A Brief Talk on Coal Dust Suppression

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Abstract. Coal dust is the solid micro-particles which are generated during coal mining, transportation, storage and processing dispersed into the air. Coal dust not only poses a great threat to the environment, but also poses a serious threat to the health of workers engaged in related industries. So, developing technical and scientific tools that are efficient, safe, practical and convenient to prevent dust and explosion, protect the environment and health and safety of employee and promote safe production in the community have become the top priorities in the industry.

Keywords: Coal dust; Hazard; Dust reduction; Explosion protection.

1. coal dust generation and harm

Coal dust is generated in producing, handling, crushing and transporting of coal, drill, blast, smash, self-weight transport, artificial gangue and other production processing are the main reasons caused coal dust. Coal dust producing on the one hand will result in the waste of coal resources; on the other hand, it will have a detrimental effect on the environment. Especially in the ventilation and dust removal equipment, production equipment, poor sanitary conditions, poor safety awareness of producers in the area of coal dust hazards and safety hazards are particularly serious.

One of the major harms of coal dust is damage the health of practitioners. When the particle diameter of coal dust is more than 100 μm, it easily settles down. When the particles diameter is between 10 μm and 5 μm, 95% of which can be filtered by nose. When the particle diameter is less than 5 μm, the coal dust can enter the human body through the respiratory tract and deposited on the upper respiratory tract and lungs. These particles could reduce the phagocytic capacity of the phagocytes, so that the silica inhaled into the human body cannot be excreted and cause pulmonary fibrosis, and the current medical treatment of pneumoconiosis cannot be cured, the occupational diseases seriously undermining the health of employees, loss work ability, or even loss their life, practitioners have an important serious impact on production and life. According to statistics, the number of deaths from pneumoconiosis patients each year is about double the number of downhole accidents in the same period. Therefore, it is imminent to take effective measures to curb coal dust and ensure the health and safety of practitioners in the industry.

Another major harm of coal dust is spontaneous combustion and high explosiveness. Coal dust explosion is a reaction process of the rapid oxidation of oxygen and coal dust in the air. Coal is a complex solid compound, broken down into fine coal dust, the total surface area increased significantly when it is suspended in the air, the ability to oxygen and oxidation is greatly enhanced, under the effect of high temperature heat sources, suspended coal Dust in the unit of time can absorb more heat, about 300°C-
400℃, you can release flammable hydrocarbons with low ignition point, increasing the hidden dangers in the production process of coal mines. When the dust concentration is in the range of 30-2000 g/m³, and encounter 700-800℃ open flame it will explode. Coal mine dust caused by a major accident accounted for a large proportion of coal mine accidents. November 27, 2005, Qitaihe Dongfeng coal mine accident in Heilongjiang province caused a death of 171 miners which is caused by coal dust explosion. These flammable gases accumulate around the coal dust particles. When the surrounding gas reaches a certain concentration and absorbs a certain amount of energy, the reaction process of the explosion chain will proceed. Within a certain space, the radicals rapidly increase and flashover of coal dust particles occurs. Coal particles quickly oxidize the heat released by the heat transfer between molecules and flame radiation to the surrounding coal dust particles, and make it involved in the explosion chain reaction, the reaction rate increased dramatically, the combustion cycle continues, when the flame speed reaching a certain level, the combustion of coal dust turns into an explosion under certain conditions. The high concentration of coal dust poses a serious threat to practitioners' life safety and social safety production. Therefore, it has a great significance to adopt reasonable methods and measures to reduce the concentration of coal dust, protect the personal safety of employees, reduce the incidence of occupational diseases and promote safe production in the society.

2. coal dust suppression method
Coal dust has a smaller particle size than coal blocks. With the particles reduction of coal dust, coal dust not only maintains the properties of coal but also has many unique properties. Such as particle size distribution of coal dust particles, nature, surface area and porosity. In addition, coal dust is a complex organic matter that is not easily wetted by water, so it has poor removal effects by watering the dust. Suppressing the generation of coal dust during the production process is the most important work. During the production period, should find out the root causes of coal dust generation. The ventilation and dust removal equipment are improved. Modern production technology and equipment are introduced to purify the sanitary conditions. Take the appropriate measures in the source of coal production can minimize the generation of coal dust.

