

论文

顶煤自燃危险性分析及注氮防火的理论研究

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摘要:

为了在理论上了解煤巷顶煤高冒区自燃升温规律,判断危险区域位置和研究注氮防火效果,在假设煤氧化速率符合Arrhenius规律的基础上,利用FLUENT软件求解了高冒区内漏风风速和氧气浓度的稳态和温度的动态分布,并对注氮后带来的冷却效果进行了推测。计算结果表明:高冒区内自燃升温体现了一个缓慢—加速的过程,贴近巷道的部分温度最低,深部次之,高温区域位于顶煤中部偏进风侧,高温区的升温速率随着巷道风速的增加而变快,当风速低于一定程度后自燃不会发生。在平均粒径保持不变时,顶煤孔隙率越大,升温幅度同样会加快。高温区域注氮可以起到明显的降温效果,短时间内注氮口附近温度显著降低,降温效果逐渐向中部和回风口延伸。

关键词: 注氮;自燃;高冒区; FLUENT; 高温区

Investigation into spontaneous combustion hazard and numerical simulation of nitrogen injection fire prevention effects in the roof coal

Abstract:

In order to theoretically understand the law of temperature rise due to spontaneous combustion in caving zone of roof coal in coal mine roadway, and identify the location of hazardous region and studied the fire prevention effects by nitrogen injection, the software FLUENT was used to solve the stable state of air leakage speed and oxygen concentration, dynamic temperature distribution and cooling effects brought by nitrogen injection in the high caving zone based on the assumption that coal oxidation rate accords with Arrhenius law. The computation results indicate that the temperature rise reflects a slow accelerating process and the portion close to roadway has lowest temperature while the deep portion comes next, the top temperature region lies in the middle part of caving zone and deviates to inlet. The rate of temperature rise in high temperature region accelerates both by the increasing air velocity in roadway and increasing porosity when practical size is kept unchanged. The nitrogen injection in high temperature region can lead to obvious cooling effects for the reason that the temperature close to injection hole decreases dramatically after short time and cooling effects extend towards part of the middle and outlet gradually.

Keywords: nitrogen injection; spontaneous combustion; caving zone; FLUENT; high temperature region

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