ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 1 , January 2021

Explosion and Fire Range Assessment System of Industrial Dust and Determination Methods of Dust Volume

Nurmamatova Rakhima Rakhmanovna

Karshi State University, Associate Professor of Labor Education

ABSTRACT: The article analyzes the explosion and fire risk assessment system of industrial dust and provides methods for determining the adhesive strength of dust layers, the risk of explosion of suspended dust in the lower limit of flame concentration (LLFC), maximum explosion pressure and its growth rate, minimum flammability and minimum explosive oxygen content.

KEYWORDS: the lower limit concentration of flame - LLCF, the amount of dust, the allowed concentration, the explosion of the air-dust mixture.

I. INTRODUCTION

Existing fire hazard assessment systems for industrial dust are different from those adopted. At present, there is no reliable way to calculate the risk of explosion of dust, based on their composition, heat of combustion, and other physical or chemical properties. If subsequent studies do not theoretically predict the level of dust hazard, experimental measurements will be required.

In order to know the risk of explosion in foreign countries, industrial dusts have been tested in laboratory methods and officially approved. These methods differ from each other because they are largely, independently developed and international standardization has not yet been implemented [10]. In addition to the differences in the methods adopted, there are also common features. In particular, they provide an assessment of hazardous properties in small dust samples, in devices with a volume of several liters. Although the experiments are widely known, the tests are performed in a laboratory setting. This approach minimizes the time required for research and ensures the safety of the experiments as much as possible, even if the dust has toxic or other abnormal properties.

II. MAIN BODY

The basics of an internal system that determines the number and nature of fire hazard indicators of materials for industrial dust explosion and fire risk assessment have been studied by M.A. Godjiello [2]. It was later refined [8] and generalized in his monograph [6]. The practical experience of using this system, accumulated in many organizations, allows to obtain the necessary initial information to create a safe environment for the technological processes of processing flammable dusts. Therefore, the list of fire and explosion hazard indicators provided by the definition orders [9] is included in the State Standard regulating the scope of fire and explosion hazard indicators for petroleum products and organic chemicals [2]. Experimental tests include the detection of a number of parameters for dust suspended and accumulatedin the air.

The risk of explosion of dust suspended in the air is determined by the lower limit of the flame concentration (LLFC), the maximum explosion pressure and its growth rate, the minimum flammability and the minimum explosive oxygen content. Unlike the United States and the United Kingdom [10], other countries do not have indicators such as the self-ignition temperature of suspended air.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 1 , January 2021

The risk of installed dust is characterized by eight indicators: flash point, spontaneous ignition, lower and upper limits of ignition temperature, combustion temperature, minimum fire concentration of extinguishing agents, as well asself-heating and shutdown temperature.

This means that the approach to assessing the level of risk of suspended dust in the countries under consideration is almost the same. The difference is that in Germany there is no experimental definition of the lower limit of flame concentration (LLFC), andin addition to the above [11], in the United States, the relative flammability of suspended dust is determined.

One of the most important properties of finely dispersed materials is the ability particles to adhere. For hard surfaces, the adhesion of particles to each other can have a significant effect on the separation and suspension of dust particles when exposed to air currents. Adhesive bonds occur only between a hard surface and a layer of particles that come in direct contact with it. The upper part of the layer with the particle space is called the adhesive forces or the contact forces between the particles.

Adhesive compounds are generally stronger than adhesive viscosity [3]. Therefore, the removal of intermediate particle layers from a hard surface often leads only to the breakdown of the adhesive bonds, but the flame does not directly affect the surface [3].In many cases, the main process of removing particles from the surface under the influence of air currents has the effect of adhesion.

The stickiness of particles can be due to various reasons: Van der-Waals (interaction); active molecular (cohesive) forces that are close to the point of contact of particles; the interaction of electric charges localized on the surface of particles; small forces resulting from the condensation of moisture in the contact zone of the particles [3]. The magnitude and ratio of the various components of the adhesive forces depend on the nature of the particles, the environmental conditions, and the magnitude of the forcewhich is in contact.

The most common types of dust are usually particles of different shapes and sizes. These factors can also affect the interaction forces between a number of other, two separate particles. Therefore, the strength of an individual contact is only a characteristic of the interaction of individual particles, but does not fully reflect their complex properties.

Another method of estimating the viscosity by the strength of a layer is to obtain a characteristic that is relevant to the dust of the dispersant, i.e., an integral characteristic of the adhesive properties of the whole set of particles in a unit of interest for practical purposes.

Dust or dust layer dispersion has the same structure. The strength of such a composition is determined by the strength of the individual bonds between the particles and the number of bonds per 1 cm² of the structure [5]. If the first component of this force is determined by the properties of the contact particles, the second depends on the geometric parameters of the composition, i.e. the size and packaging.

The thickness of the dust layer depends on two independent factors: the adhesive properties of the dust and the conditions of layer formation. The strength of the dust layer can serve as a comparative property of the dust viscosity if these layers are formed under certain standardized conditions, but not the structure of the layer. Maybe it needs to be shaped or standardized. Thus, the value of the standard impact load, $0,5-10 N\cdot m^{-2}$, was required to measure the tensile strength of the layer [3].