However, it is inevitably produce coal dust in the production process, we must take effective measures to reduce its concentration in the air; for the coal has been produced, it need to take measures in the transport and storage to curb the production of coal dust. In the traditional dust removal process, the commonly used dedusting methods mainly include wet dedusting, ventilation dust decontamination and air decontamination, etc. Although these conventional dust suppression methods are simple in operation, they are not thoroughly dedusted and deteriorate the working environment and affect the quality of coal mines. Not timely also easily lead to shortcomings such as coal dust flying. In view of the disadvantages of these traditional dust removal methods, researchers have invented chemical dust suppressants on the basis of fully studying the dust suppression mechanism. Chemical dust suppressants can generally be divided into three types of humectants, binders and coagulants. Dust suppression mechanism mainly includes wetting, consolidation, coagulation cake. Wetting agent is mainly composed of water and one or several surfactants, which can reduce the surface tension of water and greatly improve the wetting efficiency of water on coal dust. The binders include inorganic binders and organic binders, and the inorganic binders are mainly including halide, calcium oxide, coal ash, clay, clay, gypsum, kaolin, acid, etc. Organic binders are mainly natural or synthetic organic viscous materials, including crude oil, olive oil waste residue, petroleum, residual oil, lignin Derivatives, cinder oil, bitumen, paraffin, polymers and other industrial waste like waste residue in the paper mill production process, because organic binders are not easily soluble in water, they need to be emulsified before use, and then have a certain proportion with Viscosity of the emulsion, it is mainly used for transport road dust and dust transport materials; the main component of coagulant is polymer materials which is added with a variety of additives, natural or organic synthetic, the coating can be applied to the surface of the pile can be quickly formed polymer mesh protective film to prevent coal dust flying to achieve the purpose of dust explosion, but also with the coal pile peel, and have no effect with the quality of coal. At the same time for the spontaneous combustion of coal dust and high explosive, we should take
appropriate measures explosion-proof. The traditional explosion-proof measures to clean up the deposition of coal dust: Before cleaning, sprinkle water before cleaning to prevent the dust from flying and dispose of the coal dust in time; Rinse the coal dust: Treatment; brushing explosion: the main roadway to brushing, both to observe the deposition of coal dust in the roadway, but also cover the solidification has been deposited in the roadway of coal dust; rock powder explosion: rock powder is inert material, rock dust around the roadway, Can increase the deposition of dust in the explosion-proof material. The new explosion-proof means is the combination of dust suppressants and flame retardants, flame-retardant and explosion-proof in different aspects of the explosion, the new explosion-proof means more efficient than the traditional explosion-proof means. In addition, practitioners also need to strengthen the education of work safety concepts, strengthen safety awareness, do a good job of personal safety protection and improve resilience. Personal protection is to prevent coal dust on the human body the last point, wear dust masks, dust-breathing Dust masks, dust caps and other dust-proof appliances to learn the ability to deal with unexpected situations. Multi-pronged approach, coal dust suppression work can be the best, make the coal dust hazards and potential safety hazards to a minimum.

3. coal dust suppression problems and prospects
Compared with foreign countries, our country started relatively late in the research and development of coal dust suppressants, so the prospects of development and application of coal dust inhibitors are quite broad. The dust suppression efficiency of chemical dust suppressants is much higher than the traditional dust reduction method, but its application range is narrow. The main reason is that some chemical dust suppressants have higher costs. And there are fewer types of chemical dust suppressants for coal dust. Some chemical dust suppressants also cause environmental pollution, and most chemical dust suppressants have a single function. For example, some dust suppressants can only reduce dust, but cannot prevent its combustion and explosion; it is difficult to meet the needs of coal production and processing practices. The development of multi-functional composite, environmentally friendly chemical dust suppressants will be the main research and development direction of chemical dust suppressants. In the process of research and development, pay more attention to the combination of theory and practice, strengthen the mechanism of exploration. That would be greatly reduce R & D costs, reduce workload, which can reduce the price of chemical dust suppressants, chemical dust suppressants can be widely used in the coal industry production and processing practice. In addition, there are many ways to test the performance of dust suppressants, and it is often not relevant in the performance of dust suppressants measured by different methods. Therefore, it is very important to establish a scientific and uniform testing method for the performance of chemical dust suppressants. And it is also very important for the detection of chemical dust suppressants and the development and application of new chemical dust suppressants.

China is the largest coal reserve country, the proven coal reserves ranking the third in the world. Although China's coal reserves are abundant, it is not a big coal-consuming country. Compared with advanced developed countries, China's coal utilization rate is low, and coal is a nonrenewable resource and improve coal utilization, and we should maximize the advantages of China's coal power, coal dust is also a part of the coal resources. Recycling coal dust is also a way to improve coal utilization. Finding Coal dust suppressant is a method to rapid and effective recover coal dust.

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