

论文

煤粉细化过程静电放电起爆机理

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摘要:

基于水的电离和粉体动力学理论, 对煤粉细化过程中静电场和煤粉爆炸的条件进行理论建模和数值计算, 分析爆炸的可能性。数值结果表明: 带电煤粉浓度分布随时间发生变化; 不同时刻节点间电压差大部分在200 V以下, 但是在个别位置, 相邻节点间电压差可达上千伏, 甚至上万伏, 这种较高的电压差可能达到击穿电压的临界值, 导致电火花的产生。在煤粉细化过程中, 煤粉的粒度大部分在30~75 μm, 煤粉质量浓度在0.5~2.4 kg/m³, 某些时刻氧含量和有效点火能量分别大于15%和大于1 J, 这些都在煤粉的爆炸范围之内。当这些因素同时满足煤粉爆炸的危险条件时, 在煤粉细化过程中就可能产生爆炸。

关键词: 煤粉细化; 静电场; 电火花; 最小点火能量; 爆炸

Explosion mechanism of electrostatic discharge in coal pulverized process

Abstract:

Based on the theory of water ionization and powder dynamics, theoretical model of electrostatic fields was suggested in coal pulverized process, and numerical calculation was carried out. In order to analyze the possibility of explosion, explosion conditions were calculated. The numerical calculation results show that distribution of pulverized coal density changes with time; at the different moment, most of voltage difference between two nodal points is below 200 V, but some voltage difference can reach thousand volts, even reach ten thousand volt. The higher voltage difference may reach the critical value of the breakdown voltage, and causes the electric spark. In coal pulverized process, coal dust size distribution is between 30 and 75 μm, coal dust concentration is between 0.5 and 2.4 kg/m³, at some moment, oxygen percent and the effective ignition energy are more than 15% and 1 J respectively, which are all in the range of coal dust explosion. When all of the influence factors satisfy the coal dust explosion conditions at the same time, the explosion may occur.

Keywords: coal pulverized; electroatatic field; electric spark; the minimal ignition energy; explosion

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