To estimate the viscosity of industrial dusts, a method of measuring the tensile strength of dust layers formed by filtering dusty gas in the space between two filter discs can also be used [3]. Based on these approaches, a dust classification has been proposed for adhesion in a layer to determine the forces of interaction between dust particles [6]. According to this classification, powders are divided into four groups: lowly viscous, viscous, medium viscous and strongly viscous. Depending on the strength of the adhesive effect, the natural placement of the dust without interfering with the external impact of this product is better determined during the packaging process in order to assess the placement and settling capacity of the dust particles.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 1 , January 2021

Methods for studying the real properties of variable materials are better known than data from changes in dust testing [2]. A device for measuring the movement of dust is a two-part chamber in which the material under study is placed. The amount of force required to move one part relative to another describes the shear force of the metal. The camera can be replaced by a ring channel, in which case the sliding is done by rotational motion [7].

A Weiler-Rebinder device is used to study the extraction of sedimentary rocks and the shear strength of waste, the essence of which is to obtain a cut from a crushed body or material [7]. The real properties of the powder in shear strength are very important, but the fact that it is mechanically coated with particlesand complicates its adhesive effect. The nature of the intersection of the layers is so complex that, as Fuchs points out, it is not in a single plane, but is accompanied by the rotation of the particles [7].The image of the distortion further complicates the particles formed when the compressive strength is changed.

The most optimal conditions for destruction to assess the adhesive strength are the removal or a layer of dust. In this case, it is the viscosity interaction of the particles that determines its strength. Y.I. Chigirin and his students I.Piney and Y.Klinger[4] conducted research on the destruction of dust layers by cracking under the influence of centrifugal forces [2]. This method is useful for modeling the regeneration of filters and electrostatic precipitators, but it is not always difficult to obtain a half-expression of the layer strength, only that it is very difficult to determine the actual area of the cavity.

The strength of a dust or dust layer can be determined by the method used by V.N. Serov to measure its adhesion to the substrate [6].On a surface coated with a sticky oil, the layer easily thickens and then removes dust from the substrate. However, if the thickness of the layer is large enough, the separation area, which measures the adhesion of the layer particles to the side and then the viscosity of the rest, allows to find the explosive force. The study of the strength of dust layers was obtained using the method used by M. Davis [6] and later other researchers [5]. The most perfect of these methods have been studied by D. Ashton, K.A. Farley, and H. Valentine [5]. A.M. Andrianov [5] later proposed a modification of the popular device.

III. CONCLUSION

The analysis shows that there is currently no theoretical relationship to determine the adhesive strength of dust layers. Its evaluation is carried out only in the form of experiments on different devices. In this regard, in order to study the effect of dust on the transition to the suspended state, it is necessary to determine experimentally adhesive strength of the dust layers.

Existing regulations do not take into account factors such as dust emissions in production facilities and the ability of dust to become suspended.

In many countries, the approach to assessing the level of risk of dust in the mulch is almost the same. The difference is that in Germany there is no experimental definition of the lower limit of flame concentration (LLFC), and in the United States, in addition, the relative flammability of dust in the molten state is determined.

It was found in the available sources that there is no universal correlation that would theoretically determine the value of the adhesive strength of the dust layers, as well as the value of dust removal under the influence of stationary air currents and compression waves.

In addition to those considered in this study, it was found that additional research was needed to comprehensively take into account the main factors influencing the explosive risk of dust generating industries. Thus, it is necessary to study the effect of the lower limit concentration of the explosion, the maximum explosion pressure, its growth rate and other indicators of fire risk for dust-like materials. Given the process of shocks caused by explosions in the air-dust mixture, the dependence on the size of the room is of great interest.

REFERENCES

1. GOST 12.004-91 Interstate standard. SSBT "FIRE SAFETY" -2006
2. GOST 12.1.010-76 Interstate standard. SSBT "EXPLOSION SAFETY" -2003
3. GOST 12.0.001-82 Interstate Standard. SSBT "BASIC PROVISIONS" -2002
4. GOST 26824-2010 Interstate standard. SSBT "BUILDINGS AND STRUCTURES" -2012
5. Gallerin A. Method of finite elements. The basics. M. Mir, 2001.-324 p.
6. Golenev A.N., Selina N.N., Yuldashev O.R., Investigation of the fire hazardous properties of viscose fiber dust. M., Chemistry, Chemical fibers. 1989. p. 44-45.
7. Golenov A.N., Samorodov V.G.. Dust regime of industrial premises associated with the circulation of combustible dust. M. Proceedings of MISI "Explosion safety in construction." 2001. p. 27-33.
8. Korolchenko A.A., Opratov V.I. Investigation of the fire and explosion hazard of viscose fiber air suspension. Express information "fire hazard of substances and materials." M. VNIIPO, 2002, No. 5.
9. Opritov V.N. "Investigation of fire and explosion hazardous properties of air suspensions of wool dust, chemical fibers and binary mixtures formed during the processing of textile materials." M. 1980-264 p.
10. Pushenko S.L.. Assessment of explosion and fire hazard of production facilities associated with the release of combustible dust. Diss. Cand. technical sciences. Moscow, 1982. - 199 p.
11. Belov S.V., Ilnitskaya A.V., Koziakov A.F.. and others; Life Safety: Textbook for universities. — M .: Higher. school, 2007 616 p.
12.Web sites:www.lex.uz;www.ziyonet.uz; www.norma.uz;https:/yandex.ru