岩石力学与工程学报　2005 24 (2005-S1): 4740　ISSN: 1000-6915 CN: 42-1397/O3

水射流在煤层中水平钻孔的试验研究

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收稿日期 2005-5-9 修回日期 2005-5-30 网络版发布日期 2008-2-18 接受日期 2005-8-15

摘要　分析了水射流流动结构中存在的三个射流阶段和水射流作用于煤层时所具有的撞击、冲击、水楔、气蚀、剪切等破岩机理和岩石的破坏过程。深入探讨了目前有关水射流破岩的前沿问题，提议从岩石动态破碎和水射流与岩石的相互耦合作用的角度来分析水射流的破岩过程。提出了用高压水射流在煤层中钻孔的一种新方案，即采用缠绕在辊筒上的连续钢管，将水射流钻头与高压水泵连接起来，在煤层中实施连续钻孔作业，本方案自动化程度高，可加快钻孔速度。通过试验数据分析了水射流破岩距离与射流压力的非线性关系，对钻孔煤渣做了分样分析，认为水射流钻孔产生的煤渣颗粒大于普通的钻孔煤渣。研究结果表明：水射流破岩时存在一个门限压力，水射流压力和流量与破岩效率成非线性变化的相关规律，与流量相比，射流压力对破岩作用更为重要。

关键词　采矿工程；水射流；连续钢管；水平钻孔；岩石破碎

分类号

EXPERIMENTAL STUDIES ON HORIZONTAL DRILLING HOLE BY WATER JET IN COAL SEAM

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Abstract

Three jet stages in the flow structure and the rock fragmentation mechanism of strike，impact，water wedge，cavitations erosion，cutting of water jet，and the course of rock fragmentation，are analyzed. The frontier problems of rock fragmentation by water jet at present are studied，where it is suggested to study the course of rock fragmentation by water jet from the angle of the coupling effects of water jet and rock and effects of the dynamic fragmentation of rock. A new scheme of drilling a hole by a high pressure water jet in the coal seam is put forward. A continuous steel pipe twisting on a roller connects the water jet bit with the high pressure water pump，and a continuous drilling job in the coal seam can be performed，which is of drilling automatism and can quicken the drilling. The nonlinear relation between the pressures and the distances of water jet through the test datum and the delivery samples of the drilling slag are analyzed，and it shows that the slag particle by the water jet drilling is larger than that by the ordinary drilling. The conclusions are drawn that it has a critical pressure of rock fragmentation by water jet，and that the pressure and the flux of water jet have nonlinear correlative laws with the efficiency of rock fragmentation. Compared with the flow rate，the water jet pressure plays a more important role on the rock fragmentation.

Key words

mining engineering；water jet；continuous steel pipe；horizontal drilling hole；rock fragmentation

DOI:

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