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Numerical simulation study of dust concentration distribution regularity in cavern stope ☆

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Abstract

Based on the theory of gas – solid two-phase flow and the characteristics of cavern stope a model of dust migration was established. The dust concentration changing of cavern stope by ventilation in 20 min after blasting and the dust trajectory in different wind speed were simulated by Fluent Software. The results show that distribution of dust concentration is significantly affected by flow field of airway in cavern, and the dust concentration of inlet is higher than that of outlet and the highest one on the corner of inlet' s side. In the stope, the smaller the wind speed of inlet is, the shorter of dust can be captured, settled and discharged, the more obviously affected by the trajectory of gas flow field. It goes into the stage of clean cycle emissions after 60 s, the speed of dust concentration dropped is the biggest between 0 s and 70 s, the main dust in stope is respirable dust after 70 s, it needs much time to settlement.

According to the measured data of metal mining, approximately 87% of dust was generated during the drilling and blasting in the mine (Wang, 1979). A lot of dust with high concentrations was produced during the cavern stope blasting and it was difficult to be discharged. It can help choose the right speed to rule out the dust quickly which produced during cavern blasting, if the dust concentration distribution and the dust migration law of different inlet velocity in the cavern can be verified, what' s more, the labor productivity can be increased. It has great significance for choosing reasonable ventilation parameters, reducing dust hazards of stope to researching the dust concentration distribution regularity in the stope.

Highlights

► The dust concentration changing was simulated in different winds. ► The distribution of dust concentration is significantly affected by flow field. ► The dust concentration of inlet is higher than that of outlet. ► The closer to the working face, the higher the concentration of dust is.

Keywords

Cavern stope; Dust concentration distribution; Gas – solid two-phase flow; Fluent software; Numerical simulation

Figures and tables from this article:

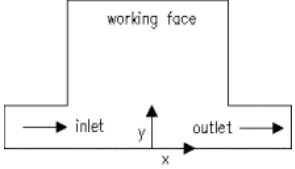

Fig. 1. The geometric model of flat cavern stope.

Figure options

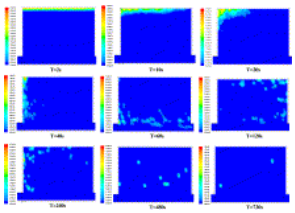
Fig. 2. The result of simulated dust concentration in stope cavern.

Figure options

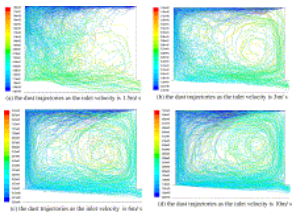
Fig. 3. Trajectory of different inlet velocity of dust concentration.

Figure options

Table 1. The setting of parameters of relevant model and boundary conditions.

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Table 2. The setting of dust source parameter.

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