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论文

瓦斯与煤自燃共存研究（II）：防治新技术

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摘要：

基于瓦斯与煤自燃共生发生场所的不同定义了煤岩跨尺度裂隙场概念，深入探讨了共生灾害防控机理及技术方法，即通过合理改变跨尺度裂隙场中的场流分布以消除瓦斯与煤自燃共生灾害——共生区域Se=0，提出固相颗粒输运改变煤岩体裂隙漏风场尺度、低温液态惰气改变采空区温度场和气体浓度场两种防治共生灾害新技术。建立了固相颗粒输运改变网络裂隙场场流模型，讨论了颗粒填充漏风裂隙场后，漏风裂隙尺度、可通路径的变化，致使漏风阻力增大，保证了瓦斯抽采处于安全的煤岩体裂隙场和低氧气浓度场；理论揭示了低温液氮防治共生灾害机理，并自主设计了液氮防灭火模拟平台，结果表明：液氮注入火区能迅速吸热膨胀，产生大量的低温氮气，扩散进入采空区空间，对热（火）源形成惰化隔离带，同时低温氮气携带水凝气与采空区隐蔽热（火）源产生的热风压进行热交换，降低热（火）源温度在可燃点温度以下，主动吞噬热（火）源。

关键词： 瓦斯；煤自燃；共存；跨尺度裂隙场

Coexistence of gas and coal spontaneous combustion (II) : new-prevention and control technologies

Abstract:

Taking into consideration the differences of disaster prevention in gas and spontaneous combustion of coal seam and goaf cross scale fracture fields, the cross scale fractures field of coal and rock mass were defined in this study.In addition, this paper studied the symbiotic disaster prevention and control mechanism, and technical change in cross scale fractures field flow distribution, through the rational elimination of gas and coal spontaneous combustion symbiotic disaster, that is, the symbiotic region was equal to 0.The authors also proposed two new control technologies, which are : to change coal rock fractures leak scale through solid phase media transport, and to change the goaf temperature field and the gas concentration field through low temperature liquid inert gas seepage.A network graph theoretical model of a particle transport of fine solid phases to change coal rock fractures scale had been developed in this study, which reveals that solid phase media can be embedded in the pneumatic transport blocking air leakage in the coal rock fractureds field, to reduce air leakage fractures scale and the effective fissure numbers, and change the scale of coal rock fractures leak field, as well as to increase air leakage resistance to ensure the safety of coal spontaneous combustion for high gas extraction.Also, the authors built an experimental simulation platform for investigating liquid nitrogen extinguishing characteristics, and the results show that the liquid nitrogen injected into the fire area can quickly cause heat expansion, resulting in a large number of low temperature nitrogen pockets in the goaf, forming a three dimensional buffer zone to reduce the external air leakage into the goaf or fire zone, to isolate the goaf or fire area.At the same time, the low temperature nitrogen gas carries water vapor condensation into the goaf, exchanging heat with hidden heat source (fire source), which can reduce the temperature of the heat (fire source) to below the temperature of flammable point and actively engulf the heat source (fire source).

Keywords: gas; coal spontaneous combustion; coexistence; cross scale fracture fields

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