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PROPAGATION CHARACTERISTICS AND ENVIRONMENTAL IMPACT OF COAL DUST EXPLOSION

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Abstract

Dust explosions are one of the main causes of mining disasters. To avoid them, it is important to understand how they are propagated. In the study reported here, computational fluid dynamics software was used to model a 3D diagonal pipe network then simulated a dust explosion at its inlet to examine its propagation characteristics. The initial conditions, boundary conditions and parameter settings were detailed description in the simulation to analyze possible propagation characteristics, assessing in particular the flame temperature, concentration of the produced CO and airflow velocity after the explosion. Our findings suggest that when dust explosions propagate in a straight pipe, the highest flame temperature is almost at the center of the pipe. When the pipe is bifurcated, the flame propagation is disrupted by turbulence and the gravity of the coal dust particles generated by the combustive reaction at the flame front. In line with the position of the flame front and the gravity of the coal dust, the production of explosion-related CO is more concentrated in the lower part of the pipe, along the section vertical to the x-axis. The shock airflow generated by coal dust explosion propagates much faster at the forks and bends in the pipes, because these structures work in the same way as obstacles in a straight pipe, bringing about an "excitation effect", which significantly increases the impact of the airflow velocity.

Key words: computational fluid dynamics (CFD) simulation, dust explosion, diagonal pipe network, environmental effect, propagation characteristics

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