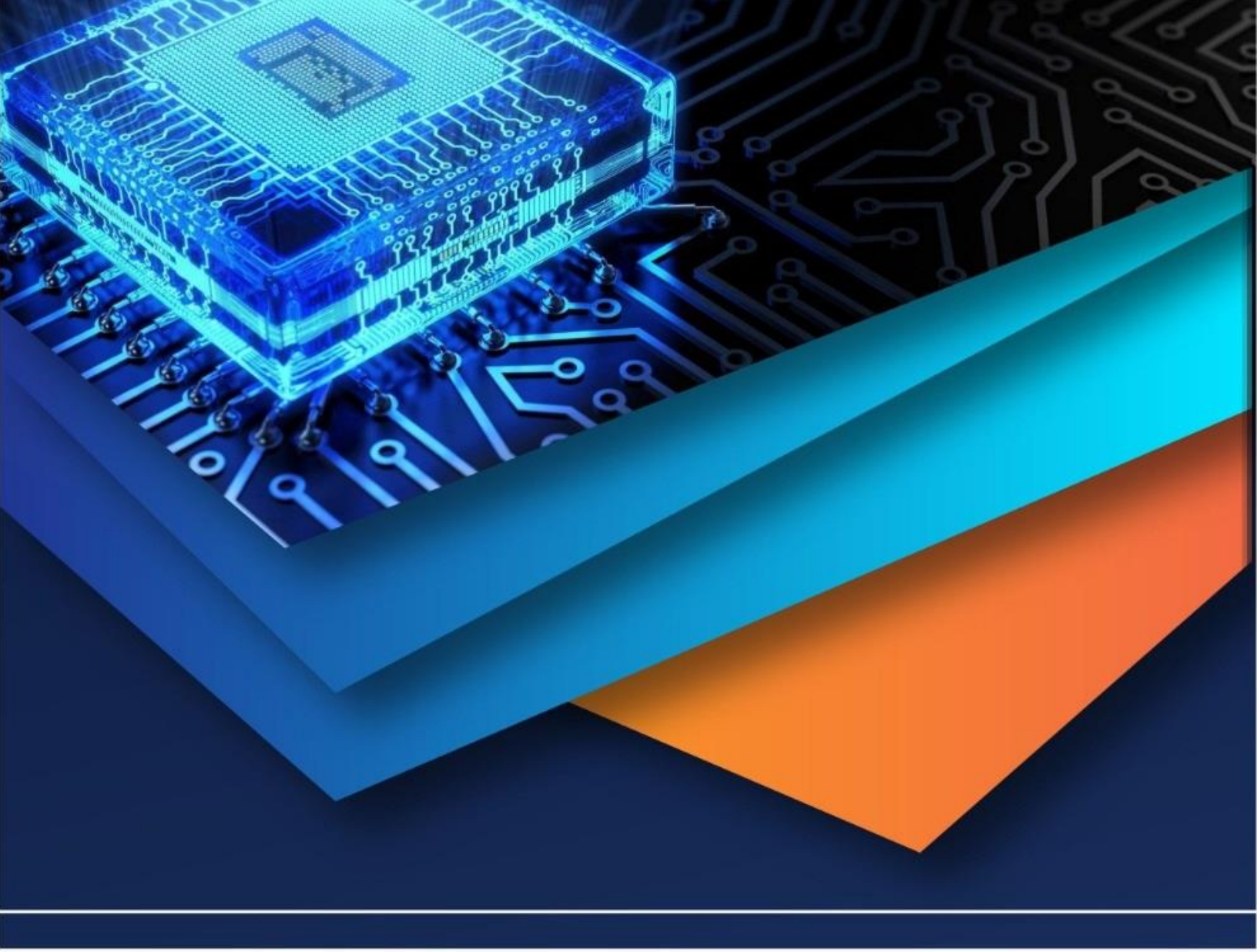
Dust explosion may cause destruction in large amount to human , property, and environment. As the cases of dust explosion is increasing every year it may possible that it become more serious topic in comparison to other topics. These explosion may occur due to some major lapses in safety like not getting proper training, or lack of knowledge and awareness of safety. Dust deflagration index and overpressure are the major factors of dust explosion. If these factors Increases then the chance of dust explosion may get higher and can cause higher damage or destruction. By giving proper knowledge to workers and aware them about how these explosion occurs and what are the reasons behind them. Dumping of dust in form of paste. So, that particle do not mix with oxygen easily and adding inert gases may also provide prevention from dust explosion

REFERENCES

[1] NFPA 652
[2] Wan sulaiman, R.M Kasmani (2011), Dust explosion protection & mitigation, explosion, severity, inerting: An overview of explosion severity on dust explosion, 2.
[3] OSHA Technical manual –section 4, chapter 6.
[4] Dust explosion prevention & protection for machines & equipment by International section for machine & system safety series no. 2033(e).
[5] Glor, M. and Schwenzfeuer, K. (1999). Einfluss der sauerstoffkonzentration auf die mindestzündenergie von staüben. Paper presented at the *Dechema Jahrestagung*. 1999. Wiesbaden, Germany.
[6] Cesana, C. and Siwek R. (2000). *Operating Instructions 20 L Apparatus* (6th edition). Birsfelden, Switzerland: Kuhner AG.
[7] Eckhoff, R.K. (2003). *Dust explosions in the process industries.*(3rd edition). USA: Gulf Professional Publishing

Websites
[1] Dustsafetyandscience.com
[2] Wikipedia

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)